COMMISSION OF ENQUIRY

APPOINTED TO ENQUIRE INTO THE TRAGIC INCIDENTS WHICH OCCURRED ON 25TH FEBRUARY 2022 AT FACILITIES OWNED BY PARIA FUEL TRADING CO. LTD LOCATED AT NO. 36 SEALINE RISER ON BERTH NO. 6, POINTE-À-PIERRE

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SUPPLEMENTAL BUNDLE OF SUBMISSIONS RECEIVED BY THE COMMISSION

Denotes that documents have not been disclosed and/ or have been redacted on the grounds of confidentiality and/ or sensitive information.

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778.	Letter to Mushtaq Mohammed - Inspection of Paria Fuel Trading Company Limited (Offshore Services Dock Yard/PAP Bond B), located at Southern Main Road, Pointe-A-Pierre.	22.03.25	**12703**
779.	Inspection Report	22.03.15	**12705**
780.	Letter to Mushtaq Mohammed - Inspection of Paria Fuel Trading Company Limited (Lube Oil Jetty/Port and marine Maintenance Department/Marine Stores/Lube Oil Blending Shed/No. 20 Fire Pump House/Boat Shed-Workshop, Dye Storage Area, Jetty), located at Southern Main Road, Point-A-Pierre.	22.03.31	**12708**
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SECTION 21 **PARIA FUEL TRADING LIMITED**			
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SECTION 22 SEAMEN AND WATERFRONT WORKERS TRADE UNION (SWWTU)			
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The Government Of The Republic Of Trinidad And Tobago

MINISTRY OF ENERGY AND ENERGY AFFAIRS

International Waterfront Centre, 1 Wrightson Road, Port of Spain, Trinidad West Indies
Tel: 1 (868) 623-6708 • Fax: 1 (868) 627-1486

2/3/13
Our Ref.: 2/3/31

MINISTRY OF ENERGY DESPATCHED
SEP 09 2014
REGISTRY SOUTH OFFICE
AND ENERGY AFFAIRS

September 4, 2014

Mr. Khalid Hassanali
President
Petroleum Company of Trinidad and Tobago Limited
Pointe-a-Pierre

Dear Mr. Hassanali,

Re: MEEA's Regulatory Inspection/Audit of Petrotrin's Port and Marine Facility – Point-a-Pierre

Reference is made to the Ministry of Energy and Energy Affairs' (MEEA's) inspection/ audit of your Port and Marine facility during the period July – August, 2014.

The objectives of this exercise were:

a) to ensure compliance with the requirements of the *Petroleum Act, Chapter 62:01*, the *Petroleum Regulations* and other legislation having legal jurisdiction;

b) to ensure that operations are being carried out in a safe, health conscious and environmentally responsible manner; and

c) to assess the *'fitness for continued service'* of the facility.

Attached for your attention is a copy of the MEEA's inspection/ audit report. The MEEA expects that the closure of the identified items will be treated with urgency and in the interim requests that an action plan be forwarded within twenty one (21) days from the date of receipt of this letter.

Matters requiring further information or clarification can be directed to the attention of Mr. Marc Rudder, Senior Petroleum Engineer, at any of the listed contacts(ext. :3309) or email: mrudder@energy.gov.tt.

Sincerely

OCCUPATIONAL SAFETY AND HEALTH AGENCY
SOUTH OFFICE
SEP 19 2022
RECEIVED

....
/f/ Permanent Secretary
Ministry of Energy and Energy Affairs

PERMANENT SECRETARY
Ministry of Energy
and Energy Affairs

Encl.: *Petrotrin's Port and Marine Facility Inspection Report*

50 YEARS OF INDEPENDENCE
TRINIDAD & TOBAGO

MINISTRY OF ENERGY AND ENERGY AFFAIRS
POWER. PROSPERITY. PROGRESS.

REPUBLIC OF TRINIDAD AND TOBAGO
MINISTRY OF ENERGY AND ENERGY AFFAIRS
Petrotrin's Port and Marine Facility Inspection Report

A. Inspection Particulars

	Details
Activity	Inspection of Petrotrin's Port and Marine Facility
Inspection date(s)	Document Review – July 18, 2014 Facility Inspections – July 24, 2014, August 07 & 14, 2014
Previous Inspection	-
Facility Identification & Details	Port Name: Petrotrin Pointe - A - Pierre Port ID No: 23003 The port and marine facility comprises of the following: 1. A Main Via Duct (MVD) 2. A Lube Oil Jetty (LOJ) – product lines are out of service 3. Berths (along MVD, LOJ and Sea Berths) 4. Slop pumps 5. Boat Shed 6. Schooner berth 7. Tug Launch 8. Tugs with fire-fighting capabilities Products include kerosene, gasoil, MO-gas, fuel oil, LPG, black oil, crude import Berths on MVD • Berth 1: 8 loading arms • Berth 2N: 5 loading arms • Berth 2S: 5 loading arms • Berth 3N: 2 loading arms for Petrotrin & 2 loading arms for Ethylchem. *Note: Berth 3N is owed by Petrotrin but arrangement made with Ethylchem on its usage. Petrotrin will use the berth only when it is not occupied by Ethylchem.* Berths on LOJ • Berth 7: • Berth 8S - bunkering berth • Sulphur berth – Managed by the hydro processing group Sea Berths • Berth 5: 3 loading arms • Berth 6: 4 loading arms
Licensee	Petrotrin
Field/ Location of Inspection	Pointe-A-Pierre
Mode of Operation during	Normal Operations

REPUBLIC OF TRINIDAD AND TOBAGO
MINISTRY OF ENERGY AND ENERGY AFFAIRS
Petrotrin's Port and Marine Facility Inspection Report

Inspection	
Inspection Officers	Mr. S Ali — MEEA — Chief Mechanical Engineer Mr. N. Arjoon — MEEA — Mechanical Engineer I Ms. N. Arjoon — MEEA — Petroleum Inspector I Ms. N. Dipnarine — MEEA — Measurement Engineer Mr. S. Yasein — MEEA — Service Provider Mr. R. Ramoutar — OSH Agency — OSH Inspector Mr. M. Superville — OSH Agency — OSH Inspector Mr. J. Loorkhoor — OSH Agency — OSH Inspector
Persons Facilitating Inspection	Mr. R. Ramouter — Petrotrin Mr. A. Gopaul — Petrotrin Mr. R. Ramjit — Petrotrin Mr. M. Moses — Petrotrin Mr. R. Samlal — Petrotrin Mr. A. Phillip — Assistant Secretary – OWTU Mr. R. Low Hoy — Communication Member – OWTU
Other Information	1. There are no fixed gas detection systems on the berths. 2. There is no automatic foam system or automatic fire suppression system on the berths except for Berth #3. This system has not been commissioned. 3. Berth #3 is owned by Petrotrin but will be used by EthylChem. When it is unoccupied by EthylChem, Petrotrin will be able to use the berth. 4. The launch landing for Berth #2N is out of service. 5. Berth #1 is out of service due to the condition of the dolphins. However, there is product in the pipelines. 6. Berth #4 is obsolete. 7. Plans are in place to install the Launch Landing in proximity to the shipping yard. 8. The expansion joints of the Main Via Duct were being inspected at the time of the inspection.

B. Action Items

No.	Area	Deficiency/ Observation/Finding	Recommended Action
1.	Documents	a) As-built drawings and site plans are not available. Petrotrin personnel indicated that same is being updated.	a) Provide as-built drawings and site plans for the entire facility.
		b) The pipelines are approximately forty years old and no inspection has ever been done on the subsea lines. Visual inspections and ultrasonic testing (if deemed necessary) is conducted on the risers of the subsea lines every two years. The integrity of the subsea sections of the pipelines is therefore uncertain. Given the age of the pipelines and the uncertainty of the integrity of the lines there is the potential risk of major leaks developing leading to pollution of the marine environment.	b) Conduct the necessary inspections of the subsea sections of the pipelines for determining the integrity of same.
		c) The exact route of the subsea pipelines has not been mapped.	c) Determine the exact route of the subsea pipelines and develop maps/drawings of same.
		d) There is a 50% backlog on the preventative maintenance and inspection programs. Such a large backlog creates the potential risk of failure of equipment, pipelines etc.	d) Determine the cause of the backlog of the maintenance programs and put measures in place for improving same.
		e) Risk assessments are currently being updated for all berths.	e) Expedite the review of risk assessments for the berths.
		f) There is no evidence of a HAZOP study being done for the facility operations.	f) Conduct a HAZOP study for facility and implements recommendations of same.
		g) There is no Fire and Life certificate from the Fire Services Division.	g) Acquire a Fire and Life Certificate from the Fire Services Division.
		h) There is no evidence indicating that the following surveys have been conducted: i) Vibration survey ii) Lighting Survey iii) Noise survey iv) Subsea Inspection of jetty support structures v) Cathodic Protection survey	h) Conduct the listed surveys and implement recommendations from same.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		i) A system for ensuring proper valve line up arrangements for loading/ receiving of product is not implemented.	i) Develop and implement a system for ensuring proper valve line up when conducting loading/receiving operations.
		j) Pumping to loading arms is handled by the Oil Stocks division. Discussions indicated that any issues regarding pumping while loading requires contacting oil stocks division who then contacts the pump attendants. Also, pump attendants do not remain at the pumps while pumping operations are ongoing. This system creates the potential for delays in communication and response in the event of an emergency.	j) Implement an effective communication system to ensure the availability of pump house attendants and effective response in the event of an emergency.
		k) There is no firefighting for the facility.	k) Provide a firefighting plan for the facility.
		l) The Contractor Management Plan is in draft.	l) Finalise the Contractor Management Plan and implement same.
		m) The Oil Spill Contingency Plan is not signed and dated by senior management.	m) Review and update the Oil Spill Contingency Plan and ensure same is signed as being approved.
		n) There are no emergency lights on the berths in the event of a power failure.	n) Conduct a survey of the entire facility for determining areas which require emergency lighting and implement same.
		o) Some of the Standard Operating Procedures require revising. Some of the procedures have dates such as 2009, 2010 and 2011.	o) Revise the Standard Operating Procedures.
		p) The Emergency Response Plan is not available.	p) Develop an emergency response plan for the facility.
		q) The training matrix for 2012-2013 is only 38% completed. 67% of the Priority 1 items have been completed while 40% of the Priority 2 items have been completed.	q) Determine reasons for lapse in completing training as determined in the training matrix and implement measures for rectifying.
		r) The Minimum Safe Manning requirements are not available.	r) Determine the minimum safe manning requirements for operations of the various sections of the facility and implement same. Consideration should be given to manning required for emergency response.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		s) The pipelines are not outfitted with leak detection systems. Also, no evidence was provided for auditing the frequency and adequacy of reconciliation being used as a leak detection method.	s) Provide records of reconciliation which is being used as a leak detection method.
		t) The safety meeting minutes refer to a Port & Marine non-conformance list of deficiencies, some of which are given a high risk rating.	t) Address all items/deficiencies from safety committee meetings and Port and Marine non-conformance list.
		u) Health surveillance although mandatory is only 75% completed.	u) Put measures in place for ensuring that all personnel undergo health surveillance.
2.	Lube Oil Jetty	a) There is a Diesel storage tank at the entrance of the Jetty. Petrotrin officials stated it was condemned; however, it is not isolated.	a) Verify if the Diesel storage tank is condemned and isolate same.
		b) The hydrant pipeline at the entrance of the jetty is leaking.	b) Repair the leaking hydrant pipeline at the entrance of the jetty.
		c) The supports for the sea water pipelines to the refinery are corroded.	c) Address corrosion on the supports for the sea water pipelines.
		d) There is corrosion on the sea water pipelines to the refinery particularly at the restraint brackets.	d) Address corrosion on the sea water pipelines.
		e) There are leaks on several of the valve connections of the sea water pipelines to the refinery.	e) Repair the leaking valve connections of the sea water pipelines to the refinery.
		f) The pipelines on the Lube Oil Jetty are not labelled to indicate content and direction of flow.	f) Label the pipelines to indicate content and direction of flow.
		g) The Lube Oil tanks # 2 (727 USG) and # 3 (592 USG) are sharing a bund, however, the capacity of the bund is questionable.	g) Determine if the bund can contain 110% of the capacity of the largest tank and rectify if necessary. Also, install crash barriers to protect the tanks from vehicular collision.
		h) The rungs of the ladder for the Lube Oil tank # 3 are not provided with anti-skid material. Also, a gauging platform is not installed.	h) Provide anti-skid rungs to reduce the risk of slipping. Also, provide a safe gauging platform for such activity.
		i) The pedestrian walkway is not demarcated.	i) Demarcate the pedestrian walkway.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		j) The curb wall at the edge of the jetty, raised elevations and the guard rails are not highly visible.	j) Paint the curb wall, the raised elevations and guard rails to increase visibility.
		k) There are no barriers to prevent persons from accidentally falling into the sea when accessing the fire hydrant along the Jetty.	k) Install barriers to reduce the risk of personnel accidentally falling into the sea when accessing the fire hydrant along the jetty.
		l) The switches in the electrical panel of the Marine Craft office are not identified.	l) Label the switches in the electrical panel of the Marine Craft Office.
		m) The valve on the water line to the safety shower near the Marine Craft office is kept closed due to a leak on the piping. The safety shower is therefore not functional when the activation lever is pushed.	m) Repair the leak on the water line to ensure the safety shower is functional when the activation lever is pushed in the event of an emergency.
		n) A slop tank and several barrels of oil in the vicinity of No. 8 Berth Switch Hose are not provided with secondary containment. Also, there are breaches in the curb wall in close proximity to the storage area where oil can enter the marine environment in the event of a leak on the tank or drums of oil.	n) Provide secondary containment for the slop tank and the drums of oil. Repair the breaches in the curb wall.
		o) The letters on the sign board near the foam tank are completely faded.	o) Repair or replace the sign board. Ensure safety signs are conspicuously displayed and maintained in a legible condition.
3.	Temporary Launch Landing for Schooner Berth	The ladder for the launch landing is corroded.	Repair/replace the corroded ladder.
4.	Main Via Duct (Pile Bent 19 – 55)	a) Sections of the pipelines, the cross members between the pile bents, the handrails and cross bars of the handrails along the Main Via-Duct are heavily corroded.	a) Assess the extent of corrosion and conduct the necessary repairs to ensure the mechanical integrity of the pipelines and the structural integrity of the cross members between the pile bents, the handrails and cross bars of the handrails along the Main via Duct are not compromised.
		b) The valve wheel on No. 11 sea line by pile bent 19 is in contact with a nearby pipeline obstructing the movement of the valve wheel.	b) Ensure movement of the valve wheel on No. 11 sea line is not obstructed.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		c) A section of the walkway over pile bent 19 by valve wheel on No. 11 sea line is not provided with fall barriers.	c) Install chains or other means to prevent persons from falling over when operating the valve or when stepping across to the other walkway.
		d) A walkway is not provided to easily access a valve on the No. 40 Sea line by pile bent 19. It was stated that scaffolding must be erected to access some of the valves.	d) Provide a safe means of access to the valve on No. 40 sea line.
		e) There are two heavily corroded suspended lines near pile bent 19. Also, the pad eye for the shackle on one of the lines is heavily corroded.	e) Repair/replace the corroded lines and the pad eye. Conduct a survey of the via duct for identifying and addressing similar issues.
		f) The height of the handrails on the walkway over pile bent 21 is inadequate. Also, there are no mid rails installed.	f) Extend the hand rails to a minimum of 42 inches and install mid rails.
		g) The obsolete Salt Water pump house by pile bent 55 is in a dilapidated condition and is not provided with any warning signs.	g) Post suitable safety signs to alert persons of the potential hazards arising from the obsolete and dilapidated Salt Water pump house by pile bent 55.
		h) There is a valve stem protruding into the walkway across pile bent 55.	h) Implement suitable measures to prevent injury to persons from the protrusion of the valve stem into the walkway over pile bent 55.
		i) There is heavy corrosion on a section of the No. 21 sea line leading to pile bent 55. Also, the flange on the sea line by pile bent 55 is heavily corroded.	i) Repair/replace the corroded lines and flange.
		j) A section of a walkway over pile bent 55 is supported by the No. 21 sea line.	j) Provide dedicated supports for the walkways.
		k) There is heavy corrosion on the flange of the 8 inch outer line of No. 21 sea line by pile bent 53.	k) Replace the corroded flange on the outer line of No. 21 sea line by pile bent 53.
		l) A three (3) inch aluminium line is suspended from the No. 21 sea line by wire. Also, the No. 50 sea line is suspended by chains from the eight inch line adjacent to the No. 21 sea line near pile bent 30.	l) Provide dedicated supports for the pipelines. Refrain from adding additional load to the pipelines.
		m) The grating on the walkway is uneven in several areas crating potential tripping	m) Secure the grating on the walkway to prevent tripping hazards from uneven

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		hazards.	surfaces.
		n) There is only one means of access/egress from pile bent 19 to pile bent 55.	n) Install an additional means of access/egress to safely evacuate persons on the Main Via Duct in the event of an emergency.
5.	Main Via Duct (From Pile bent 80)	a) Some of the product pipelines are showing signs of corrosion. The number 18 gas oil sea pipeline is severely corroded.	a) Assess the extent of corrosion and conduct the necessary repairs to ensure the mechanical integrity of the pipelines is not compromised.
		b) Some of the manual valves at PB 80 appear to be leaking.	b) Determine if the manual valves are leaking and rectify.
		c) The Muster Point at PB 80 is clearly not identified.	c) Clearly identify the Muster Point at PB 80.
		d) There are several pipelines that are out of service but are not easily identifiable.	d) Label the out of service pipelines to indicate same.
		e) The handrails of the walkway are corroded and which creates the potential for personnel injury.	e) Assess the extent of corrosion and conduct the necessary repairs to ensure the structural integrity of the handrails is not compromised.
		f) The channels supporting the pipelines are corroded.	f) Assess the extent of corrosion and conduct the necessary repairs to ensure the structural integrity of the channels is not compromised.
		g) The cross members between the piles of the Main Via-Duct are corroded.	g) Assess the extent of corrosion and conduct the necessary repairs to ensure the structural integrity of the cross members between the pile bents are not compromised.
		h) There are obsolete deteriorated wooden structures/piles at two locations on either side of the Main Via Duct. Should these structures/pile fail they would impact the pipelines along the duct.	h) Remove the obsolete deteriorated wooden structures/piles located on the sides of the Main Via Duct.
		i) Number 23 gas oil pipeline is incorrectly labelled as number 22 gas oil at one section of the Main Via-Duct.	i) Correctly re-label the pipeline. Put measures in place for identifying and addressing similar deficiencies.
		j) There are items on the walkway that are partially obstructing it creating tripping hazards.	j) Ensure the walkway is maintained clear of items that could restrict access or constitute a tripping hazard.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		k) The valves for some of the pipelines are not easily accessible to personnel due to their position. l) A piece of wood is being used to separate two pipelines from touching.	k) Implement measures to ensure valves are easily accessible to personnel. l) Implement suitable engineering measures to ensure pipelines are not touching.
6.	Berth # 1 (Main Via Duct)	a) The overhead trolley crane is not certified by and the Safe Working Load (SWL) is not posted on same. b) The lifting winches: i. are not certified by a competent person, ii. do not have guards installed, iii. do not have legible nameplates, iv. do not have the on/off positions identified, v. are not uniquely identified. c) The Slop Oil tank on the lower deck does not have secondary containment. d) The Slop Oil tank does not have any provisions for automatic detection of high levels. This is of concern as the valves are 'passing' product when closed and the product is entering the slop tank. e) Some of the pipeline pressure gauges are not labelled to indicate which pipeline they monitor. Also, some of the gauges are not functioning. f) There is no Pressure Relief Valve (PRV) on the air tank for the winches. g) The rungs for the access ladder to the upper gantry are corroded. h) The PRV for 16 SOP pipeline failed and product is being directed to the Slop Tank. i) Some of the lifting winches are missing. j) The pipelines for the berth are currently pressurized as they have product in them.	a) Certify the overhead trolley crane and post the Safe Working Load (SWL) on same. b) Ensure the lifting winches: i. are certified by a competent person, ii. have guards installed, iii. have legible nameplates, iv. have the on/off positions identified, v. are uniquely identified. c) Ensure secondary containment is provided for the Slop Oil tank. The secondary containment should be able to contain 110% the capacity tank. d) Install high level alarms for the Slop Oil tank or implement measures to ensure the Slop Oil tank is monitored to prevent overspill. e) Label the pressure gauges appropriately and ensure all the gauges are functional. f) Install a Pressure Relief Valve (PRV) on the air tank of the winches. g) Remove the corrosion from the access ladder and treat to prevent further corrosion. h) Ensure the PRV is replaced before the Berth is put back into service. i) Replace the missing lifting winches. j) Implement measures to ensure the pipelines and valves are not maintained in

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		This is a dangerous condition as the valves are under pressure and are currently passing product.	a pressurized condition while the berth is out of service.
7.	Berth #2N (Main Via Duct)	a) The lifting winches: i. are not certified by a competent person, ii. do not have guards installed, iii. do not have legible nameplates, iv. do not have the on/off positions identified v. are not uniquely identified.	a) Ensure the lifting winches: i. are certified by a competent person, ii. have guards installed, iii. have legible nameplates, iv. have the on/off positions identified v. are not uniquely identified.
		b) Some of the pipeline pressure gauges are not labelled to indicate which line they monitor and some of the gauges are not functioning.	b) Label the pressure gauges appropriately and ensure all the gauges are functional.
		c) The Slop Oil tank does not have any provisions for automatic detection of high levels. This is of concern as the valves are 'passing' product when closed and the product is entering the slop tank.	c) Install high level alarms for the Slop Oil tank or implement measures to ensure the Slop Oil tank is monitored to prevent overspill.
		d) The Slop Oil tank on the lower deck does not have secondary containment.	d) Provide secondary containment for the Slop Oil tank. The secondary containment should be able to contain 110% the capacity tank.
		e) Some of the fenders are missing.	e) Install sufficient fenders.
		f) The ramp associated with the fenders is corroded.	f) Repair/replace the corroded ramp.
		g) The walkway to one of the dolphins is slanted on the vertical axis.	g) An investigation should be conducted to determine the reason the walkway is tilted on the vertical axis.
		h) The dolphin for the stern line is out of service. Another dolphin nearby is being utilized and this results in the mooring line extending over the channel. The channel cannot be accessed by other vessels as the mooring line acts as an obstruction.	h) Implement measures to ensure the mooring line does not restrict access to the channel.
		i) The Low Tide access point to the berth is out of service.	i) Repair the Low Tide access point to the berth.
8.	Berth # 2S (Main Via Duct)	The presence of bees on the Main Via Duct on July 24, 2014 prevented the inspection of	Submit the inspection report identifying the non-conformances on berth # 2S and an

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		Berth # 2S.	action plan on the closure of these items.
9.	Berth # 3 (Main Via Duct)	a) The portable fire extinguishers are resting on the floor and their locations are not identified.	a) Store portable fire extinguishers on stands, racks, or hangers, the location of which are readily identified in accordance with NFPA 10 – Standard for Portable Fire Extinguishers.
		b) The Petrotrin's lifting winches are not certified by a competent person and the winch for the Utility boom does not have a guard.	b) Certify the lifting winches are by a competent person and install a guard on the winch of the Utility boom.
		c) The EthylChem Ltd.'s lifting winches do not have guards on them and they are not certified by a competent person.	c) Ensure EthylChem Ltd.'s lifting winches are certified by a competent person and install guards on the winches.
		d) The lifting winches are not uniquely identified to allow easy reference.	d) Uniquely identify the lifting winches for easy reference.
		e) The Slop Oil tanks on the lower deck do not have secondary containment.	e) Ensure secondary containment is provided for the Slop Oil tanks. The secondary containment should be able to contain 110% the capacity of the largest tank.
		f) The bumper guards for the dolphins are in a dilapidated condition.	f) Repair/replace the bumper guards for the dolphins.
		g) There is no wind sock for the berth.	g) Install a wind sock for the berth.
10.	Berth # 5	a) There is severe corrosion on the bleed lines, valves and flanges of booms 1-4. Also, the handrails on the deck under the loading arms are corroded.	a) Assess the extent of corrosion and conduct the necessary repairs of the corroded bleed lines, valve and flanges of boom 1-4 and also the handrails.
		b) There is no fall barrier provided across the top of the ladder near the toilet/shower.	b) Install a chain barrier or other means of fall prevention at the top of the ladder near the toilet/shower.
		c) The raised elevation at the entrance of the catwalks to the spring line dolphins are a potential tripping hazard.	c) Modify the design to prevent the tripping hazard. In the interim highlight the raised elevation to increase visibility.
		d) There is heavy corrosion on the access ramps to the dolphins.	d) Repair or replace the access ramps.
		e) The "Warning to Vessels" sign posted in the vicinity of the entrance to the forward spring line dolphin is not adequately	e) Adequately secure the "Warning to Vessels" sign.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		secured and is a potential drop object hazard.	
		f) The lifting winches: i. are not certified by a competent person, ii. do not have guards installed, iii. do not have spooling devices. iv. are not numbered for ease of identification v. SWL is not indicated	f) Ensure the lifting winches: i. are certified by a competent person, ii. have guards installed, iii. have spooling devices. iv. numbered for ease of identification v. SWL posted
		g) The No. 2 winch line is not running on the pulley.	g) Return the winch line to the pulley.
		h) There is no bushing/bearing for the No. 3 winch line pulley.	h) Install a bushing/bearing on the No. 3 winch line pulley.
		i) Some of the studs on the valve body above the winches are not long enough for adequate threading of the nuts.	i) Install studs of adequate length on the flanges of the valves above the winches.
		j) The low headroom areas created by the cross bars by the winches are not highlighted.	j) Highlight the low head room areas created by the cross bars by the winches.
		k) The Slop Oil tanks on the lower deck do not have secondary containment.	k) Ensure secondary containment is provided for the Slop Oil tanks. The secondary containment should be able to contain 110% the capacity of the largest tank.
		l) The incoming and departing lines for the slops oil pump are heavily corroded at the bends below the deck surface.	l) Repair or replace the heavily corroded flowlines.
		m) There are no handrails/barriers at the top of the platform for accessing the valves near the slops oil pump.	m) Provide handrails/barriers for the platform to reduce the risk of personnel falling off the platform.
		n) The location of fire extinguishers is not demarcated.	n) Label the location for lifesaving equipment.
		o) The berth is outfitted with a single man raft for emergency evacuation. There are no measures in place for evacuation of personnel when there is increased POB on the facility.	o) Put measures in place for evacuation when the POB on the facility is increased.
		p) There are no life rings throughout the	p) Provide life rings on the facility.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		facility.	
11.	Berth # 6	a) Some of the fenders on the landing stage are damaged.	a) Repair or replace the fenders on the landing stage.
		b) The "Suppression" labels on the fire water activation buttons are faded.	b) Provide conspicuous labels for the fire water activation buttons.
		c) The side bolts and supporting base of the 'Danger' sign posted on the Jetty Hut are corroded. This is a potential drop object hazard.	c) Assess the state of corrosion and ensure same is adequately secured.
		d) There are exposed conductors in the vicinity of the phone in the Jetty Hut.	d) Secure all exposed conductors to prevent contact with energized conductors.
		e) A first aid kit is not available on the berth.	e) Provide a first aid kit.
		f) The life float is dirty and stored inside the Jetty Hut. The location does not permit for easy deployment in the event on an emergency. Also, this is a single man raft and there is no provision for emergency evacuation when there is increased number of personnel on the facility.	f) Maintain cleanliness of the life float and store appropriately for easy retrieval. Put measures in place for evacuation when POB is increased on the facility.
		g) A section of the mid rail and toe board is missing by the walkway at the top of the first ladder used to access the SPM platform. It was stated that there are plans to construct a stairway to replace the ladder at this location.	g) Implement measures to safeguard against possible incidents that could arise from the missing section of the mid rail and toe board at this area until the construction of the stairway.
		h) The belt on the contractor pump stored on the SPM platform is not adequately guarded.	h) Implement and enforce proper procedures to ensure unsafe equipment is not utilized by contractors on the berth.
		i) There is a major concern with the scaffolding erected by the contractors on the SPM platform. Some of the planks are loose and gratings instead of planks are used in some areas.	i) Effectively manage the contractors to ensure the health, safety and welfare of all employees.
		j) Tins of paint and paint thinners are not provided with secondary containment.	j) Provide secondary containment for these items to prevent pollution of the marine environment in the event of leaks.
		k) There are exposed electrical lines and corrosion of the electrical supports.	k) Secure all exposed electrical lines to prevent contact with energized conductors. Remove, if obsolete.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
		l) The direction of flow is not indicated on the pipelines on the SPM platform.	l) Indicate the direction of flow on the pipelines on the SPM platform.
		m) There are no fire extinguishers provided at the SPM platform.	m) Develop a firefighting plan for the facility and provide fire extinguishers as required in the plan.
		n) There are oil sheens near the obsolete risers alongside the Single Point Mooring (SPM) platform.	n) Determine the source of pollution and employ measures to mitigate the release of oil into the marine environment.
		o) The fire alarm panel is malfunctioning and as a result the fire alarm is silenced.	o) Determine the reason the fire alarm panel is malfunctioning and rectify accordingly.
		p) The handrails of the hydrant/wind sock landing are severely corroded.	p) Repair/replace the corroded handrails of the hydrant/wind sock landing.
		q) The rungs of the access ladder to the wind sock platform are corroded.	q) Repair/replace the rungs of the access ladder to the wind sock platform. Also, ensure the rungs are not smooth to prevent a slipping hazard.
		r) The identification sign near the gangway platform is faded.	r) Repaint the faded identification sign by the gangway landing.
		s) The base of the light pole and the handrails of the gangway platform are corroded.	s) Conduct the necessary repairs to the corroded structures to ensure the integrity is not compromised.
		t) The slops trough is out of service and has two holes.	t) Seal the holes in the slop trough and return to its intended service as necessary.
12.	Berth # 7	According to Petrotrin officials, Berth # 7 is out of service due to structural issues of the dolphins and heavy corrosion of the pipelines and infrastructure on the berth.	Submit a report to the MEEA identifying the reasons the berth was taken out of service, status of the product in the pipelines and future plans for the berth. Also, ensure that access is restricted to authorized persons and if the area is deemed unsafe then adequate measures are in place to prevent injury to people, property and the environment.
13.	Berth # 8	Berth # 8 is out of service. Heavy corrosion on the handrails and infrastructure was observed.	Submit a report to the MEEA identifying the reasons the berth was taken out of service, status of the product in the pipelines and future plans for the berth. Also, ensure that access is restricted to authorized persons and if the area is deemed unsafe then adequate measures are in place to prevent injury to people, property and the environment.

No.	Area	Deficiency/ Observation/Finding	Recommended Action
14.	General	a) The obsolete Berth #4 is not properly lit.	a) Remove the obsolete structure. In the interim, provide lighting.
		b) Wind socks are not installed on all the berths.	b) Install wind socks on all the berths.
		c) Conspicuous identification signs are not posted on all the berths.	c) Prominently display identification signs on all the berths to notify incoming vessels and rescue teams.
		d) First aid kits are not provided on all the berths.	d) Provide first aid kits to personnel on the berths.
		e) There is no signage on the berths to indicate where life jackets are required.	e) Provide signage indicating areas where life jackets are required.
		f) There are no life rings on the berths.	f) Develop a lifesaving appliances plan for the berth to determine locations where life rings should be located and provide same.

Guidance Notes:

[1]Recommended actions listed in the tables above are provided as a possible means of addressing the noted deficiencies/ observations. Any alternative means of closing out the action items must be forwarded in your company's action plan when responding to this report. These alternative means must provide an equivalent or better level of protection for the noted deficiencies/ observations.

[2]Deficiencies/ observations which your company believes are not safety critical or for which there are sufficient measures in place to control the risk and therefore does not warrant implementation must be highlighted in your action plan with suitable justifications. The Ministry would review these justifications and respond accordingly.

...End of Report...

DNV·GL

Company Report

National Facilities Audit of the Oil & Gas Industry in Trinidad and Tobago

Ministry of Energy and Energy Industries (MEEI), Government of the Republic of Trinidad and Tobago

Petrotrin Refinery

Report No.: OAPUS310GKOCH (PP140703-PR)
November 7, 2016

Project Name:	National Facilities Audit of the Oil & Gas Industry in Trinidad and Tobago
Customer:	Ministry of Energy and Energy Industries (MEEI), Government of the Republic of Trinidad and Tobago
Contact Person:	Amanda Kissoon
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Objective:
The objectives of this report are to present the results of the National Facilities Audit of the Oil & Gas Industry in Trinidad and Tobago and to provide specific results for the Petrotrin Refinery.

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Executive Summary

The Ministry of Energy and Energy Industries (MEEI), Government of the Republic of Trinidad and Tobago (T&T), contracted Det Norske Veritas Trinidad & Tobago Limited (DNV GL) to conduct a National Facilities Audit of the Oil and Gas Industry (Tender Notice CTB 16/3/300).

The project was performed over a 9-month period starting in July 2015 and involved 30 companies selected based on DNV GL's knowledge of the T&T energy industry and considerations of perceived risk. The final approval for the selection of the 30 companies was given by the MEEI. The audit was comprehensive, encompassing offshore as well as onshore activities, and covered infrastructure in the upstream, midstream and downstream segments of the domestic energy sector.

The overall results of the audit and analysis are presented in the report, and specific details that pertain to Petrotrin Refinery are documented.

Hazard Grouping	COMAH Score
Safety	High Risk (A)
Environmental	High Risk (A)

System Audit	Audit Score Weighted Average
National Facilities	Implementing (2.02)
Petrotrin Refinery	Developing (1.62)

Equipment Audit	Audit Score Weighted Average
National Facilities	Implementing (1.93)
Petrotrin Refinery	Developing (1.08)

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1.0 INTRODUCTION

The Ministry of Energy and Energy Industries (MEEI), Government of the Republic of Trinidad and Tobago (T&T), contracted Det Norske Veritas Trinidad & Tobago Limited (DNV GL) to conduct a National Facilities Audit of the Oil and Gas Industry (Tender Notice CTB 16/3/300).

The project was performed over a 9-month period starting in July 2015 and involved 30 companies selected based on DNV GL's knowledge of the T&T energy industry and considerations of perceived risk. The final approval for the selection of the 30 companies was given by the MEEI. The audit was comprehensive, encompassing offshore as well as onshore activities, and covered infrastructure in the upstream, midstream and downstream segments of the domestic energy sector.

The primary purpose of the audit was to establish the integrity of facilities in the T&T domestic energy sector.

T&T has been commercially producing oil and natural gas for over a century. The first onshore oil production was in 1908. Natural gas was first used as fuel for power generation and as a feedstock for petrochemical manufacturing in the late 1950s. The country experienced its first offshore oil production boom in the mid-1950s and the second such offshore oil production boom in the 1970s with Amoco fields coming on-stream. There was a concurrent increase in natural gas production as feedstock for petrochemical manufacturing, steel manufacturing and power generation.

The 1980s gave rise to an expansion of the Point Lisas Industrial Estate and the late 1990s saw the start of the LNG business in T&T. The new LNG plants prompted the development of new gas fields and new pipeline systems to transport gas from the production fields to the LNG plants.

A significant portion of oil, gas and manufacturing facilities in T&T are ageing or have been retrofitted to extend their economic lives. In recognition of their ageing energy infrastructure, the upstream companies embarked on a massive maintenance program following the 2010 Macondo accident to ensure that their facilities were up to international standards for HSE. In the downstream sector, companies periodically conduct turnarounds to ensure that their plants are in optimum condition. These activities are executed in consultation with the MEEI and other regulatory institutions. Hence, the MEEI conceptualized this project to understand the status of the integrity of these facilities and to formulate a Plan Forward.

This report first explains the general approach and overall results of the National Facilities Audit and then presents the company-specific findings for the Petrotrin Refinery.

2.0 APPROACH TO THE NATIONAL FACILITIES AUDIT

2.1 Audit Format

The work was executed by DNV GL with staff from the USA, UK and T&T, in close cooperation with the MEEI staff from the Port of Spain and San Fernando offices. The audit process was designed based on a one-week program per company. A typical audit week consisted of:

- A planning meeting between DNV GL and MEEI staff on Monday to review the pre-collected information,
- Audits at the company on Tuesday and Wednesday,
- A walk-through inspection followed by a close-out meeting with feedback to the Company on Thursday, and
- A reporting meeting between DNV GL and MEEI staff on Friday.

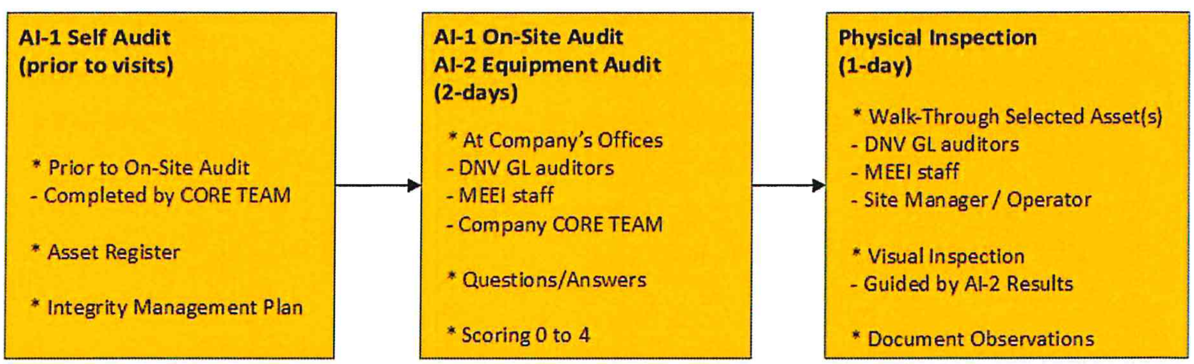

Figure 1. Audit Format for One-Week Audits.

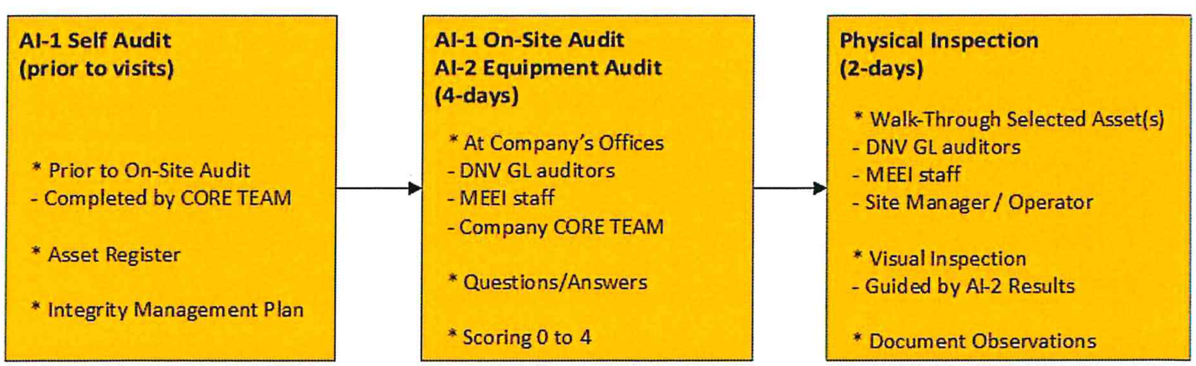

Figure 2. Audit Format for Two-Week Audits.

Twenty seven (27) companies were subject to a three-day audit in a one-week period, while three (3) companies were subject to a six-day audit conducted over a two-week period, as shown in Figure 1 and Figure 2. The rationale for selecting these three companies for a two-week audit was that they have extensive assets and they are key companies in the National Oil & Gas infrastructure by their interconnecting nature and large downstream capacities. Other companies in the audit are very much dependent on the reliable operations of the assets of these three critical companies.

All formal communications with the companies were conducted through the MEEI, including the establishment of contacts, requests for information, scheduling of the audits, and walk-through inspections. The MEEI communicated with DNV GL about any arrangements made with the companies.

The audit approach was developed to create an open conversation with the companies in order to gather as much information as possible about their current level of development and implementation of AI processes. The audits were conducted versus global Oil & Gas industry best practice, and were used cooperatively with the companies to identify notably good practices and areas that offer opportunities for improvement. If an immediate safety concern was identified during the audit, this concern was verbally reported during the close-out meeting with the company and to the MEEI for immediate action or follow-up. In addition, the auditors noted their observations during the walk-throughs. Some of these observations may have been identified as possible integrity issues, which were suggested for follow-up action by the MEEI. Typically, these items are visual cues such as the presence of leaks, clamps, dents, or apparent corrosion/metal loss.

A kick-off meeting with the companies involved in the audit was organized by the MEEI on August 18, 2015. DNV GL presented the audit findings in a Final Presentation to the MEEI on April 5, 2016. Stakeholder meetings were conducted with companies and the MEEI on April 7, 2016.

2.2 Audit Protocol

The AI audit protocols developed by DNV GL were derived from DNV GL's International Safety Rating System (ISRS™ 8th Ed), which includes the requirements of international standards, as follows:

- OSHAS 18001 Health and Safety Standard
- ISO 14001 Environmental Management System
- ISO 9001 Quality Management Systems
- ISO 55000 Standards for Asset Management
- ISO 31000 Risk Management
- OSHA 1910 Occupational Safety and Health Standards
- SEVESO II Directive -96/82/EC Directive on the COMAH approach

Thus, the protocol is a collation of global good practice. The protocol was put in the form of a list of questions that were the same for each company.

The protocol was divided into three phases: AI-1 Self Audit, the AI-1 System Audit and AI-2 Equipment Audit.

The questions in the AI-1 Self Audit and AI-1 System Audit addressed the following elements of the management system:

1. Asset Management
    - ISRS Element Summary: *Asset Management is the maintenance of physical assets in the workplace to ensure acceptably low risk for optimum operability and cost. The maintenance program describes the maintenance regime for each asset in the asset register. Maintenance and operations personnel must coordinate activities to plan and execute the management program. Inspections of appropriate areas ensure the general condition of assets is maintained.*

2. Change Management
    - ISRS Element Summary: *Management of Organizational Change - Organizational change is a constant in the modern workplace which should be controlled with an effective change management process. This includes having mechanisms for effectively retaining critical skills and capabilities, and to manage the risks associated with changing the structure of the organization.*

    - ISRS Element Summary: *Management of Engineering Change - An effective engineering change management process provides a coherent, systematic, and simple mechanism for identifying and controlling hazards through the change process with emphasis on the transition phase. Well implemented, MOC ensures that the health, safety, and environment of the facility and its personnel is not compromised by inadequate evaluation of hazards, threats, and other potential undesired events related to change, and the intended benefits of the change are fully realized as planned.*

3. Communication and Promotion
    - ISRS Element Summary: *Good communication is essential for effective management of change. In an ever changing workplace effective communication is critical both to inform and motivate personnel. Good communication is more than telling – it should be an interactive process of "giving and getting understanding". Promotion campaigns and varied communication channels should be used to promote HSEQ improvement in a fresh and interesting way. Management and group meetings should be focused on key HSEQ issues and coordinated to ensure important information is filtered up and cascaded down effectively. Exceptional group and individual performance should be identified and widely communicated to reinforce correct behaviors.*

4. Contractor Management
    - ISRS Element Summary: *In their drive for efficiency, organizations are increasingly making use of contractors, outsourcing, and temporary employees. A major challenge associated with this trend is how to ensure contractors comply with the organization's safety and environmental standards, when contractor personnel are managed by others. Effective contractor management requires a rigorous selection process, clear definition of responsibilities, competence checks, adequate supervision and careful monitoring of performance. Excellent communication is required to ensure effective coordination with company personnel and processes. Effective purchasing and supply chain management ensures materials and equipment are sourced on time, and of the desired quality.*

5. Emergency Response
    - ISRS Element Summary: *Effective emergency preparedness means planning and practicing in advance so that, in the event of an emergency, the harm to people, the environment and to the business is minimized. First, potential emergencies should be identified and categorized. Plans should then be developed to respond to these emergencies. Systems for emergency communication should be established and technical systems, for example, fire protection and emergency power, should be put in place. Emergency teams of experienced personnel should be established to execute the emergency plans and their competence should be ensured through regular drills and exercises. Finally, adequate first aid and medical support should be available if required.*

6. Leadership
    - ISRS Element Summary: *Good leadership begins with defining the organization's expectations (purpose, vision, values, goals and policies), aligning these with the expectations of other stakeholders and developing a strategy for achieving these expectations. Leaders are responsible for defining the core business of the organization and identifying the major business risks. Leaders must also demonstrate commitment to improvement through practical leadership by "walking the talk." This is particularly emphasized in terms of the focus on Process Safety Management (PSM)/Integrity/Risk within the leadership, and the encouragement of a suitable culture within the organization.*

7. Learning from Events
    - ISRS Element Summary: *Learning from events is critical to drive continual improvement in safety, environmental and business performance. An effective Learning from Events system transforms undesired events into improvement opportunities. Managers should strive to create a "no blame" culture in the organization to foster high levels of event reporting. Personnel should be particularly encouraged to report near misses, which offer the greatest number of learning opportunities. All events should be risk assessed and investigated appropriately, involving both managers and front line personnel. Investigations must uncover the basic causes of events before determining the necessary corrective and preventive actions. Actions must be tracked to completion and the results communicated to all necessary stakeholders.*

8. Planning and Administration
    - ISRS Element Summary: *Projects' unique character introduces risks into the workplace and requires careful planning to ensure risks are controlled and that projects are completed on time, on budget and to the desired quality. Formal accountabilities should be defined for each project. Project plans define the goals, responsibilities, resources and risks throughout the project lifecycle ensuring process safety is built into plant, equipment and systems through the application of suitable studies and Process Safety Project Reviews. Effective execution and control ensures changes are managed, work is completed correctly and stakeholder expectations are met. Post project review ensures lessons are learned for future projects.*

9. Project Management
    - ISRS Element Summary: *Projects are unique activities with a beginning and an end. Their unique character introduces risk into the workplace and requires careful planning to ensure risks*

are controlled and that projects are completed on time, on budget and to the desired quality. Formal accountabilities should be defined for each project. Project plans define the goals, responsibilities, resources and risks throughout the project lifecycle ensuring process safety is built into plant, equipment and systems through the application of suitable studies and Process Safety Project Reviews. Effective execution and control ensures changes are managed, work is completed correctly and stakeholder expectations are met. Post project review ensures lessons are learned for future projects.

10. Results and Review
    - ISRS Element Summary: *To survive and prosper, a business must achieve good results. Business results are measured simply by comparing actual performance against the safety, environmental and business goals set by the leadership team. The challenge for business leaders is to direct business and work processes both to manage risks and achieve good business results. Sustained or continually improving performance can be demonstrated by preparing trends of business results. Performance benchmarking may be undertaken by those organizations who wish to compare themselves with industry leaders or world class. The management system is the leadership team's primary tool to manage risks and drive improvement. Formal management reviews are necessary to evaluate the performance of the management systems, identify improvement actions and feedback into the strategy and planning process. Corporate Social Responsibility demands that businesses demonstrate good safety, environmental and business performance to all relevant stakeholders.*

11. Risk Management
    - ISRS Element Summary: *The first duty of managers is to effectively manage risk. Risk management begins with the identification and evaluation of health, safety, security and environmental risks. This requires the application of effective Process Hazard Analysis (PHA) techniques to inform decision making and resource allocation. Employees must have a good awareness of risk at all times. A team approach to process and task risk evaluation will drive a strong risk culture in the organization.*

    - ISRS Element Summary: *Once risks have been identified, a hierarchy of controls should be in place to manage the risks. Engineering/design controls are the first choice to eliminate risks where possible. Administrative controls including procedures, rules, work permits and warning signs are the next choice to mitigate risk. Personal and environmental protective equipment are the last line of defense. Materials and products should be effectively identified, labeled, stored and inspected to ensure quality is controlled. Controls should be in place to ensure processes perform within critical parameters. It is also necessary to assess the means of demonstrating the control of process hazards to stakeholders through the use of Major Hazard Reports.*

    - ISRS Element Summary: *Risk monitoring is essential to provide assurance to managers and other stakeholders that all risks are effectively controlled. Risk Monitoring builds on Risk Evaluation and Risk Control to complete the risk management continual improvement loop. Effective monitoring should identify where risk controls are inadequate and initiate the necessary improvement actions.*

12. Training and Competence
    - ISRS Element Summary: *Personnel must have the necessary competence to execute their jobs effectively. An effective training system is important in order to identify and deliver the training necessary to ensure individual competence. Training should only be performed to fill an identified need, based on an analysis of existing competence, role requirements, training objectives and employee aspirations. Training should be delivered by competent instructors using appropriate communication techniques and resources. Effective orientation/inductions are important for leaders and employees to ensure they are not at risk when they start in a new position.*

The questions in the AI-2 Equipment Audit covered the following equipment and equipment-related topics, where applicable:

1. All Equipment and Locations
    - Including leaks, bad actors, pressure relief, bypasses of safety critical equipment, temporary equipment and idle equipment.
2. Electrical and Instrumentation
3. Facility Piping
4. Fired Heaters and Boilers
5. Launchers and Receivers
6. Pipelines and Risers
7. Pressure Vessels
8. Pressure Safety Valves (PSVs)
9. Rotating Equipment
10. Structures
11. Tanks
12. Special Emphasis
    - Including corrosion assessment, cathodic protection, chemicals program, coatings, injection points, hydrogen sulfide (H_2S), corrosion under insulation (CUI), flow assurance and positive materials identification.

An internal quality check of the AI audit protocol was performed after the first five audits were completed in October 2015. The auditors found that the protocol was well-received by the companies, that it covered a wide range of AI topics and that the topics were relevant to the companies' processes. The protocol questions also allowed the auditors the flexibility to ask relevant information across the range of companies that were included in the National Facilities Audit. Therefore, no major adjustments/corrections to the audit protocol were deemed necessary for the remaining audits.

The difference between the System Audit and the Equipment Audit is in the line of questioning, focused on management systems in the System Audit and equipment specific details in the Equipment Audit. The walk-through inspection provided an impression of the physical condition of the facilities and was used to confirm that systems and equipment aspects at the site matched the descriptions provided during the System Audit and Equipment Audit question/answer sessions.

The walk-through inspection, along with applicable document review, was used to assess the status of the implementation of AI systems in the facilities. No operational tests, functional checks, or non-destructive tests (NDT) were performed on any of the equipment. Therefore, any discussion of the "current status of mechanical integrity" is strictly related to the procedures and practices being described by and observed at the companies and the visual appearance of the assets.

2.3 Audit Staffing and Scheduling

To complete the company audits within the specified schedule, five audit teams were formed, each consisting of two DNV GL auditors, typically accompanied by one to three MEEI staff. Each company was requested to provide the names of four people who would form their Company Core Team to participate in the audit. The Core Team typically included at least one senior manager from the Company's Leadership Team and consisted of staff with titles equivalent to: 1. Site Manager, 2. Integrity Manager, 3. Operations and Maintenance Manager and 4. Health, Safety, Environmental (HSE) Manager.

Because of the wide range of topics covered in the audit protocol, companies could offer different staff to be the Core Team members for the AI-1 System Audit and for the AI-2 Equipment Audit. In addition, if there were any audit questions that were better answered by specialist staff not on the Core Team, then those staff could be requested to participate in all or part of the audit.

2.4 Information Requested from Companies

Each company was requested to provide the following documentation prior to the audits:

- An Asset Register for the company;
- A copy of their written AIM Plan, if available, and
- A completed self-assessment questionnaire (Self Audit).

The self-assessment, together with the Asset Register and AIM Plan, served as a basis for the System Audit and Equipment Audit by the auditor teams. The auditors could request additional information from the companies in support of any answers they provided.

In addition to written documentation (either electronic or as hard copy), photographs of the facilities were taken during the walk-through inspections, where possible and where permission was given.

2.5 Audit Scoring System

Table 1 shows the scoring system from 0 to 4 used for each question during the audits and a color scale from red (0, 1) to yellow (2) to green (3, 4) was applied to generate heat maps, bar charts and spider plots.

Table 1. Audit Scoring System, with Colors Used in Heat Plots.

4 = Optimizing	The activity or practice is effective and efficient. Visible continuous improvement culture/efforts are in place.
3 = Managing	The activity or practice is documented and effectively implemented.
2 = Implementing	The activity or practice is documented with implementation ongoing, but not fully mature.
1 = Developing	The activity or practice exists, although it may be incomplete and undocumented.
0 = Learning	The activity or practice is absent or ad hoc and little awareness of the expectation is in place.

** Note that the auditors scored to 0.5 point increments.*

By using this common definition for scoring, possible variations in scoring between the different audit teams were minimized. The auditors asked the questions as outlined in the AI audit protocol, discussed the answers provided and probed deeper with follow-on questions for each of the topics, as needed. A score was then assigned to the answer to reflect the current status for that particular topic. The auditors were allowed to use half-point increments when noting their scores. The resulting scores per topic and overall scoring were used to compare the companies and draw conclusions.

2.6 Determination of Companies' Overall Hazard Grouping

In order to prioritize the companies in the National Facilities Audit in terms of intrinsic risk (IR), the methodology for Safety Hazard Grouping and Environment Hazard Grouping from the UK Control of Major Accident Hazards (COMAH) Regulation was applied. This Regulation applies a prioritization methodology originally designed to categorize individual sites where operations take place. For this study, the methodology was modified to allow determination of the Overall Hazard Grouping for an individual company. The COMAH methodology consists of two calculations: (i) Safety Hazard Score and (ii) Environmental Hazard Score, as shown in Figure 3.

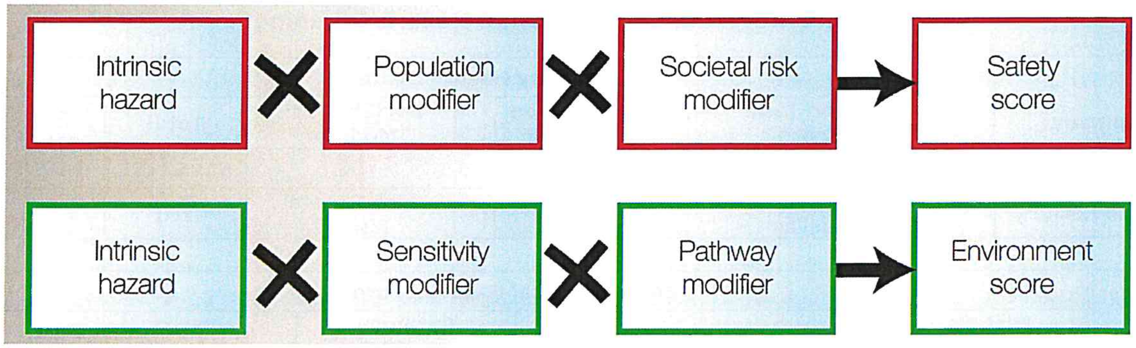

Figure 3. COMAH Methodology for Hazard Score Incorporating Safety and Environmental Hazards.

The Safety Hazard Score is computed from the multiplication of a Base Score (S1) that depends on the installation type, a Population Modifier (S2) based on the number of people who could be affected by an accident and a Societal Modifier (S3) that rates if an accident constitutes "high" or "low" societal risk. A point value is assigned to each of the three terms and the total S1 x S2 x S3 value then determines the Safety Hazard Score as "A," "B," "C," or "D," where A is the highest risk and D is the lowest risk.

The Environmental Hazard Score is computed from the multiplication of a Base Score (E1) that again depends on the installation type, a Sensitivity Modifier[1] (E2) based on the sensitivity of the affected environment in case of an accident, and a Pathway Modifier (E3) that indicates whether or not fluids from a spill would have direct access to the environment. A point value is assigned to each of the three terms and the total E1 x E2 x E3 value then determines the Environment Hazard Score as "A," "B," "C," or "D," where A is the highest risk and D is the lowest risk.

For the final Risk Matrix, the highest of the two groupings was used (i.e., if a company had Safety Hazard Grouping "A" and Environmental Hazard Grouping "B," then the Overall Hazard Grouping as determined as "A," which is the highest intrinsic risk). Using this COMAH calculation, the Petrotrin Refinery Hazard Scoring is shown in Table 2.

[1] Examples of environmentally sensitive areas include a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI).

Table 2. Safety and Environmental Hazard Grouping.

Company	Safety Hazard Score				
	Installation Type Base Score	Population Modifier	Societal Risk Modifier	Total	SAFETY HAZARD GROUPING
	S1	S2	S3	S1xS2xS3	
Petrotrin Refinery	Petrochemical processing, including refining - 8	>1000 people - 16	High Societal Risk - 2	256	A

Company	Environmental Hazard Score				
	Installation Type Base Score	Sensitivity Modifier	Pathway Modifier	Total	ENVIRONMENT HAZARD GROUPING
	E1	E2	E3	E1xE2xE3	
Petrotrin Refinery	Petrochemical processing, including refining - 9	Highly vulnerable receptor - 4	Clear pathways, both direct and indirect - 2	72	A

The underlying concept to the COMAH methodology is the Major Hazard Barrier model, illustrated in Figure 4. To prevent an accident from a major hazard becoming a major event with disastrous outcome, there are preventive barriers in place that control the likelihood and there are mitigation barriers in place to control the consequences of an event. As long as there are sufficient and effective barriers are in place, there is some control over the situation, but when barriers are breached, safety and the environment can be affected.

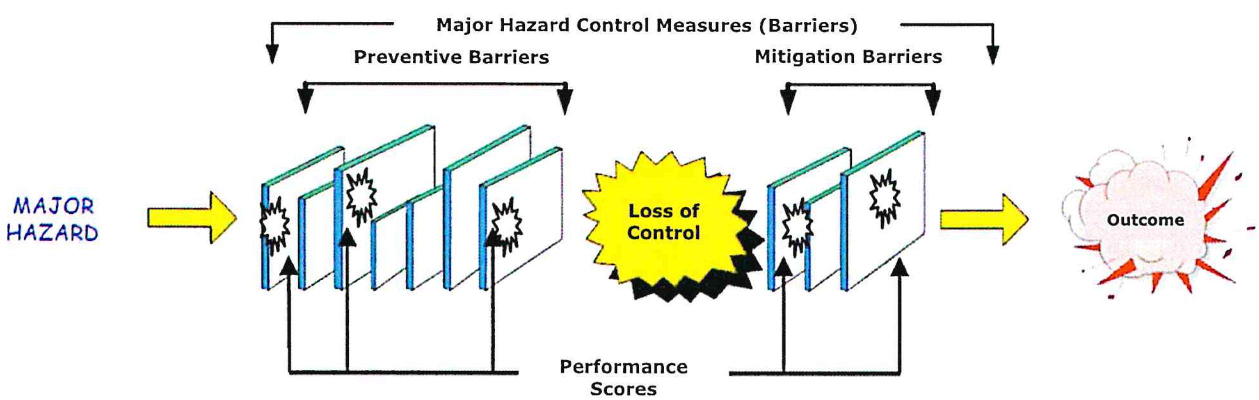

Figure 4. Major Hazard Barrier Model.

In addition to the Safety and Environment Scores, the assessor can include as a basis for prioritization "other intelligence" in the intrinsic risk evaluations, such as:

- Volumes handled
- History of incidents/accidents
- Business criticality to T&T

In the National Facilities Audit, the "other intelligence" was used. The size of many of the companies and their operations is significant and comparable to other globally notable locations. For example, the combined downstream and midstream companies rank among the largest facilities in the world within their respective market segments. The history of known events for companies was used, as a heavily publicized oil leak was one of the motivations for the National Facilities Audit. Business criticality was also considered because the Oil & Gas industry in T&T is interconnected and interdependent. Examples of interdependencies include Petrotrin Onshore, which is a large company with many facets and contracts with other producers, and the Petrotrin Refinery, which processes the majority of the oil and gas, and the marketing companies and downstream companies which distribute and process the products. All these factors are considered together when determining intrinsic risk and for setting priorities and making meaningful comparisons.

2.7 Self Audit

The Self Audit was intended to assess the awareness of the implementation of AI programs and systems by the companies themselves, prior to being audited. The companies were asked to provide their status of the "Practices in Place" and provide specific comments on possible gaps, concerns and issues. The Self Audit results were compared with the System Audit results. The company's scores on their Self Audit questionnaires were not altered. The scores from the System Audits, in the same topic categories, were compared with the Self Audit scores and any differences were noted. Significant differences between Self Audit and System Audit scores are themselves findings, and were discussed with the companies.

2.8 Requested Documentation

In addition to the Self Audit, DNV GL requested several other documents prior to the Audit. These documents included the Company's Asset Register and AIM Plan. The asset documentation enabled DNV GL auditors to have an understanding of the Company and served as a guide for the Audit discussions.

The Asset Integrity Management (AIM) Plan requested from the companies was the basis for much of the discussions that took place during the Technical Audits. The elements of an AIM Plan are defined in International Standard ISO 55001 "Asset management — Management Systems — Requirements". The Standard specifies the requirements for the establishment, implementation, maintenance and improvement of a management system for asset management, referred to as an "asset management system".

The Asset Register requested from the companies to be audited served as a general guide for the discussions. Without a list of assets, it would be difficult to ask equipment-specific questions. It was further anticipated that the level of documentation regarding the physical company assets would vary significantly across the industry. The information received showed these differences. Table 3 lists the elements.

Table 3. Required Content of Pre-Audit Documentation: AIM Plan and Asset Register.

Documentation		#	Required Content
AIM Plan	Critical Elements	1	Understanding the Organization and its context
		2	Understanding the Needs and Expectations of Stakeholders
		3	Determining the Scope of the Asset Management System
		4	Asset Management System
		5	Leadership and Commitment
		6	Policy
		7	Organizational Roles, Responsibilities, and Authorities
		8	Actions to Address Risks and Opportunities for the Asset Management System
		9	Asset Management Objectives and Planning to Achieve Them
		10	Resources
		11	Competence
		12	Awareness
		13	Communication
		14	Information Requirements
		15	Documented Information
		16	Operational Planning and Control
		17	Management of Change
		18	Outsourcing
		19	Monitoring, Measurement, Analysis, and Evaluation
		20	Internal Audit
		21	Management Review
		22	Nonconformity and Corrective Action
		23	Preventive Action
		24	Continual Improvement
Asset Register	Mandatory	1	Listing of Processes and Equipment
		2	Equipment Numbers
		3	Equipment Names
		4	Equipment Locations
	Optional	5	Asset Age
		6	Mileage
		7	Size
		8	Materials of Construction
		9	Operating Conditions

During the Audit, other relevant documentation was requested or was volunteered by the Companies. The documents included, but were not limited to, procedures, plans, programs, lists, drawings, maps, photographs, forms, checklists, assessments, risk registers, risk matrices and mission, philosophy and policy statements.

2.9 Walk-Trough Inspections

The DNV GL auditor teams selected one or more assets for a walk-through inspection for each company. In the selection process, the DNV GL auditors considered:

- Input from the MEEI, including prior inspection reports and with particular attention to historical information about unintended releases (e.g., gaseous leaks, liquid spills, etc.).
- The information gathered during the System Audit and Equipment Audit in the days leading up to the walk-through inspection.

The terminology in Table 4 was used to describe the condition of the facilities, based on the impressions by the auditors during the physical walk-through inspections.

Table 4. Qualification Levels to Assess Status of Viewed Facilities.

Acceptable	The general appearance of the facilities was clean and organized, and there were not many obvious material degradation issues visible.
Fair	The general appearance of the facilities included observations of minor housekeeping issues, and/or ongoing material degradation issues.
Concerning	The general appearance of the facilities indicated poor housekeeping, a possible backlog of maintenance and/or inspection activities, and/or evidence of current or recent damage, incidents, or accidents.

2.10 Overall Assessment

The results from the above-described audit activities were compiled and analyzed to develop an overall assessment of the national status of AIM in T&T energy companies. These results were presented in the form of heat maps, bar charts and spider plots.

2.10.1 Heat Maps

Heat maps show individual data points with various colors in a tabular format. For the purpose of this audit, the color-coding of the audit scores is shown in Table 1. The heat maps use intermediate shades on the color scale, creating a continuous spectrum from red (scores 0, 1) to yellow (score 2) to green (scores 3, 4). The audit score of 2.0 is seen as a crucial cut-off point, corresponding to full development and documentation of a company's AIM program or system and hence the availability of auditable AI information.

A benefit of heat maps is that the reader can quickly recognize the colors as they relate to the company scores in the table and establish an overview of the results. One can easily discern the high scores (green) from the low scores (red).

2.10.2 Bar Charts

Bar charts show the average scores per company versus the national or category average. The bar charts are organized with the relevant scores descending from left to right. Bar charts allow for an easy comparison of the company scores side-by-side and versus the average.

2.10.3 Spider Plots

Spider plots resemble, as the name suggests, a spider web with radiating spokes connected by a connecting "web." Each system element (from the System Audit) or equipment topic (from the Equipment Audit) is represented by a spoke in the spider plot. The scoring along the radii is from the lowest (score 0) in the center of the spider plot, to the highest (score 4) at the outer diameter of the spider plot. In cases when there was no score for a spoke, the spider plot shows a score of zero and a box "N/A" for "not applicable" is shown.

Spider plots were generated for each individual company, both for System Audit and Equipment Audit results and the plots also include the national average score or category average for comparison. When seen together, spider plots are a powerful method to benchmark the results of multiple companies across all of the elements or topics. Any scores above or below the average are easily recognized.

3.0 GENERAL RESULTS

3.1 Compilation, Assessment and Benchmarking of Results

The results of the audits were reviewed and benchmarked against each other and against the national average by the use of bar charts, heat maps and spider diagrams. From these analyses, overall conclusions are drawn, including the status of development and implementation of AIM programs used for T&T's Oil & Gas facilities.

3.1.1 Self-Audit and System Audit Results

The average scores from the Self Audit and System Audit are listed in Table 5 and the average scores[2] from the Equipment Audit are shown in Table 6.

[2] Average scores from the Equipment Audit were calculated from the number of companies with that type of equipment.

Table 5. Average Scores for Self Audit and System Audit – by Element.

Audit Elements(*)	Self Audit	System Audit
Results & Review	-	1.83
Planning & Administration	2.75	1.84
Asset Management	2.91	2.00
Leadership	3.13	2.01
Training & Competence	2.91	2.01
Communication & Promotion	-	2.13
Risk Management	2.84	2.13
Project Management	2.79	2.34
Contractor Management	2.91	2.37
Learning from Events	3.09	2.39
Change Management	2.80	-
Emergency Response	2.95	-
Average	**2.87**	**2.02**

(*) Elements without score had no questions.

Table 6. Average Scores for Equipment Audit – by Topic.

Audit Topics	Equipment Audit
Fired Heaters and Boilers	2.36
PSVs	2.15
Rotating Equipment	2.11
Pressure Vessels	2.07
All Equipment and Locations	2.04
Electrical and Instrumentation	1.94
Tanks	1.88
Facility Piping	1.78
Launchers and Receivers	1.73
Structures	1.73
Special Emphasis	1.69
Pipelines and Risers	1.37
Average	**1.93**

The average scores from the System Audit given by the auditors were compared with the average scores of the Self Audits prepared by the companies. The results are listed in Table 5 and graphically displayed in the spider plot in Figure 5. While not the case with Petrotrin Refinery, both the tables and figure show that the companies generally reported higher scores than those determined by the auditors, by almost a full point (2.87 for Self Audit and 2.02 for System Audit). This may be the result of:

- Not rigorously following the scoring guidelines for the audit.
- Respondents to Self Audits generally tend to over-state the answers to the questions.
- At the time of the Self Audit, not all companies may have had a good understanding of the meaning of AIM. For example, some answers indicated a focus on HSE rather than on AI.

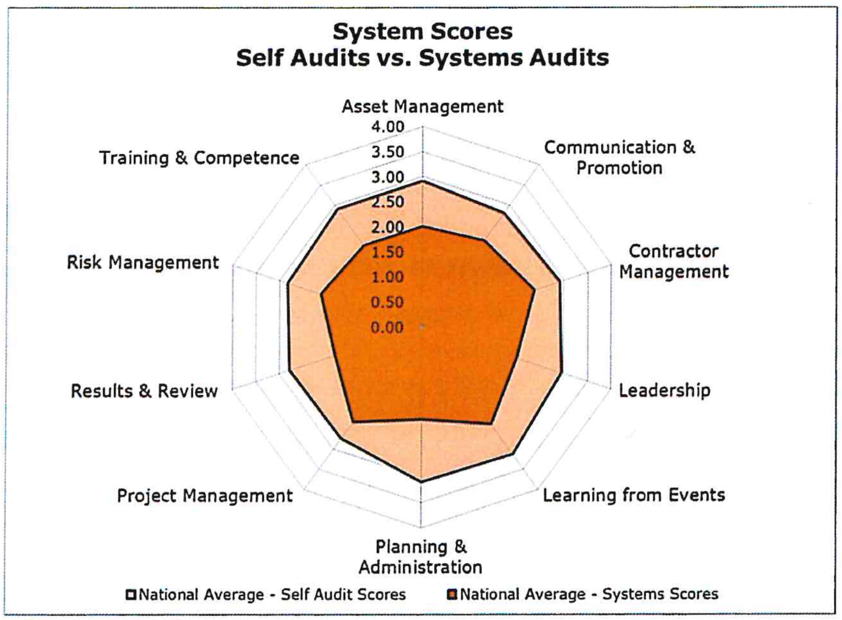

Figure 5. Average Performance Scores from Self Audits and System Audits.

Figure 6 is a bar graph with the results of the System Audit for all 30 audited companies. The diagram shows that the national average is 2.02, which represents a score where management systems are developed and starting to be implemented. Of the 30 audited companies, only one company approached the highest possible score, with 3.7, where management systems have been optimized and continuously improved through management review. Four other companies have scores close to 3.0, where management systems have been implemented and operated for some time without being fully optimized. Four companies are at or below the weakest scoring of 1.0, where learning predominates and few, if any, elements of a management system are actually in place. The figure shows that Petrotrin Refinery scored at 1.62, which put the company in the developing stage.

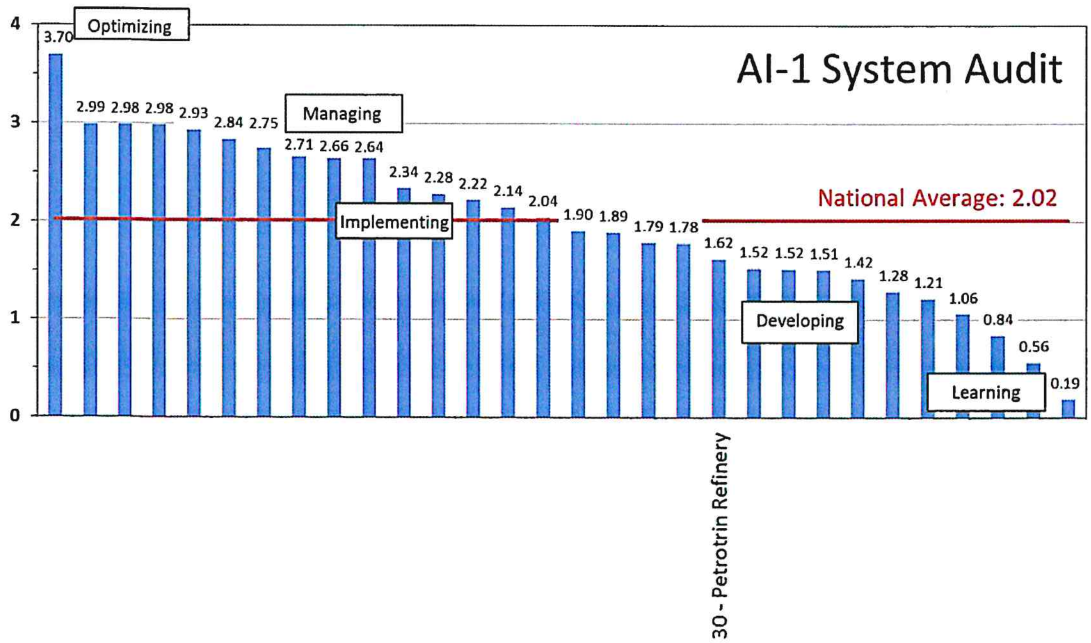

Figure 6. Performance Scored per Company vs. National Average – for AI-1 System Audit.

Referring back to Table 5, the highest national average scores were obtained for the system elements: Learning from Events [2.39], Contractor Management [2.37] and Project Management [2.34], whereas the lowest scores for system elements were Results and Review [1.83] and Planning and Administration [1.84].

The relatively high scores for "Learning from Events" are related to a clear approach by most companies for investigating events. They generally implemented procedures to identify immediate and basic (or root) causes of events. Designated individuals are formally trained and competent in their use.

"Contractor Management" scored relatively high for most companies. Contractors are generally monitored or supervised in regard to compliance with applicable procedures, regulations and standards, regulatory requirements, safe work practices, and conditions of work permits or authorizations.

The high scores for "Project Management" can be attributed to equipment and facility design in accordance with recognized and generally accepted good engineering practices. Companies reported that deviations from stated codes or standards are justified, approved and recorded using a variance process. Important design parameters are generally documented as Process Safety Information and included but were not be limited to information pertaining to hazardous materials used in the facility, hazards of technologies applied, and specific equipment data. Generally, there were methods implemented for identification, approval, control, and documentation of design changes for design and project work.

"Results and Review" scored relatively low, because many companies do not perform benchmarking of their AI programs against industry peers or other high hazard industries. This should be considered to augment the management review program and stimulate new ideas for more effective management of AI. AI leading and lagging measures are often not established by operators, to provide a measure of how their AI objectives are being met. Periodic reviews of the training and competence program are not always made to verify training plan compliance and to establish that the program is delivering the desired competence levels for effective management of AI.

The relatively low score for "Planning and Administration" can be attributed to the lack of implementation of fully resourced training and competency plans, and definition of requirements for refresher training. These training and competency plans should address both employees and contractors. Many companies do not have a fully implemented use of information technology plan, which outlines the key information, document, and knowledge management tools and competencies needed in support of AI, along with the supporting work processes. Furthermore, companies often do not regularly assess their strategic plans and do not update them on an annual basis.

3.1.2 Equipment Audit Results

Figure 7 is a bar graph of the results of the Equipment Audit for all 30 audited companies. The diagram shows that the national average is 1.93, which is close to the score of 2.0, where the activity or practice is developed and documented, but not implemented. Only three companies had a score of 3.0 or higher. Most of the companies scoring between 2.0 and 3.0 are either international companies or privately-owned downstream companies. Approximately half of the companies (17 of 30) scored below the national average. Six companies had scores at 1 or below, with Petrotrin Refinery at 1.08.

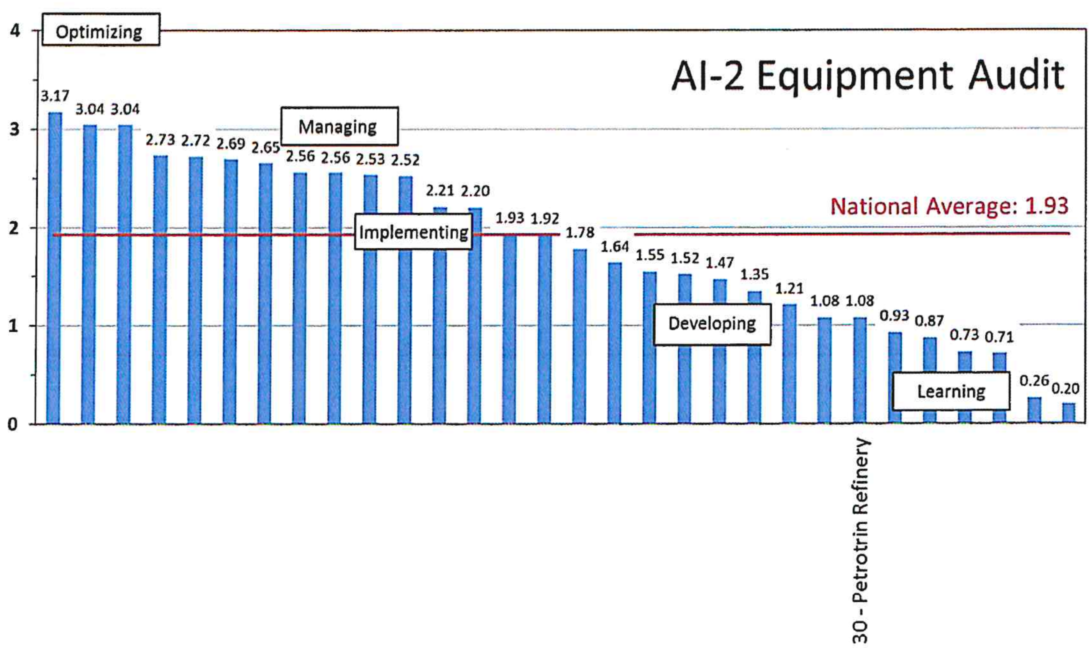

Figure 7. Performance Scores per Company vs. National Average – for AI-2 Equipment Audit.

Comparing the results shown in Figure 6 (System Audit) and Figure 7 (Equipment Audit) indicates that a reasonable correlation exists between the two types of scores.

Referring back to Table 6, the highest national average scores were obtained for the equipment types: "Fired Heaters and Boilers" [2.36], "Pressure Safety Valves" [2.15] and "Rotating Equipment" [2.11],

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whereas the lowest national scores for equipment types were the "Special Emphasis" [1.69], "Structures" [1.73], "Launchers and Receivers" [1.73] and "Facility Piping" [1.78].

The relatively higher scores for "Fired Heaters and Boilers" and for "PSVs" can be explained by the requirements for documentation, periodic[3,4] inspection, and testing of such equipment, as required by the Government of T&T.

The relatively high score for "Rotating Equipment" is also an expected result. Rotating equipment, such as transfer pumps and compressors, are business critical for the companies and, therefore, they receive more attention from the inspection/maintenance departments than some of the other equipment that has been perceived to have less immediate impact on business.

The low score for the "Special Emphasis" areas indicates that some companies may be more reactive than proactive in dealing with less common degradation mechanisms.

The low scores for "Structures" (such as platforms, piers, buildings and vessel and piping supports) indicate that structures do not receive the same level of attention as other equipment.

Not every company owns/operates pipeline launchers and receivers, but the low Equipment Audit scores show that these components are not given the same attention as those that require MEEI regulatory inspections. Similarly, "Facility Piping" scores are relatively low, indicating that more focus is given to other equipment such as the vessels, tanks, and pumps, than to the piping that is connecting them.

[3] T&T Boilers Regulations of 1969 require steam boilers to be examined by a licensed boiler examiner every twelve months.
[4] T&T Oil Tanks Regulations provide specific requirements for safety valves for oil tanks and gas separators.

4.0 RISK ASSESSMENT

Figure 8 is the Risk Matrix of the current status of AIM in T&T. The Risk Matrix was compiled from the combined intrinsic risk groupings ("A", "B", "C" and "D" per COMAH methodology) and the performance risk (audit scores from 0 to 4) for each audited company. The white horizontal bars represent the results of the companies that were audited. The length of each bar indicates the approximate range of the average System Audit score and the average Equipment Audit score for that company. As indicated in the figure, the colors represent the overall lowest risk (green), medium risk (yellow) and highest risk (red).

The figure shows the wide range of AIM-performance across the industry. This Risk Matrix can be used to prioritize follow-up actions by the MEEI for those companies having a high intrinsic risk (overall hazard grouping "A") or medium high intrinsic risk (overall hazard grouping "B") and low AI-performance as measured by their audit scores.

The figure shows that the Petrotrin Refinery score is in the upper right quadrant where high Intrinsic Safety Risk is combined with low-scoring Performance leading to the conclusion that the refinery is a high risk facility, where both the likelihood of failure and the consequences of failure are high.

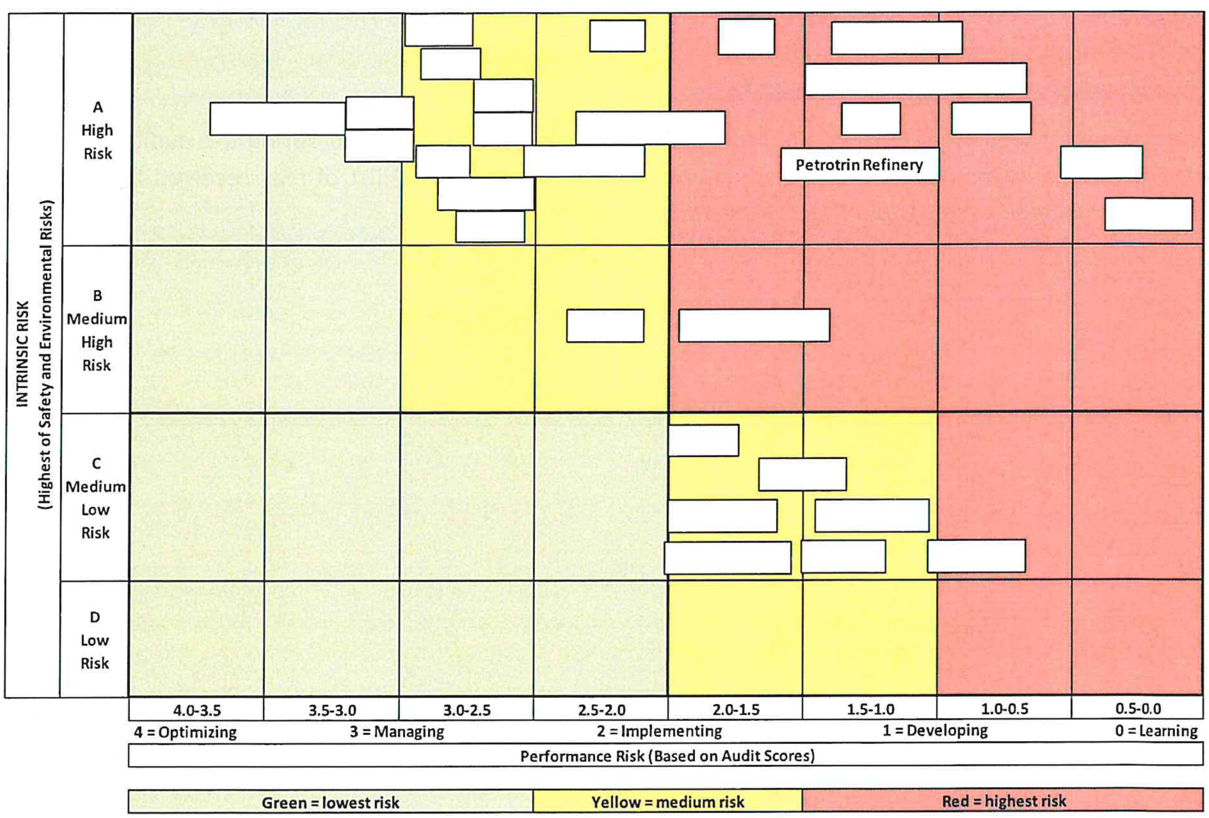

Figure 8. Results of National Facilities Audit, in Matrix of Performance Risk versus Intrinsic Safety Risk (per COMAH) Methodology.

5.0 PETROTRIN REFINERY RESULTS

5.1 Background

The state-owned Petroleum Company of Trinidad and Tobago Limited Refinery (Petrotrin Refinery) is located on 2,000 acres of land in Point-a-Pierre, has a full conversion capacity of 168,000 bpd (barrels per day) and average throughput of approximately 112,000 bpd[5]. It accepts locally produced crude oil through pipelines and imported crude oil from oil tanker deliveries at its port facility and has extensive storage capacity onsite. The main refined products include LPG, aviation fuel, motor gasoline, diesel and fuel oil. Petrotrin's petroleum products are sold locally, as well as to customers across the Caribbean, Latin America and the eastern seaboard of the USA.

The refinery complex has a history of more than 100 years, with associated changes in ownership and processes over that time. Currently, Petrotrin Refinery, Petrotrin Onshore and Petrotrin Trinmar are controlled by the same Board of Directors. Because of the toxicity and explosive nature of the petrochemicals processed by refinery, as well as the proximity of both the plant and its port facilities to environmental receptors, the Petrotrin Refinery has been given a high IR rating with an overall hazard grouping "A."

5.2 Pre-Audit Documentation

Petrotrin Refinery presented most of the requested documentation prior to and during the audit, as shown in Table 7. A written AIM system document was provided in draft form. A list of files received from Petrotrin Refinery is provided in *Appendix A: List of Received Documentation*.

[5] https://www.petrotrin.com/en/About%20Us/Our%20Company.aspx

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Table 7. Summary of Documentation from Petrotrin Refinery.

Documentation	Received	Description
Self Audit	YES	(received)
Asset Register	YES	Asset listings generated from the plant database were provided for asset categories labeled "UT, HP, OM, HO, MA, and CO". Details were given at the equipment and individual component level. The listings included information such as equipment identification numbers, object type, descriptions, functional locations, manufacturer, model numbers, serial numbers, technical ID numbers, a validity date, and a status field.
Asset Integrity Management Plan	NO	No current Asset Integrity Management (AIM) plan was available, but a draft AIM system document for use by the refinery was provided. This document is a Draft for the Petrotrin-group of companies (Petrotrin Trinmar, Petrotrin Onshore, Petrotrin Refinery), and is intended to replace the current version (2013) of a similar document used by Petrotrin Trinmar and Petrotrin Onshore. The draft AIM system document includes an introduction, a description of the AIM system, and definitions. The description addresses thirteen elements as follows: (1) management leadership, commitment, and accountability, (2) personnel competence and training, (3) risk assessment management, (4) management of change, (5) documentation management, (6) third party services, (7) incident investigation, analysis and learning, (8) community awareness and emergency preparedness, (9) maintenance and process integrity, (10) facilities management, (11) standards and procedures, and (12) basic care, and (13) performance management.
Supporting Documentation	YES	Various checklists, drawings, lists, maps, plans, procedures, reports, and risk matrices.

Table 8 is a summary of the content captured in the provided documentation. The AIM Plan was provided as a draft version. Based on a comparison of the Draft AIM Plan and the ISO 55001 Standard, only 1 of the 24 elements was missing. Some of the elements were not explicitly identified in the document but mentioned within the text of other elements. Overall, the Draft AIM Plan can be the basis for a complete AIM Program; however, implementation of the AIM Plan has not commenced.

The Asset Register provided the four mandatory elements, which suggests that the company has created an inventory of the equipment. The size of the equipment items could be deduced from the equipment names, but no separate column was provided in the list to allow sorting by size. No other optional equipment information was provided.

Table 8. Required Content of Pre-Audit Documentation: AIM Plan and Asset Register Provided by Petrotrin Refinery.

Documentation		#	Required Content	Included?
AIM Plan	Critical Elements	1	Understanding the Organization and its context	YES
		2	Understanding the Needs and Expectations of Stakeholders	YES
		3	Determining the Scope of the Asset Management System	YES
		4	Asset Management System	YES
		5	Leadership and Commitment	YES
		6	Policy	YES
		7	Organizational Roles, Responsibilities, and Authorities	YES
		8	Actions to Address Risks and Opportunities for the Asset Management System	YES
		9	Asset Management Objectives and Planning to Achieve Them	YES
		10	Resources	YES
		11	Competence	YES
		12	Awareness	YES
		13	Communication	NO
		14	Information Requirements	YES
		15	Documented Information	YES
		16	Operational Planning and Control	YES
		17	Management of Change	YES
		18	Outsourcing	YES
		19	Monitoring, Measurement, Analysis, and Evaluation	YES
		20	Internal Audit	YES
		21	Management Review	YES
		22	Nonconformity and Corrective Action	YES
		23	Preventive Action	YES
		24	Continual Improvement	YES
Asset Register	Mandatory	1	Listing of Processes and Equipment	YES
		2	Equipment Numbers	YES
		3	Equipment Names	YES
		4	Equipment Locations	YES
	Optional	5	Asset Age	NO
		6	Mileage	NO
		7	Size	YES
		8	Materials of Construction	NO
		9	Operating Conditions	NO

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5.3 Audit Results

5.3.1 General

The Petrotrin Refinery has an Average Equipment Audit score of 1.08 and an average System Audit score of 1.62 (average PR score range 1.08-1.62), as shown in Table 9 .

Table 9. Refinery Average Element and Topic Scores for Self Audit, System Audit, and Equipment Audit.

Audit Elements(*)	Self Audit	System Audit
Asset Management	1.92	1.85
Change Management	1.88	-
Communication & Promotion	-	1.50
Contractor Management	1.80	2.00
Emergency Response	1.25	-
Leadership	1.00	1.50
Learning from Events	2.00	2.38
Planning & Administration	1.29	1.50
Project Management	1.33	1.63
Results & Review	-	0.89
Risk Management	1.20	1.70
Training & Competence	1.00	2.17
Weighted Average	**1.55**	**1.62**

(*) Elements without score had no questions.

Audit Topics	Equipment Audit
All Equipment and Locations	1.33
Electrical & Instrumentation	1.19
Facility Piping	1.17
Fired Heaters & Boilers	1.07
Launcher/Receiver	1.00
Pipeline/Risers	1.12
Pressure Vessels	0.96
Pressure Safety Valves (PSVs)	0.97
Rotating Equipment	1.04
Special Emphasis	1.15
Structures	1.05
Tanks	1.11
Weighted Average	**1.08**

(*) Equipment without score was not applicable.

These scores reflect that the activity or practice exists, although it may be incomplete and undocumented or is only partially documented and implemented, and not fully mature. The AI program is in the Developing Stage. The auditors found a commitment from management to AIM, with a dedicated AI manager having been appointed a year ago. The company realizes its lack of effective processes, practices and procedures as related to AIM and exhibited a desire for change and improvement.

Because of the low scoring, Petrotrin Refinery is recommended for prioritized follow-up action by the MEEI, based on the combined high intrinsic risk (overall hazard grouping "A") and low AI performance rating (average PR score less than 2).

5.3.2 System Audit

"Results & Review" (0.89) scored the lowest in the System Audit. The Asset Integrity activities in the refinery are currently not reviewed periodically. However, there is an Internal Audit Program (under the HSE group) that is looking for compliance. These audits include Chemical Safety Management, Safety Inspection Audits (HSE) and involve limited Asset Integrity activities - specifically a visual/walk-through inspection of the exterior of tanks. In addition, the OSH Agency periodically performs an External Audit of

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the refinery. From these audits, reports are distributed to the owners of the assets, who then are responsible to implement the recommendations. It was noted that from a list of approximately 2000 non-conformance items, there are an estimated 600-700 open items, of which 90% are overdue.

While AI activities are not specifically audited, Petrotrin Refinery has performed reviews of Risk Registers, PHAs, and HAZOPs annually since 2014. A team of HSE, operations, and maintenance people is involved. There are Facility Risk Assessments that include mitigation measures for each of the identified hazards. The risks as related to AI are built into these assessments, but not specifically called out. It was found that the assessment of performance gaps and analysis of root cause are not consistently applied. A formal risk policy and over-arching guide are absent.

Petrotrin Refinery has put KPIs in place since January 2015 and these will be reviewed/modified annually. There is historical data available in certain categories (such as mechanical availability %). There are Level 1 to Level 4 KPIs, where Level 1 KPIs are mainly lagging indicators and Level 2, 3, and 4 will be leading indicators. At this time, only Level 1 KPIs are clearly mapped out. The KPIs are signed off by the senior management, and communicated monthly, including:

- number of overdue inspections
- mechanical availability %
- number of overdue temporary management of change orders
- number of under-specified materials in use
- number of unplanned shutdowns
- % planned maintenance hours vs. % unplanned maintenance hours

Petrotrin Refinery must be commended for developing KPIs, and continued tracking of these is essential for improving AI management.

"Planning & Administration" (1.50) scored relatively low in the System Audit, and Petrotrin Refinery recognized this as well in their Self Audit. For the purpose of AI, there is no central database for document handling. Separate databases are maintained on various topics, including:

- Injury database dates back at least to 1997.
- Engineering drawings have been stored electronically since about 2000.
- Vehicle accidents database since 2003.
- About 40% of about 70,000 prior paper drawings and documents that are stored in the vault have been scanned/digitized since 2011.
- Non-conformance tracking database since 2012.
- Most level 1 KPI-related data since Oct 2014

Petrotrin Refinery should develop a centralized, integrated database that allows easy lookup of past inspection reports, future inspection frequencies, maintenance planning, and other information related to AI activities. The database should also be connected to the existing SAP equipment database and various maintenance, inspection, and operational procedures.

"Training & Competence" (2.17) scored relatively well in the System Audit. However, while a training matrix exists for each individual, and records are maintained in SAP, there is little or no review of Training and Competence Plans as related to AI activities and no overarching plan for defining AI competence. Contractors are pre-qualified and there is a list of functional areas for trade staff, but AI competency criteria and safety attributes of each position do not exist.

"Learning from Events" (2.38) scored the highest in the System Audit. Petrotrin Refinery has a documented process called the Business Loss Incident Management Procedure (BLIMP). Depending on the size of the incident, the investigation is performed by a team consisting of individuals from HSE, the unit involved, and other units at the refineries. The results of the investigations are reported to the VP of Refining.

5.3.3 Equipment Audit

"Pressure Vessels" (0.96) scored the lowest in the Equipment Audit. Typical for a refinery, responsibility for equipment is plant by plant (unit by unit). As a result, historic data related to Asset Integrity of equipment is stored/documented at different locations around the refinery. In the future, the intent is that the information will be stored centrally in the Centralized Maintenance Management System (CMMS), which is Petrotrin's SAP data system. The records may be fairly well maintained, but not distributed which makes accessibility an issue.

Petrotrin Refinery uses API 510 "Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration" to set the inspection frequency of pressure vessels. It was unclear if the TAR schedule for the equipment overruled the API 510 frequency schedule, and if or how remedial repair plans were implemented.

"Pressure Safety Valves (PSVs)" (0.97) scored low in the Equipment Audit. PSVs are essential for assuring safety in operations, and therefore the Government of T&T has requirements for documentation, periodic inspection, and testing of such equipment. Petrotrin Refinery's own procedures require a three-yearly certification (annual for air vessel PSVs). However, this schedule is often pushed out to meet the four-yearly Turn-Around (TAR) schedules and therefore is not in compliance.

The Inspection Department has responsibility for PSV recertification and Crosby-based software is used for recertification planning. SAP may contain a complete asset inventory but this is not used as the asset register for PSVs. Petrotrin Refinery considers all PSVs as critical but there are three categories depending on difficulty to isolate/remove. The company maintains paper records for each PSV, but no centralized list is used for trending across different categories (e.g., fluid service, size, manufacturer, age). Similarly, rupture discs used to protect PSVs are not tracked systematically. Trending of PSV and rupture disc data would provide an opportunity for a defect elimination program.

"Tanks" (1.11) scored low in the Equipment Audit. While the company uses certified inspectors per API 653 "Tank Inspection, Repair, Alteration, and Reconstruction", many internal tank inspections were reported to be past due. Access to tank internals is difficult due to ongoing operations. The Inspection Department has an advisory role to indicate when inspections should be performed, but Operations may not be able to make the tanks available for inspection. Tank operations are organized plant by plant, and no individual has been assigned to oversee AI inspections, tests, and maintenance activities for tanks across the refinery. Many older tanks have no overfill protection and no high-level alarms, which increases the risk of incidents.

Similarly, other equipment such as "Facility Piping", "Fired Heaters and Boilers" and "Rotating Equipment" are lacking a technical focal point, are subject to a piece-meal approach with respect to AI, and are not benefitting from data trending.

5.3.4 Health, Safety and Environment

The management of the Petrotrin Refinery reports recognizing positive behaviors through a reward system for recognition of hazards. This has been in place for one year now. There is also a rewards/recognition program for about 20 contractors, which is awarded annually. The impression of the employees is that reporting of issues is encouraged from different levels of management. Incident reports appear to be focused on cause, and not on blame.

Information on HSE issues (accidents, incidents, hazards) is shared with the line managers. HSE issues are discussed with employees. There are scheduled walk-arounds with senior management and employees. There is good reporting of injuries, vehicle accidents, and oil spills. However, there is improvement needed for reporting near-misses.

Individual Job Hazard Analyses (JHAs) for people, assets, and environment are done for every job. The JHA also covers Job Safety Analysis (JSA) as related to HSE. Both employees and contractors are involved in completing the JHAs. The Risk Assessment Matrix includes People, Assets, Environment, Reputation, but does not include Business Performance. The risk matrix for HSE is the same as that for AIM and is used company-wide. Petrotrin Refinery recognizes that there are still a lot of gaps in the JHA system, which is currently being reviewed to improve it. In the risk matrix, the historic data (actual occurrences) are considered more than the likely data (possible occurrences).

The above-described elements from the audits are further supported by the following notable mentions and opportunities for improvement for the company.

5.3.5 Notable Mentions

- management commitment during the audits,
- campaign and pilot initiatives demonstrate a desire for change and improvement, and
- there are some AIM processes in place (e.g., Plant Change Procedure, Defect Elimination Process, and Permit-to-Work Process).

5.3.6 Opportunities for Improvement

- There is currently an inadequate systematic approach to elements of AI, including:
  - not using the company's Asset Register to schedule,
  - limited tracking and no trending of inspection activities,

  - not cataloguing or indexing its Best Practices,
  - not associating specific equipment with applicable corrosion control documents,
  - a dependence on turn-around schedules to set inspection frequencies, and
  - no safety criticality ranking of equipment.
- The refinery's AIM system is immature, with policies and procedures in Draft and others not effectively followed,
- KPIs are in place, but were only recently implemented,
- business loss management is based on "actual" outcome rather than "potential" outcome,
- a lack of action tracking and close-out management was apparent, and
- a significant backlog of inspection activities exists (especially tank internal inspections).

5.4 Walk-Through Inspections

5.4.1 Description

The physical walk-through inspections at the Petrotrin Refinery included the Port and Marine area with Pile Bent 80, Berth 5, and Berth 6, the Oil Stock Holding Tank Farm West with Tanks 103, 129, 102, 101, 100, Sea Line 66, Sea Line 61, and production units No. 4 VDU, No. 2 VBU, No. 8 CDU, and the LPG Unit.

Based on the impressions of the auditors, the integrity status of the viewed facilities appeared overall as being in concerning[6] condition. The observations by the auditors during the walk-through inspection are consistent with the System and Equipment audit scores, as shown below:

Examples of good conditions and/or practices include:

- recently refurbished Tank 103, current work on refurbishment of Tanks 102, 101, 100.

Examples of conditions and/or practices identified for improvement include:

- main piping and valves were labeled, but individual equipment was generally poorly tagged or not labeled (Port and Marine).
- personnel interviewed at Port and Marine and at Tank Farm West appeared unaware of clamps on Sea Line 61 outside the areas of their immediate responsibilities.
- poor labeling and lack of labeling of equipment (No.4 VDU, No.2 VBU, No.8 CDU).

Items identified by the auditors as possible integrity issues, and suggested for follow-up action by the MEEI include:

[6] "Concerning" is defined as "The general appearance of the facilities indicated poor housekeeping, a possible backlog of maintenance and/or inspection activities, and/or evidence of current or recent damage, incidents, or accidents."

- a total of 4 clamps was reportedly applied in the last 4 months on Sea Lines 61, 62, 66, and on the LPG line (Port and Marine area). These clamps were all installed following leaks that were detected.
  - Check the condition, if the clamps are documented, and whether these clamps are temporary or permanent repairs.
- an oil spill boom was located around Sea Line 36 at Berth 5 (there was no clamp report for this line).
- MCA No.3 Vent Valve failure on Berth 6 results in oil being drained from arm manually into buckets and under deck sump after unloading.
- temporary hose connection rigged up on Berth 6.
- temporary clamp on Tank 103 connection to main tank fill pipeline ring, inside the bund.
  - Check the condition, check if the clamp is documented, and whether the clamp is a temporary or permanent repair.
- bund area around Tank 129 filled with crude oil and water mixture.
- single valve with drain line from ground level of Tank 129 appeared to have an ongoing leak.
- coffer dam around one clamp, and two more clamps onshore on Sea Line 61 (Tank Farm West beach area).
  - Check the condition, if the clamps are documented, and whether these clamps are temporary or permanent repairs.
- clamp of charge line of No.4 VDU.
  - Check the condition, check if the clamp is documented, and whether the clamp is a temporary or permanent repair.
- temporary, misaligned, and non-standard pipe supports at No.4 VDU.
- a multitude of water and steam leaks were observed in both No. 4 VDU and No. 2 VBU.
- hydrocarbon leaks were observed in multiple places (e.g., Pump P5505C, at several locations in pipe racks, and at valve spindle on inlet to heaters) at No. 4 VDU and No. 2 VBU.
- hydrocarbon leaks were observed in multiple places (e.g., at fittings on compressor, prior oil spray onto overhead piping, oil leak to drain under heads on C5220A-D).
- water and steam leaks of overhead piping under insulation.
- poor general condition of equipment in No.8 CDU (e.g., unidentified pump with steam leaks, and heavy corrosion visible on almost every component).
- evidence of fire in the unit (No.8 CDU); foundation of pump that was removed after a fire, and surrounding area shows much fire damage.

- wet insulation at LPG unit (plant growing from insulation).
- water and steam leaks at LPG unit; operator reported maintenance request was not completed for 2-3 months and leaks have become much more severe since then.
- process unit leaks at LPG unit; steam leaks on insulated piping at Depropaniser Bott. Cooler 931 (front and rear sides).
- process unit leak at LPG unit; and steam steak on insulated piping at De-Ethaniser Reboiler 930 (rear side).
- visible corrosion in multiple places on piping in LPG unit (e.g., brown corrosion product emanating from circumferential weld in piping that appeared to be stainless steel).

5.4.2 Photographs

Appendix B shows photographs taken during the walk-through physical inspection. The photographs are grouped according to equipment or location within the refinery, and are accompanied by descriptive captions. Where required, further clarifying text is added.

5.5 Summary

The audit of the AI program of Petrotrin Refinery showed that the company is in the "Developing Stage" (see definition in Section 2.5,, Table 1). This assessment is based on the following:

- The AIM plan was provided as a draft version, which can be the basis for a complete AIM program. It should be noted that implementation of the AIM plan has not commenced.
- The provided Asset Register showed that the company has created an inventory of its equipment.
- The observations by the auditors during the walk-through inspections are consistent with the System and Equipment scores.

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APPENDIX A LIST OF RECEIVED DOCUMENTATION

#	Filename	# of Pages	Doc Type
1	Onshore Asset Valuation renewal 2015 2016 PAP 2015 jan 21.xlsx	2	Asset Register
2	Pipeline Data Sample.pdf	1	Asset Register
3	PETROTRIN DRAFT AIMs Procedure.doc	23	Asset Register
4	Petrotrin UT Status of Fire Water Pumps 2015.doc	2	Asset Register
5	Refinery Asset Vulnerability Inventory (2).xlsx	7	Asset Register
6	UT Assets in Plant 1000.xlsx	1	Asset Register
7	HP Assets in Plant 1000.xlsx	1	Asset Register
8	OM Assets in Plant 1000.xlsx	1	Asset Register
9	HO Assets in Plant 1000.XLS	1	Asset Register
10	MA Assets in Plant 1000.xlsx	1	Asset Register
11	CO Assets in Plant 1000.XLS	1	Asset Register
12	Sour Water Stripper Reflux line - Blank List.doc	1	Checklist
13	Blank List Hotwell Piping - Blank List.docx	1	Checklist
14	31C2D1.PDF	1	Drawing
15	31C2D2.PDF	1	Drawing
16	31C2D3.PDF	1	Drawing
17	31C2D4.PDF	1	Drawing
18	31C2D5.PDF	1	Drawing
19	31C2D6.PDF	1	Drawing
20	31C2D7.PDF	1	Drawing
21	Bitumen Combo.pdf	7	Drawing
22	40C1D300.PDF	1	Drawing
23	40C1D301.PDF	1	Drawing
24	40C1D302.PDF	1	Drawing
25	40C1D303.PDF	1	Drawing
26	40C1D304.PDF	1	Drawing
27	54C4D1 Sht1.PDF	1	Drawing
28	54C4D1 Sht2.PDF	1	Drawing
29	54C4D2.PDF	1	Drawing
30	54C4D3.PDF	1	Drawing
31	54C4D4.PDF	1	Drawing
32	54C4D5.PDF	1	Drawing
33	54C4D6.PDF	1	Drawing
34	56C5D54 Slops Recovery System.PDF	1	Drawing
35	79-D-G-110 Rev 1A.PDF	1	Drawing
36	79-D-G-120.PDF	1	Drawing

#	Filename	# of Pages	Doc Type
37	93-D-A-50 Re. 1A.pdf	1	Drawing
38	93-D-G-51 Rev. 2.pdf	1	Drawing
39	93-D-G-52 Rev. 2.pdf	1	Drawing
40	93-D-G-53 Rev. 2.pdf	1	Drawing
41	93-D-G-54 Rev. 2.pdf	1	Drawing
42	54C4D10.PDF	1	Drawing
43	54C4D11.PDF	1	Drawing
44	54C4D12.PDF	1	Drawing
45	54C4D13.PDF	1	Drawing
46	54C4D14.PDF	1	Drawing
47	54C4D15.PDF	1	Drawing
48	54C4D16.PDF	1	Drawing
49	54C4D7.PDF	1	Drawing
50	54C4D8.PDF	1	Drawing
51	54C4D9.PDF	1	Drawing
52	54C4D28.PDF	1	Drawing
53	54C4D29.PDF	1	Drawing
54	54C4D30.PDF	1	Drawing
55	54C4D31.PDF	1	Drawing
56	54C4D32.PDF	1	Drawing
57	54C4D33.PDF	1	Drawing
58	54C4D34.PDF	1	Drawing
59	54C4D35.PDF	1	Drawing
60	74-D-G-1027 Rev 4.PDF	1	Drawing
61	FCCU Combo.pdf	35	Drawing
62	53C2D1.PDF	1	Drawing
63	53C2D2.PDF	1	Drawing
64	53C2D3.PDF	1	Drawing
65	53C2D4.PDF	1	Drawing
66	53C2D5.PDF	1	Drawing
67	FCCU LOCATION DESCRIPTION TABLE (DRAWINGS).pdf	8	Drawing
68	FCCU P&IDs PHASE II UPGRADE.pdf	88	Drawing
69	FCCU PFDs PHASE II UPGRADE.pdf	6	Drawing
70	FCCU Process PIDs.pdf	100	Drawing
71	FCCU Utility PIDs.pdf	18	Drawing
72	53C2D10.PDF	1	Drawing
73	53C2D11.PDF	1	Drawing
74	53C2D12.PDF	1	Drawing

#	Filename	# of Pages	Doc Type
75	53C2D13.PDF	1	Drawing
76	53C2D14.PDF	1	Drawing
77	53C2D15.PDF	1	Drawing
78	53C2D6.PDF	1	Drawing
79	53C2D7.PDF	1	Drawing
80	53C2D8.PDF	1	Drawing
81	53C2D9.PDF	1	Drawing
82	53C2D16.PDF	1	Drawing
83	53C2D17.PDF	1	Drawing
84	53C2D18.PDF	1	Drawing
85	53C2D19.PDF	1	Drawing
86	53C2D20.PDF	1	Drawing
87	53C2D21.PDF	1	Drawing
88	53C2D22.PDF	1	Drawing
89	53C2D23.PDF	1	Drawing
90	53C2D24.PDF	1	Drawing
91	53C2D25.PDF	1	Drawing
92	75-D-G-1002.pdf	1	Drawing
93	75-D-G-1003 SHT 2.pdf	1	Drawing
94	75-D-G-1003-SHT 1.pdf	1	Drawing
95	75-D-G-1004.pdf	1	Drawing
96	75-D-G-1005.pdf	1	Drawing
97	75-D-G-1006.pdf	1	Drawing
98	75-D-G-1007.pdf	1	Drawing
99	75-D-G-1008.pdf	1	Drawing
100	75-D-G-1009.pdf	1	Drawing
101	GCX Combo.pdf	25	Drawing
102	75-D-G-1010.pdf	1	Drawing
103	75-D-G-1011.pdf	1	Drawing
104	75-D-G-1012 SHT 1.pdf	1	Drawing
105	75-D-G-1012 SHT 2.pdf	1	Drawing
106	75-D-G-1013.pdf	1	Drawing
107	75-D-G-1014.pdf	1	Drawing
108	75-D-G-1015.pdf	1	Drawing
109	75-D-G-1016.pdf	1	Drawing
110	75-D-G-1017.pdf	1	Drawing
111	75-D-G-1018.pdf	1	Drawing
112	54C5D1.PDF	1	Drawing

#	Filename	# of Pages	Doc Type
113	54C5D2.PDF	1	Drawing
114	54C5D3.PDF	1	Drawing
115	54C5D4.PDF	1	Drawing
116	75-D-G-1034.pdf	1	Drawing
117	75-D-G-1035.pdf	1	Drawing
118	75-D-G-1036.pdf	1	Drawing
119	75-D-G-1039.pdf	1	Drawing
120	H__Team_11.0 Construction_11.pdf	1	Drawing
121	Merox com Kelsen.pdf	33	Drawing
122	54C5D10.PDF	1	Drawing
123	54C5D11.PDF	1	Drawing
124	54C5D12.PDF	1	Drawing
125	54C5D4.PDF	1	Drawing
126	54C5D5.PDF	1	Drawing
127	54C5D6.PDF	1	Drawing
128	54C5D7.PDF	1	Drawing
129	54C5D8.PDF	1	Drawing
130	54C5D9.PDF	1	Drawing
131	21C2D75 - Admin Ground Floor.PDF	1	Drawing
132	21C2D76 - Admin Second Floor.PDF	1	Drawing
133	21C2D77 - Admin First Floor.PDF	1	Drawing
134	29C1D2 - Site 1.PDF	1	Drawing
135	30-10-2013 MainLab AS-BUILT.dwg	1	Drawing
136	40C5D21- Site 5.PDF	1	Drawing
137	47C3D206 - CTS.PDF	1	Drawing
138	47C3D207 - East Area Office.PDF	1	Drawing
139	47C3D208 - East Area WorkShop.PDF	1	Drawing
140	47C3D209 - TBS.PDF	1	Drawing
141	47C3D216 - Fire Dept.PDF	1	Drawing
142	47C3D218 - Instrument.PDF	1	Drawing
143	47C3D221 - Machine Shop.PDF	1	Drawing
144	47C3D222 - Maintenance Co-Ordinator.PDF	1	Drawing
145	47C3D225 - MP&S.PDF	1	Drawing
146	47C3D226 - Refinery Office.PDF	1	Drawing
147	47C3D227 - Rexformer.PDF	1	Drawing
148	47C3D229 - Welding Shop.PDF	1	Drawing
149	57C3D264 - Electrical Shop.PDF	1	Drawing
150	57C5D297 Sht 2 of 8 - Inspection.PDF	1	Drawing

#	Filename	# of Pages	Doc Type
151	58C3D23 Sht 2 - Inspection Downstairs.pdf	1	Drawing
152	58C3D23 Sht3 - Inspection Upstairs.PDF	1	Drawing
153	58C3D35 - Pump Shop.PDF	1	Drawing
154	2PLAT44A.pdf	1	Drawing
155	2PLAT44B.pdf	1	Drawing
156	2PLAT44C.pdf	1	Drawing
157	2PLAT44D.pdf	1	Drawing
158	2PLAT44E.pdf	1	Drawing
159	2PLUN67A.pdf	1	Drawing
160	2PLUN67B.pdf	1	Drawing
161	2PLUN76.pdf	1	Drawing
162	2PLUN77.pdf	1	Drawing
163	2PLUN78.pdf	1	Drawing
164	2PLUN79A.pdf	1	Drawing
165	2PLUN79B.pdf	1	Drawing
166	10C5D15 SHT 1-2.PDF	2	Drawing
167	10C5D16.PDF	1	Drawing
168	16C1D195.PDF	1	Drawing
169	18C5D305.PDF	1	Drawing
170	19C1D377.PDF	1	Drawing
171	2PLUN67A.pdf	1	Drawing
172	2PLUN67B.pdf	1	Drawing
173	44C1D153.PDF	1	Drawing
174	47C4D200.PDF	1	Drawing
175	47C5D05.PDF	1	Drawing
176	47C5D124.PDF	1	Drawing
177	48C4D59.PDF	1	Drawing
178	52C5D547.PDF	1	Drawing
179	58C1D254.PDF	1	Drawing
180	58C5D98.pdf	1	Drawing
181	76-E-G-001.pdf	1	Drawing
182	76-E-G-002.pdf	1	Drawing
183	76-E-G-003.pdf	1	Drawing
184	76-E-G-004.pdf	1	Drawing
185	76-E-G-005.pdf	1	Drawing
186	76-E-G-006.pdf	1	Drawing
187	76-E-G-007.pdf	1	Drawing
188	76-E-G-008.pdf	1	Drawing

#	Filename	# of Pages	Doc Type
189	76-E-G-009.pdf	1	Drawing
190	Alky Combo.pdf	9	Drawing
191	MX-6240N_20150930_060038.pdf	1	Form
192	Number of Hydrants.docx	1	Letter
193	sealines from to.xls	1	List
194	DETAILS OF LOADING FACILITIES.docx	1	List
195	Sea line data at P-a-P.pdf	2	List
196	1cdu.pdf	6	List
197	2girb.pdf	2	List
198	2htu.pdf	32	List
199	2unif.pdf	2	List
200	3vdu.pdf	7	List
201	4vdu.pdf	17	List
202	8cdu.pdf	7	List
203	h2.pdf	16	List
204	vbu.pdf	16	List
205	1CDU.xlsx	1	List
206	1HTU.xlsx	1	List
207	2GIRB.xlsx	1	List
208	2HTU.xlsx	1	List
209	3VDU.xlsx	1	List
210	4VDU.xlsx	1	List
211	8CDU.xlsx	1	List
212	CSP.xlsx	1	List
213	FCCU.xlsx	1	List
214	GASCON.xlsx	1	List
215	H2.xlsx	1	List
216	HCF.xlsx	1	List
217	HCM.xlsx	1	List
218	MTBE.xlsx	1	List
219	Sealine.xlsx	1	List
220	SRU.xlsx	1	List
221	SRU1.xlsx	1	List
222	VBU.xlsx	1	List
223	Listof compressors.xlsx	4	List
224	Tanks for Demolition - updated 17-08-2015 (3).xlsx	1	List
225	Utilities Data forInsurers 2014-2015 for Air Water Electricity and Steam - Jan 10th 2015.xls	5	List

#	Filename	# of Pages	Doc Type
226	Petrotrin PSM Workbook 1 (05.02.14).xlsx	1	List
227	Petrotrin Work Categories for local Contractors Only.pdf	1	List
228	Heavy Oil Equipment and optimization 26th August.xlsx	7	List
229	Heavy Oil Equipment and optimization 18th August.xlsx	2	List
230	8CDU_2015_10_14_7-3_Shift.xls	1	List
231	8CDU_2015_10_13_7-3_Shift.xls	1	List
232	PAP_REFINERY_Drainage_Flow_2.pdf	1	Map
233	Hydrant Map.pdf	1	Map
234	PLAN OF ROAD TANK WAGONS LOADING SYSTEM.xlsx	1	Map
235	Hard copy - Will supplement when electronic copy is available	1	Map
236	Petrotrin Strategic Plan.pdf	6	Plan
237	SteamLeaksInitiative_20150925.xlsx	1	Plan
238	Initiative1 AssetTagging Poster_20150914.pdf	1	Plan
239	Draft AIM policy Rev 2.doc	2	Policy
240	RecordsManagement-PolicyGuide.pdf	6	Policy
241	JHA Participants Manual 2011.doc	28	Procedure
242	BLIDocument2008FINAL(2).pdf	57	Procedure
243	Vendor Registration Guide.pdf	19	Procedure
244	Vendor Evaluation Policy Guide.pdf	8	Procedure
245	Sample Inspection CCD.pdf	4	Procedure
246	Contractor Selection System.pdf	23	Procedure
247	Petrotrin Plant Change Manual.pdf	74	Procedure
248	PSM Dept Petrotrin report.docx	22	Report
249	April 2015 Refining Performance Review.pdf	21	Report
250	August 2015 Refining Performance Review.pdf	24	Report
251	December 2014 Refining Performance Review.pdf	9	Report
252	February 2015 Refining Performance Review.pdf	15	Report
253	January 2015 Refining Performance Review.pdf	14	Report
254	July 2015 Refining Performance Review.pdf	23	Report
255	June 2015 Refining Performance Review.pdf	25	Report
256	March 2015 Refining Performance Review.pdf	18	Report
257	May 2015 Refining Performance Review.pdf	26	Report
258	Tank MP6 Spill Final Report - 2014 November 25.pdf	31	Report
259	Petrotrin WD 3 Grand Ravine.pdf	2	Report
260	Risk Assessment Matrix (RAM).pptx	1	Risk Matrix
261	Petrotrin Asset Integrity Framework - Draft.pdf	1	Risk Matrix
262	Level 1 KPIs.xlsx	1	Risk Matrix
263	AI-1 Self-Audit Questions - Final 30th September 2015.xlsx	4	Self Audit

#	Filename	# of Pages	Doc Type
264	Records of Process Safety Incidents.docx	1	Summary
265	Leak log Sample.pdf	1	Summary

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APPENDIX B

PHOTOGRAPHS TAKEN DURING WALK-THROUGH PHYSICAL INSPECTION

PORT AND MARINE

Figure B-1 Near main pipe viaduct: Boom in the water around area where Sea Line 61 Clamp was reported.

- Leak detection is by operator vigilance during loading or offloading operations.
- Clamps are used when leaks are found.
- Clamps are not used unless the pipelines leak (i.e., no preventative clamps are applied.)
- It was reported that 4 clamps have been applied in the last 4 months on lines 61, 62, 66 and on the LPG line.
- This is reportedly an increase above the normal frequency of clamp usage of around one per year.

PILE BENT 80

Figure B-2. Main pipe viaduct near Pile Bent (PB) 80.

Figure B-3. Main pipe viaduct: Repair work near PB80, with Boom in the water around Sea Line 36.

Figure B-4. Close-up view of repair work near PB80.

- Work underway on structure and repair of the 36 line riser.
- Evidence of corrosion on vertical section of riser just above the concrete coating.
- Appearance of viaduct concrete and steel structures looked okay, without major cracks or spalling of concrete.

BERTH 5

Figure B-5. View of Berth 5.

Figure B-6 Sea Line 62 at Berth 5.

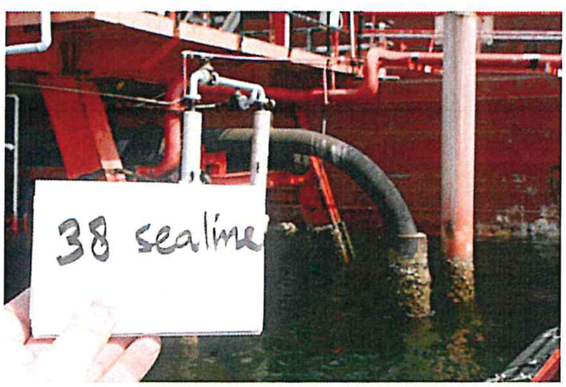

Figure B-7 Sea Line 38 at Berth 5.

Figure B-8. At Berth 5: Boom in the water and scaffolding above water around area of Sea Line 36 Splash Zone, (no Clamp was reported here.)

Figure B-9 Sea Line 36 at Berth 5.

- Corrosion on Sea Line 36 between flange and top of concrete coating

BERTH 6

Figure B-10. View of Berth 6.

Figure B-11. View of Berth 6.

Figure B-12. At Berth 6: Boom in the water around area where Sea Line 66 Clamp was reported.

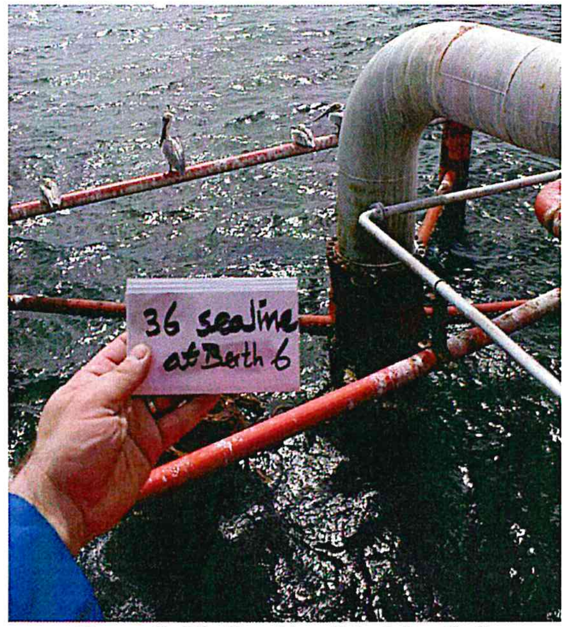

Figure B-13. Sea Line 36 at Berth 6.

Figure B-14. Sea Line 33 at Berth 6.

Figure B-15. Sea Line 38 (out-of-service) at Berth 6.

Figure B-16. Loading arms at Berth 6.

Figure B-17. Drain valve used at Loading Arm, due to MLA No. 3 Vent Valve failure.

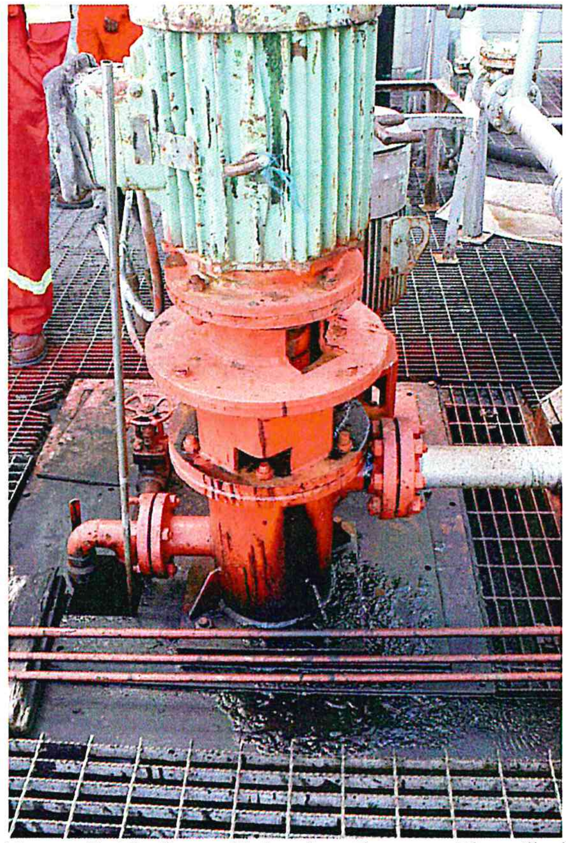

Figure B-18. Sump Unloading Pump, with spilled crude to sump.

Figure B-19. Unreadable name plate on Sump Unloading Pump.

Figure B-20. Temporary hose connection into flanged pipe, with spilled crude to sump.

Figure B-21. Pipeline numbers are painted on main manifold at Berth 6, but individual valves are not labeled with unique numbers.

- 66 Sea Line has some corrosion on outer elbow and between flange and concrete coating.
- 33 and 37 Sea Lines are used for manifold crossover on Berth 6 only.
- Berth 6 has two Crude Oil Loading Arms that are being used on a regular basis. A valve on Loading Arm 3 has failed, and maintenance has been on hold for several months, pending a contractual issue with the Loading Arms Supplier.
- MCA No. 3 vent valve failure results in oil being drained from arm manually into buckets and under deck sump after unloading.
- Bert 6 Sump Unloading Pump has leaking gland.
- Temporary hose connection rigged up to allow emptying of sump – evidence of oil spillage.
- Generally, no equipment items are tagged or labelled with unique numbers.

OIL STOCK HOLDING TANK FARM WEST

Figure B-22. Tank 103 was recently refurbished. Paint on tank and bund area look good.

Figure B-23. Tank 103 connection to main tank fill pipeline ring. A double-flanged connection is visible, to what was reported as a temporary clamp in the fill line, located inside the tank bund.

- Tank 103 has been refurbished.
- Clamp is in place on filling line to Tank 103 (ca. 18 months) and this line is due to be replaced.

Figure B-24. Tank 129 showing corroded exterior. Bund area around this tank is filled with crude oil and water mixture. The bund of Tank 129 is shared with Tank 103.

Figure B-25. Drain line piping with single valve from ground level of Tank 129.

Figure B-26. Close-up of drain line piping from Tank 129, showing wet inside as evidence of ongoing leak.

Figure B-27. Valve at ground level of Tank 129, with 4 of 8 bolts missing from blind flange.

Figure B-28. Example of unlabeled transfer piping at West Tank Farm (at Tank 129.)

Figure B-29. Example of unlabeled piping and valves connected to Tank 129.

- Tank 129 is in-service but not currently in use.
- The general external condition is poor and there is a lot of oil in the bund.
- Base outlet on Tank 129 is closed with valve and flange with 4 bolts only.
- Base drain pipe on Tank 129 is closed with valve only and outlet of pipe was wet on the inside suggesting some passing from the valve and leakage into the bund.

Figure B-30. Onshore Tank 102, recently refurbished, with clean bund area and aboveground pipework.

Figure B-31. Onshore Tank 101, recently refurbished, with clean bund area and aboveground pipework.

Figure B-32. Onshore Tank 100, with ongoing construction work, with clean bund area and aboveground pipework.

- Tank 100 is under refurbishment.
- Extensive remediation of the soil in Tank 100 bund has replaced oil soaked earth with clean sand. All piping was clean, exposed and sitting on new pipe supports.

Figure B-33. Line 66 Diverter Valve at Tank 100.

Figure B-34. Line 66 at Bund Area of Tank 100, showing current line (black coating) and previous pipeline 66 (rusty brown.)

- Actuator on Line 66 diverter valve was faulty and was being replaced.
- Bund on Tank 100 in the first visible section of Line 66 on land.
- Line 66 from Tank 100 bund to shoreline was apparently replaced ca. 4 years ago.

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Figure B-35. Sea Line 61 at the beach between West Tank Farm and Marine Area, showing Coffer Dam at area where clamp was reportedly present ca. 20 meters offshore.

- Line 61 has 2-off 24 inch clamps adjacent to each other ca. 20m onshore and one clamp reportedly ca. 20m offshore. The onshore clamps are ca. 2 years old and the offshore clamp is ca. 4 years old.

NO. 4 VDU AND NO. 2 VBU

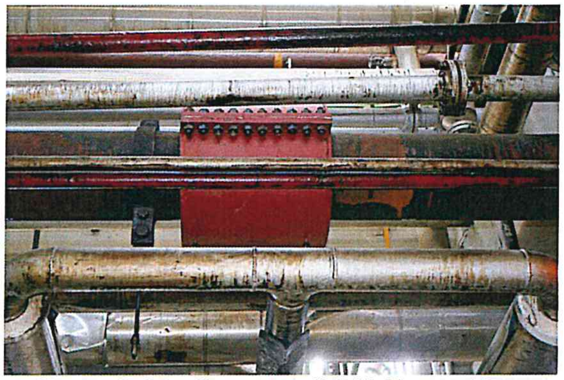

Figure B-36. Clamp on 4VDU Charge Line.

Figure B-37. Temporary pipe support in 4VDU.

Figure B-38. New structural steel I-beam installed in 4VDU to repair equipment structure.

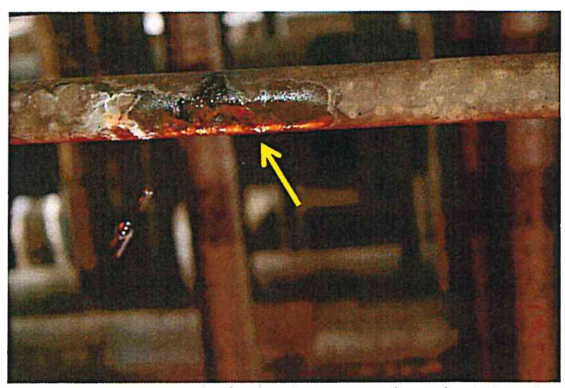

Figure B-39. Pinhole leak in overhead piping in 4VDU (guide showed this was a water leak.)

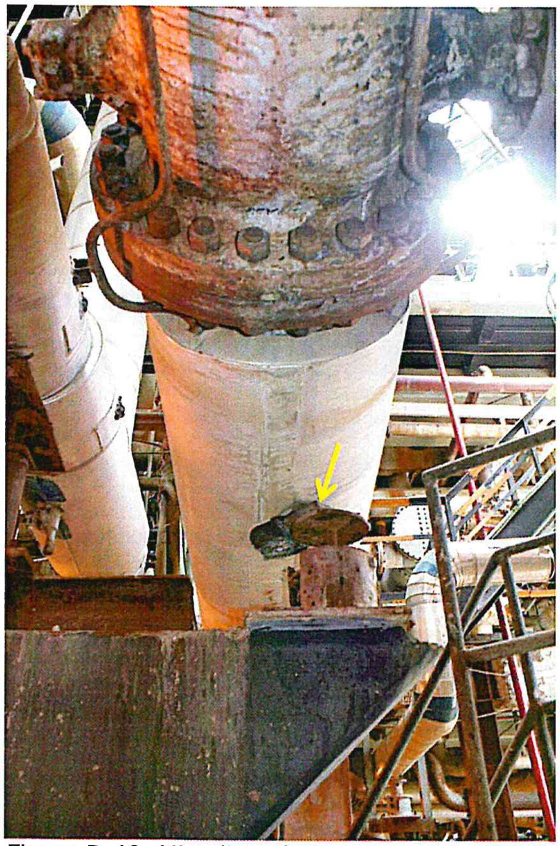

Figure B-40. Mis-aligned pipe support in 4VDU.

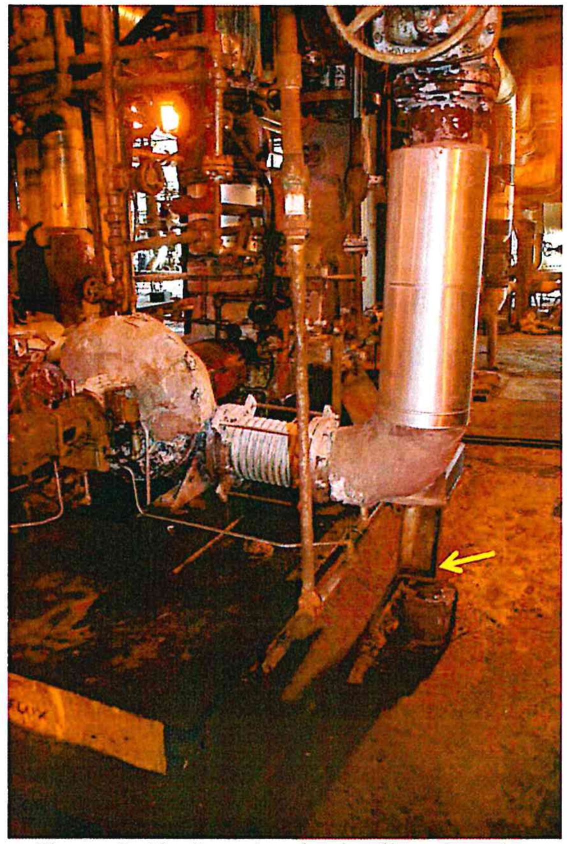

Figure B-41. Non-standard, off-center pipe support in 4VDU.

Figure B-42. Multiple steam leaks in piping of process area of 4VDU.

Figure B-43. Continuous leak from piping under furnace in 4VDU (presumably water.)

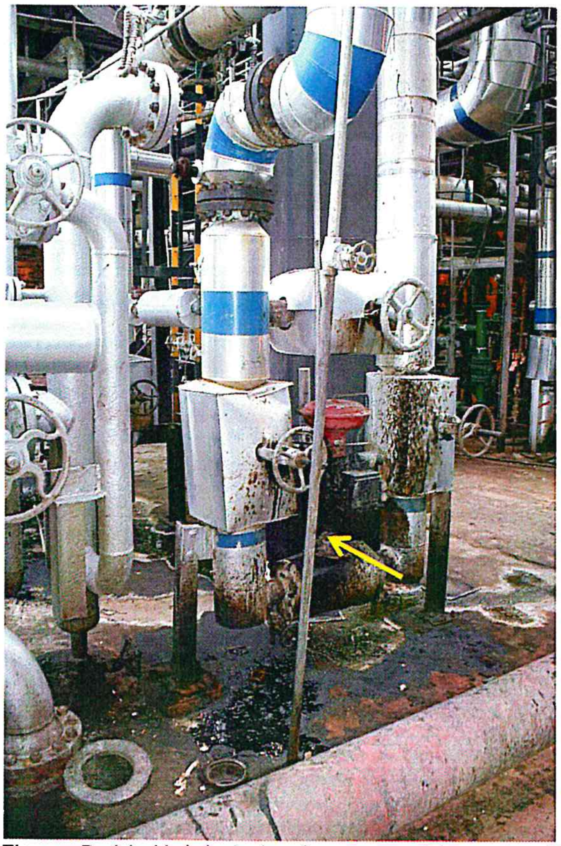

Figure B-44. Unlabeled valve area with crude oil leaks and splashes in 4VDU.

- Some equipment numbers are shown on equipment plinths.
- Clamp on Charge Line following leak – ca. 2 months.
- Temporary pipe supports in place where equipment has been removed.
- Pinhole spray water leak in pipework above walkway.
- Misaligned pipe support near to column.
- Steam trace heating lines leaking and hanging from pipework.
- Structural repairs evident - steel columns on wooden plinths.
- Leaking barrier fluid from pump P5505C.
- Leaking fluid (water?) falling onto hot pipework around P5516B.
- Pipe Rack was covered in black drips resulting from previous pipe failure.

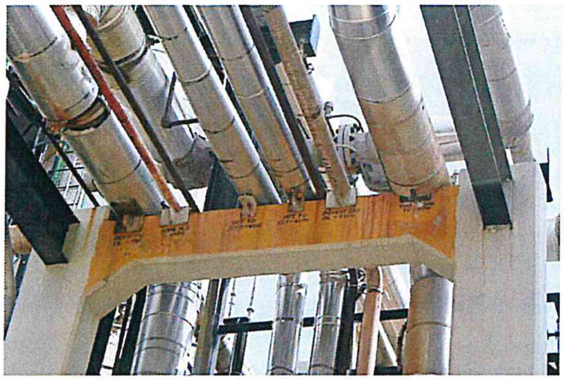

Figure B-45. Example of labeled piping, at entrance to 2VBU. Generally, no other labeling was present on piping inside the unit.

Figure B-46. Unlabeled area with crude oil spill on the ground and covering the equipment.

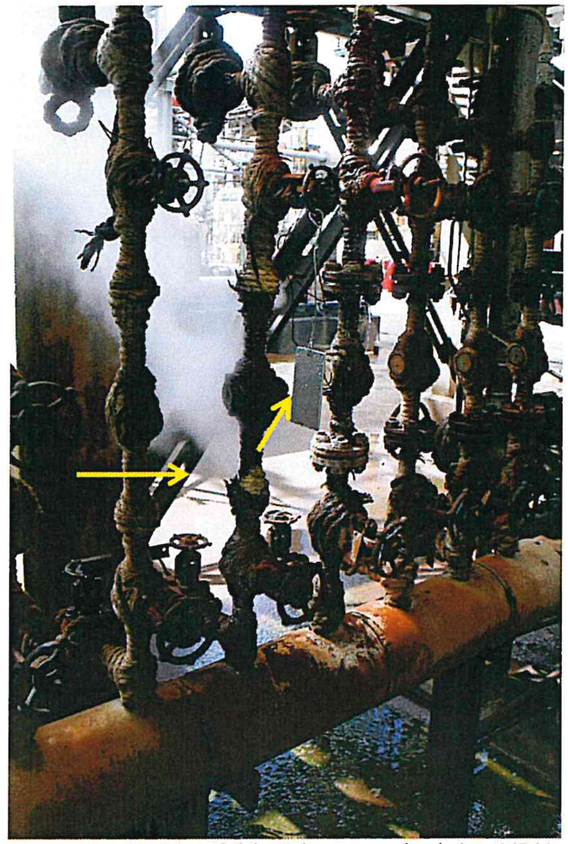

Figure B-47. Manifold with steam leak in 4VDU. Note the aluminum tag, as part of the "steam leak tagging initiative". The tag does not have any inscribed numbering to identify the leak location.

Figure B-48. Fluid (presumably water) leaking from manifold near Visbreaker Heater in 2VBU. Note the aluminum tag related to the "steam tagging initiative".

Figure B-49. Pump in 2VBU that was disconnected for maintenance, but axle was still running on one (left) side of the drive train.

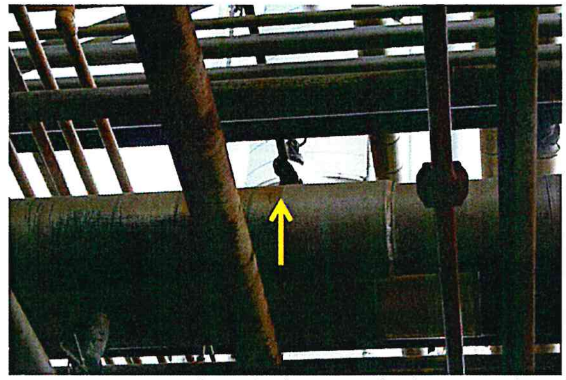

Figure B-50. Unidentified steam leak in overhead piping in 2VBU, with steam potentially impacting other pipes.

Figure B-51. Close-up of previous photograph, showing steam leak originates at hole in piping.

- Oil leaking from valve spindle on inlet to heaters.
- More leaks visible from steam trace heating.
- 2 VBU pump out – significant steam leak and pump disconnected from drive but running.

NO. 8 CDU

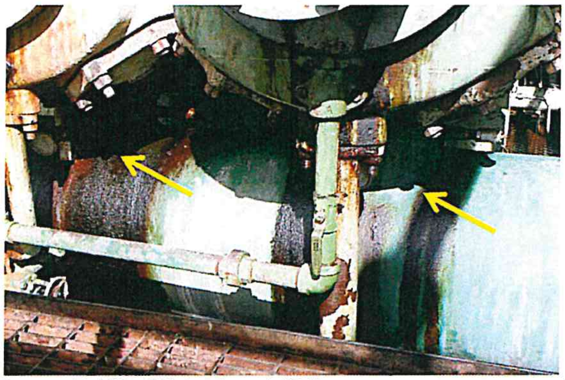

Figure B-52. Oil leaks at fittings on compressor at 8CDU.

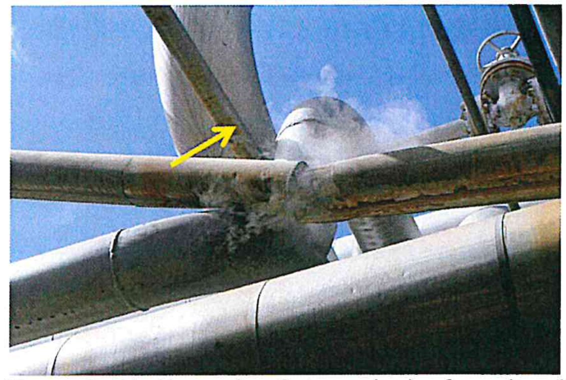

Figure B-54. Example of steam leak of overhead piping under insulation at 8CDU. Steam emanates from poorly fitted insulation.

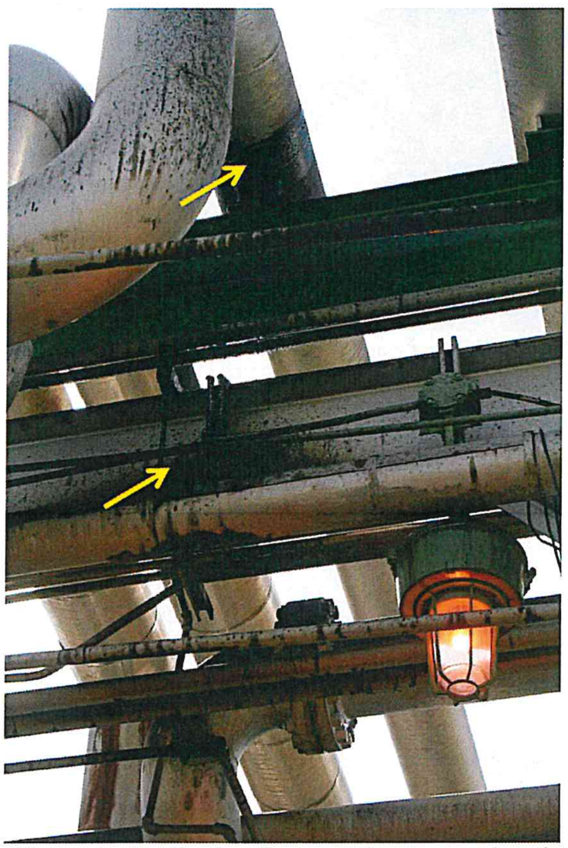

Figure B-53. Crude oil sprayed onto overhead piping in 8CDU – presumably from high-pressure crude leak in nearby piping.

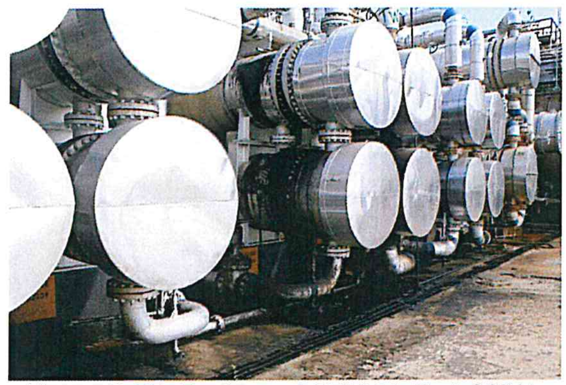

Figure B-55. Equipment C5220A-D at 8CDU.

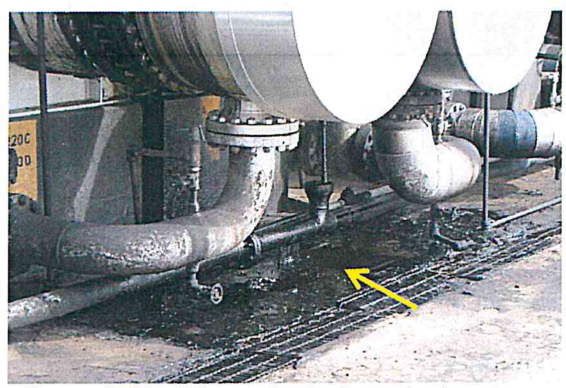

Figure B-56. Oil leak to drain under heads on equipment C5220A-D at 8CDU.

Figure B-57. Unidentified pump at 8CDU with steam leaks and heavy corrosion visible on almost every component.

Figure B-58. Foundation of pump that was removed after fire at 8CDU. The surrounding area still shows much fire damage.

Figure B-59. Example of steam leak at threaded fitting at 8CDU.

Figure B-60. Piping is labeled only at the main manifold of the unit (8CDU.)

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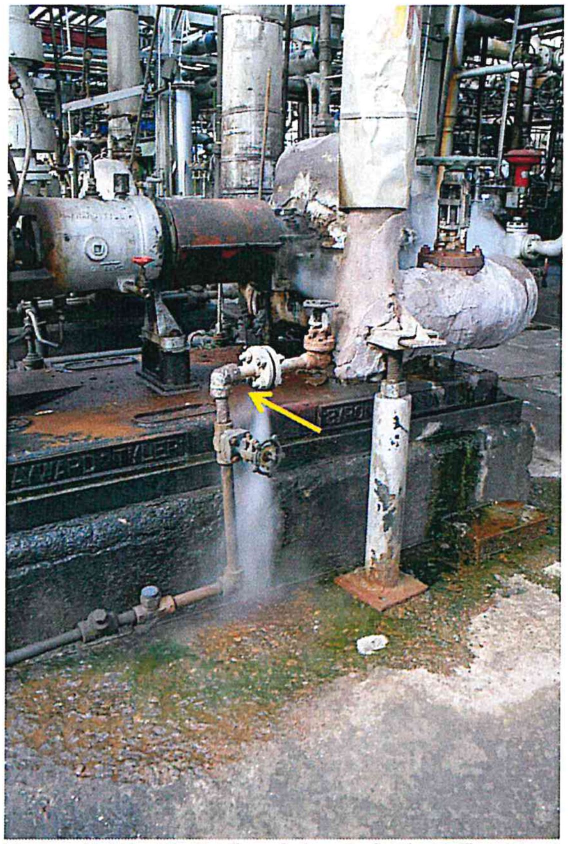

Figure B-61. Example of steam leak at flange at 8CDU.

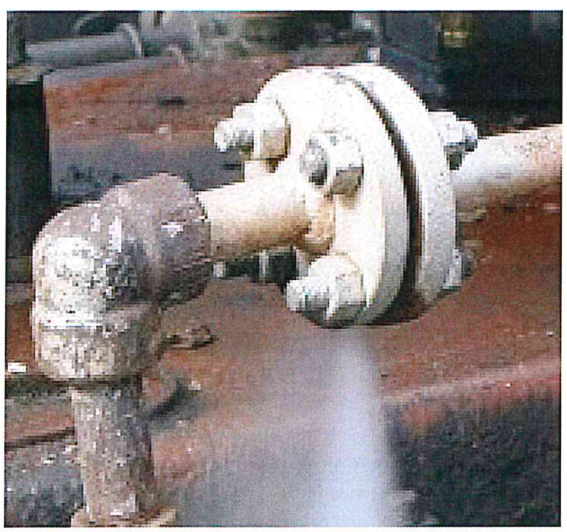

Figure B-62. Close-up of previous photograph.

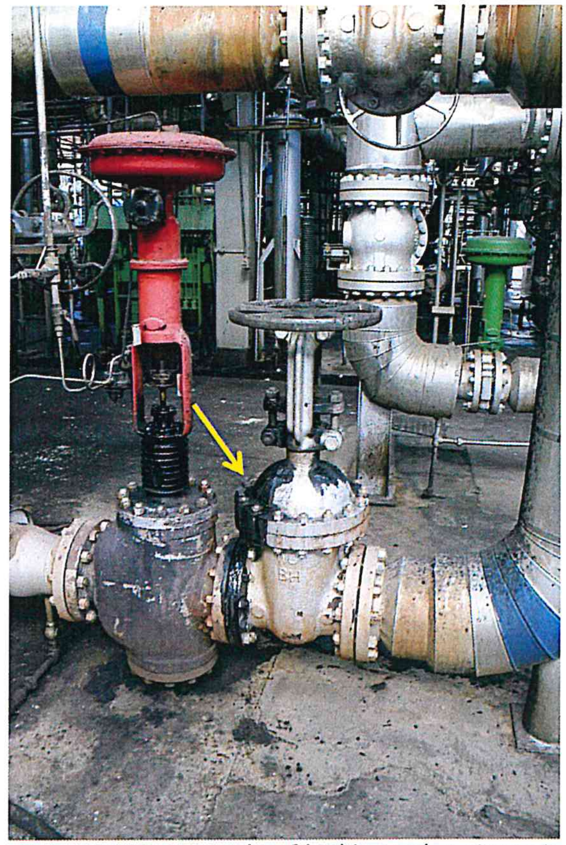

Figure B-63. Example of leaking valve stem at 8CDU. Also note the lack of labeling on any of the piping and valves.

- Possible leak from small bore fitting on compressor.
- Oil leaking from the heads on equipment C5220 A-D.
- Several oil leaks from valve spindles.

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LPG UNIT

Figure B-64. LPG Unit (front side.)

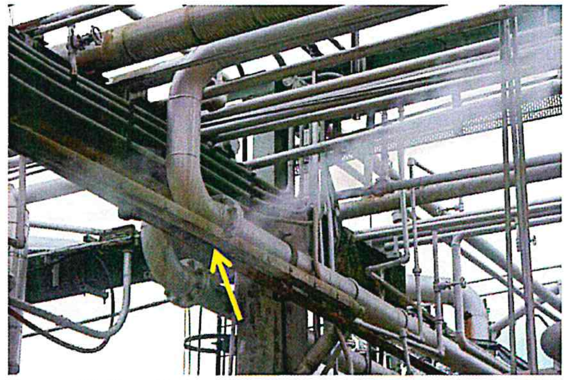

Figure B-67. Example of piping high-velocity leak (presumably steam) in LPG unit.

Figure B-65. LPG Unit (rear side.)

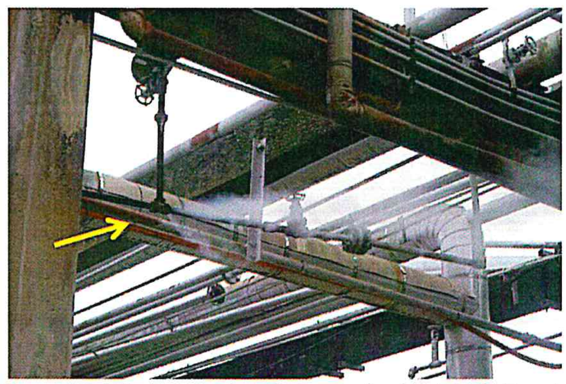

Figure B-68. Example of steam leak at T-fitting in LPG unit.

Figure B-66. Plant growing from piping insulation in LPG unit (front side.)

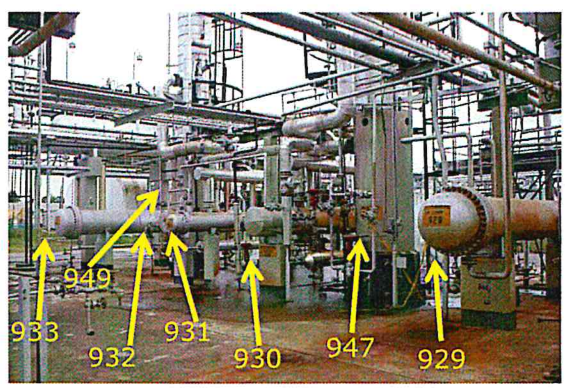

Figure B-69. View of LPG unit, with [from right to left] De-ethanizer Overhead Condenser 929, De-ethanizer Column (LPG) 947, De-ethanizer Reboiler 930, Depropaniser Bott. Cooler 931, Depropaniser Reboiler 932, and De-propaniser Column (LPG) 949, Depropaniser Overhead Condenser 933.

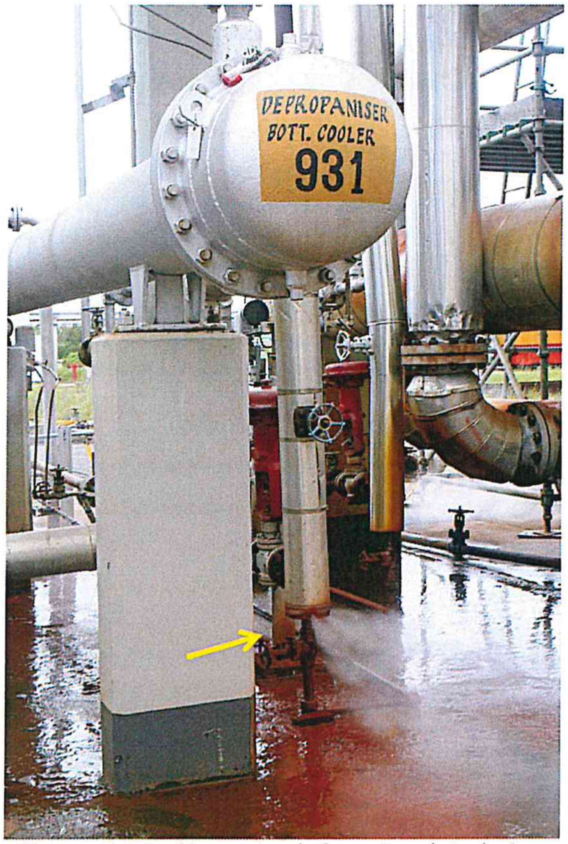

Figure B-70. Steam Leak from insulated pipe under Depropaniser Bott. Cooler 931 (front side.)

Figure B-71. Close-up of Previous Photograph.

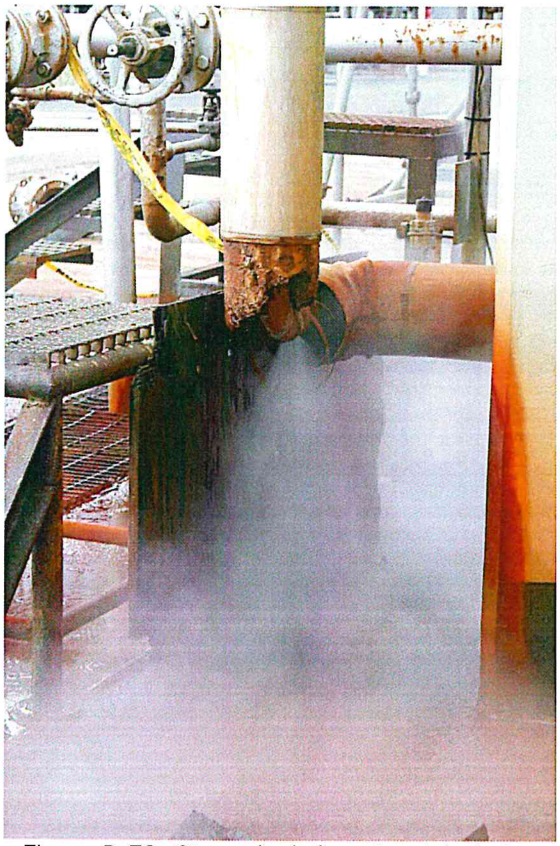

Figure B-72. Steam leak from insulated pipe under Depropaniser Bott. Cooler 931 (rear side.)

Figure B-73. Close up view of previous photograph.

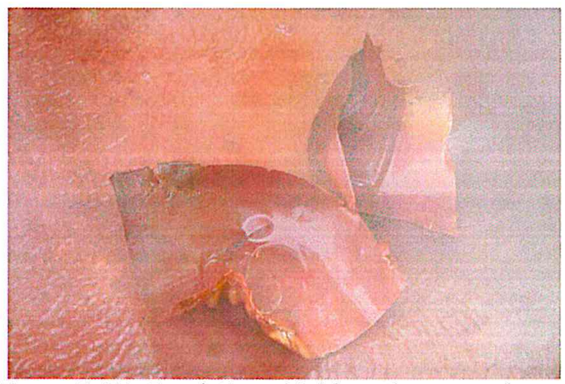

Figure B-74. Insulation shield on the ground near steam leak at Depropaniser Bott. Cooler 931 (rear side.)

Figure B-75. Steam Leak from insulated pipe of De-Ethaniser Reboiler 930 (rear side.)

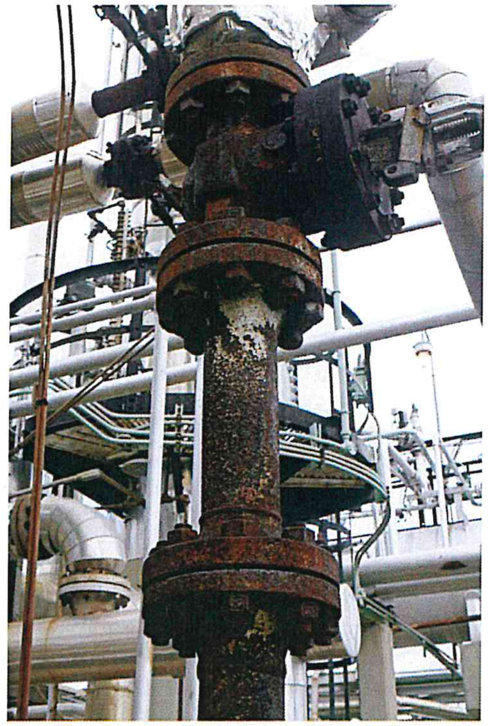

Figure B-77. Rusty piping above steam leak area on De-Ethaniser Reboiler 930 (rear side)

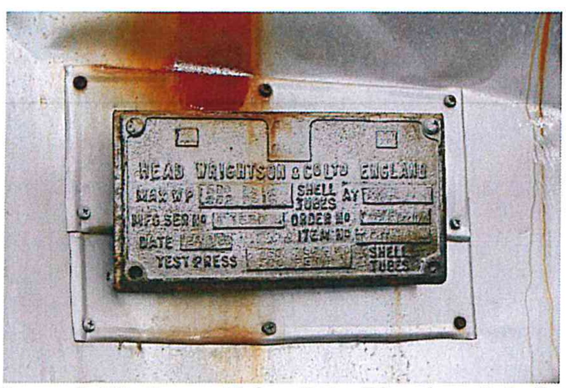

Figure B-76. Name Plate of De-Ethaniser Reboiler 930.

Figure B-78. Uncovered insulation near steam leak area on De-Ethaniser Reboiler 930 (rear side)

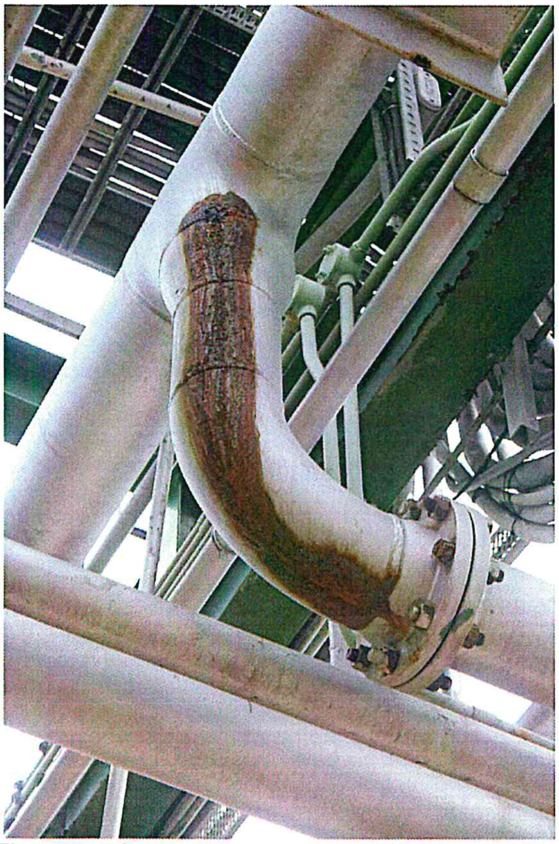

Figure B-79. Brown corrosion product emanating from circumferential weld in piping that appeared to be stainless steel in LPG Unit.

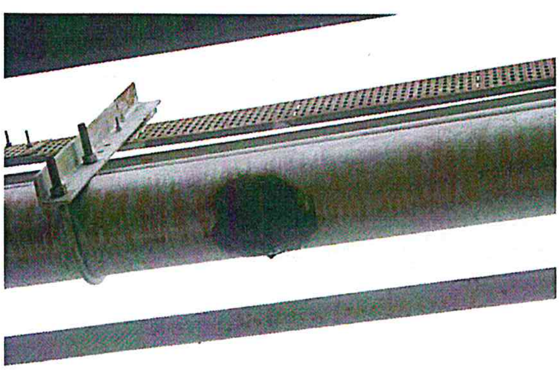

Figure B-80. Example of brown corrosion product in a localized area, on what appeared to be painted piping in LPG Unit.

ABOUT DNV GL

Driven by our purpose of safeguarding life, property, and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter, and greener.

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OSHA: (5) 1/7/59

March 21, 2022

Mr. Mushtaq Mohammed
General Manager
Paria Fuel Trading Company Limited
Southern Main Road,
Pointe-a-Pierre.

Dear Mr. Mohammed

Inspection of the Paria Fuel Trading Company Limited *(Berths 1 to 6)*, located offshore Gulf of Paria.

Reference is made to the above inspection conducted on the March 10, 2022. The purpose of the inspection was to ensure compliance with the Occupational Safety & Health Act Chapter 88:08 ("the OSH Act").

Present during the inspection were:

FACILITATORS:

Name	Organisation	Position
Mr Paul Yearwood	Paria Fuel Trading Company Limited	HSE Coordinator
Mr. Hassan Mohammed	Paria Fuel Trading Company Limited	Facilities (Mechanical) Engineer
Mr. Sharaz Hosein	Paria Fuel Trading Company Limited	Engineer
Mr. Jason Beckles	Paria Fuel Trading Company Limited	Operations Team Supervisor
Ms. Gina Perrotte	Mechanical Engineer	Kenson

OSH AGENCY:

Name	Position
Mr Dion Lawrence	Safety and Health Inspector II
Mr Warren Ali	Safety and Health Inspector I
Mr Kerwin Durity	Safety and Health Inspector I
Ms Lisa Ramlalsingh	Safety and Health Inspector I

An inspection report detailing the instances of non-compliance with the OSH Act is attached for your immediate attention. Please be informed that failure to address the findings may result in the risk of bodily injury and damage to equipment and the environment.

It is expected that these findings will be addressed and a report on the status of the corrective measures submitted to the OSH Agency within twenty one (21) working days of receipt of this letter.

Also, be advised that a re-inspection of the establishment will be conducted within three (3) months of receipt of this letter to ensure compliance.

Kindly note that failure to effectively address the findings in the inspection report could result in enforcement action by the OSH Agency. Furthermore, pursuant to Section 83(1) of the OSH Act, contravention of any provision or failure to comply with any duty, instruction or directive issued therein is deemed a safety and health offence and is subject to the jurisdiction of Section 72 of the OSH Act and the Industrial Court.

For further information or clarification on the above please contact Mr Dion Lawrence at 722-3521 or send an email to dion.lawrence@osha.gov.tt

Yours respectfully,

Mr Dion Lawrence
Safety and Health Inspector II
Occupational Safety and Health Agency

INSPECTION REPORT

Date Inspected : March 10, 2022
Facility : Paria Fuel Trading Company Limited, Berths (1 – 6)
OSHA : Messers Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh
Facilitators : Messers Paul Yearwood, Hassan Mohammed, Sharaz Mohammed, Jason Beckles and Ms. Gina Perotte

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
Documentation	1. The following documents were not available at the time of the visit:	
	• Top side and subsea structural reports of the facilities.	**8 (4)**
	• Lighting survey	**33(1)**
	• Calibration certifications for the flame detector (eye) for the fire suppression system.	**6(2)(a)**
	• Risk assessment for offshore facilities and port operations.	**13A (1)**
Fire and Emergency Response	1. At the time of the inspection there was a systems trouble identified in the Berth 1 - Fire Gas Control Panel. In addition there was no power in the fire gas control panel for Berth 5 and Berth 6. Failure to maintain the fire alarm and detection system can compromise emergency response.	**6 (2) (a) & 29**

INSPECTION REPORT

Date Inspected : March 10, 2022
Facility : Paria Fuel Trading Company Limited, Berths (1 – 6)
OSHA : Messers Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh
Facilitators : Messers Paul Yearwood, Hassan Mohammed, Sharaz Mohammed, Jason Beckles and Ms. Gina Perotte

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	2. Two (2) nozzles on the fire suppression system at **Berth # 1** were not functioning properly. Failure to address can affect the firefighting capabilities at the facility	**6 (2) (a)**
General Duty	1. There were no rat guards seen on the mooring lines (vessel loading in Berth 2 South).	**31 (c)**
	2. The fuel lines on Boom #1 located on Berth 2 South were not labelled to indicate the type of fuel being transported in the lines.	**6(2) (a) & 6 (2) (d)**
	3. At the time of the inspection there were no wind sock installed at Berth # 6.	**6 (1)**
	4. Poor housekeeping was observed in the Storage Room at Berth # 6. Failure to address can increase the risk of slips trips and falls	**6 (2) (a) & 31(b)**
	5. There were no railings outside the electrical room on the eastern side of Berth 6.	**6 (2) (a) & 6(2)(e)**
	6. During the inspection it was revealed that there was is only one (1) person on shift at a time on the berths. There were no documented procedures developed and implemented to	**6 (2) (a) & 13A(1)(a)**

INSPECTION REPORT

Date Inspected : March 10, 2022
Facility : Paria Fuel Trading Company Limited, Berths (1 – 6)
OSHA : Messers Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh
Facilitators : Messers Paul Yearwood, Hassan Mohammed, Sharaz Mohammed, Jason Beckles and Ms. Gina Perotte

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	address emergency situations associated with lone working.	
Electrical	1. The ground wire for the viaduct was compromised as a result of theft as indicated by the facilitators. Failure to ensure adequate grounding can compromise electrical safety.	**6 (2)(a)**
Maintenance	1. There was a build-up of corrosion on pipes and flanges on the offshore installations.	**6 (2) (a)**
	2. Loose planks were observed on the gangway between Berths 2 south and 3.	**6 (2) (a) & 6 (2) (e)**
	3. There was no tagging/identification of out of service piping at the facilities.	**6 (2) (d)**
	4. The gangway handrails on Berths 2 north and 3 showed signs of rotting	**6 (2) (a) & 6(2)(e)**
	5. The two (2) ton chain block located in the Berth 1 area was past its service date of December 21, 2021. Failure to address may increase the risk of bodily injury and damage to property to operators and others in close proximity.	**6 (2) (a)**

INSPECTION REPORT		
Date Inspected : March 10, 2022 **Facility : Paria Fuel Trading Company Limited, Berths (1 – 6)** **OSHA : Messers Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh** **Facilitators : Messers Paul Yearwood, Hassan Mohammed, Sharaz Mohammed, Jason Beckles and Ms. Gina Perotte**		
CATEGORY	**FINDINGS**	**NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)**
	6. There was a damaged door on the eastern side of room housing the gas fire panel in Berth 5. Failure to address same can result in bodily injury to persons who may access same.	**6 (2)(a)**
	7. There were some missing metal gratings under the loading arm at Berth # 6. Failure to address same can result in falls to persons whom may access the area.	**6 (2) (a) & 6 (2) (e)**
	8. Metal to metal contact was observed on the No. 23 Gas Oil line.	**6 (2) (a)**

---End of Report---

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OSHA: (5) 1/7/59

March 21, 2022

Mr. Mushtaq Mohammed
General Manager
Paria Fuel Trading Company Limited
Southern Main Road,
Pointe-a-Pierre.

Dear Mr. Mohammed

Inspection of Paria Fuel Trading Company Limited located at Southern Main Road, Point a Pierre

Reference is made to the above inspection conducted on the following dates; March .

Present during the inspection were:

FACILITATORS

Name	Organisation	Position
Mr. Randolph Archbald	Paria Fuel Trading Company Limited	HSE Coordinator
Mr Joel Lutchmansingh	Paria Fuel Trading Company Limited	HSE/Quality
Mr Collin Piper	Paria Fuel Trading Company Limited	Terminal Manager
Mr Paul Yearwood	Paria Fuel Trading Company Limited	HSE Coordinator

OSH AGENCY

Name	Position
Mr Dion Lawrence	Safety and Health Inspector II

Mr Warren Ali	Safety and Health Inspector I
Mr Kerwin Durity	Safety and Health Inspector I
Ms Lisa Ramlalsingh	Safety and Health Inspector I

An inspection report detailing the instances of non-compliance with the OSH Act is attached for your immediate attention. Please be informed that failure to address the findings may result in the risk of bodily injury and damage to equipment and the environment.

It is expected that these findings will be addressed and a report on the status of the corrective measures submitted to the OSH Agency within twenty one (21) working days of receipt of this letter.

Also, be advised that a re-inspection of the establishment will be conducted within three (3) months of receipt of this letter to ensure compliance.

Kindly note that failure to effectively address the findings in the inspection report could result in enforcement action by the OSH Agency. Furthermore, pursuant to Section 83(1) of the OSH Act, contravention of any provision or failure to comply with any duty, instruction or directive issued therein is deemed a safety and health offence and is subject to the jurisdiction of Section 72 of the OSH Act and the Industrial Court.

For further information or clarification on the above please contact Mr Dion Lawrence at 722-3521 or send an email to dion.lawrence@osha.gov.tt

Yours respectfully,

Mr Dion Lawrence
Safety and Health Inspector II
Occupational Safety and Health Agency

INSPECTION REPORT

Date Inspected : **March 07th ,08th and 09th**
Facility : **Paria Fuel Trading Company Limited**
OSHA : **Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh**
Facilitators : **Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
DOCUMENT REVIEW CONDUCTED ON 07th, 08th and 09th MARCH 2022		
Documentation	There was no drill matrix presented at the time of the inspection.	**6 (1)**
	The following Paria SOPs were not approved or implemented: ▪ Hose or Loading Arm Connection/Disconnection ▪ Hydrant water pressure in the Port During Testing of Berth Sprinklers ▪ Mooring Operations ▪ Port Planning Offshore ▪ Pre Loading Discharge ▪ Loading Operations ▪ Testing of hydrant water sprinklers monitors ▪ Vessel Berthing ▪ Vessel Cargo Tanks Inspection and Sampling ▪ Work Vests Requirements **Offshore** ▪ Pre Loading Discharge ▪ Special Pipe Line Operations and Trouble Shooting **Onshore Operations** ▪ Documents were in the format from Petrotin and made no reference to Paria Fuel Trading Company Limited	**6 (1) & 6(2)(a)**

INSPECTION REPORT **Date Inspected : March 07th ,08th and 09th** **Facility : Paria Fuel Trading Company Limited** **OSHA : Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh** **Facilitators : Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	3. There is no documented traffic management plan for the facility	**6 (2) (d)**
System/Policies/ Procedures	1. No lighting surveys were conducted. Conducting lighting surveys can be interpreted as an employer taking reasonable practicable means to prevent harm to workers due to inadequacy of lighting; taking into consideration, the deterioration of lighting fixtures through time and the addition/ alteration of facilities throughout the years. The failure to conduct these surveys may result in employees performing duties in inadequate lighting; and consequently create the potential for injury; especially because of the nature of the operations and the design of the building (restriction of natural lighting).	**33(1)**
	2. There was no evidence of any health surveillance conducted for employees	**25 K (1)**
	3. There were no lock out systems in place for process shut down procedures	**6 (2) (a)**
	4. There were no defined standard/ best practice used to assess and verify the risk assessment, method statement and Emergency Response Procedures (ERP) used in diving operations	**6 (2) (a)**

INSPECTION REPORT

Date Inspected : March 07th ,08th and 09th
Facility : Paria Fuel Trading Company Limited
OSHA : Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh
Facilitators : Mr Randolph Archbald and Mr Joel Lutchmansingh

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	5. The Permit to Work procedure was not suitable and sufficient as there were no means to address gaps found during the audit process.	**6 (2) (a)**
	6. The audit revealed that a contractor intervention was not initiated albeit an audit revealed contractors operating without Third party certification. This can increase the risk of bodily injury	**6 (2) (a)**
	7. Training, certification and authorization were required for the Permit To Work Signatories however the certification process has not been implemented	**6 (2) (a) & 6 (2) (d)**
	8. Periodic review of the permit system could not be verified at the time of the inspection	**6 (2) (a)**
	9. The contractor management programme did not include a system for continuous evaluation of the contractors particularly after critical accidents/ major incidents and major non-conformances that may occur while conducting works for Paria Fuel Trading Company Limited	**6 (1)**

<u>**INSPECTION REPORT**</u>

Date Inspected : March 07th ,08th and 09th
Facility : Paria Fuel Trading Company Limited
OSHA : Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh
Facilitators : Mr Randolph Archbald and Mr Joel Lutchmansingh

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
Fire and Emergency Response	1. There was no Fire Certificate for the facility issued by the Fire Authority (Trinidad and Tobago Fire Service).	**6 (2)(a), 7(1) and 26 (2)**
	2. The roles and responsibilities of individuals were not clearly defined in the Island Berth emergency response plan	**6 (1) & 6(2)(d)**
	3. The response escalation from level 1 to level 2 was not clearly defined in the emergency response plans	**6 (1)**
	4. The emergency shutdown procedures were not defined in the Island Berth emergency response plan.	**6 (2) (a)**
	5. The roles, responsibilities and functions of the Emergency Responders in emergencies at the Main via Ducts and the Berths were not clearly defined.	**6 (1)**
	6. The ground monitoring procedure was not defined in the Kerosene Tank Farm emergency response procedure	**6 (2) (a)**
	7. TTFS roles and responsibilities as it relates to accessing the Main via Duct and Berths were not defined.	**6 (1)**

INSPECTION REPORT

Date Inspected : **March 07th ,08th and 09th**
Facility : **Paria Fuel Trading Company Limited**
OSHA : **Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh**
Facilitators : **Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	8. No annual review and emergency drills exercises were conducted as stated in the Mixed Butanes ERP	**6 (2) (a)**
	9. The ERP did not identify a procedures for: ▪ Earthquakes ▪ Man overboard ▪ Rescue plan for diving mishaps Failure to ensure that an emergency plan is developed based on a risk assessment made in accordance with Section 13A may result in persons not being familiar with their course of action in an emergency situation	**8(2) (b)**
	10. There were no records to indicate that the emergency response plan was communicated to the employees and contractors. Also no records were presented to verify that the rescue team identified for high angle and confine space rescue were adequately trained to perform the required task. In addition there was no mention of external rescue personnel (TTFS etc. in the event the situation could not be handled internally	**6 (2) (d)**
	11. There were no drills conducted for bomb threats at the facility Further to such, there was no drills (fire, explosion medical etc.) conducted for onshore operations.	**6 (2) (d)**

INSPECTION REPORT

Date Inspected : **March 07th ,08th and 09th**
Facility : **Paria Fuel Trading Company Limited**
OSHA : **Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh**
Facilitators : **Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
Fuel Storage	1. There was no Ministry of Energy and Energy Industries approvals for the hydrocarbons stored at the facility.	**(6) (2) (a), (6) (2) (b) and 7 (1)**
General Duty	▪ There was no risk assessment and emergency response conducted for armed security personnel working on the berths ▪ The risk assessments for the establishment were neither suitable nor sufficient as it lacked details with respect to identification of hazards and the control measures required for the following: **Process Hazard Analysis** ▪ Throughout the document references to Petrotrin were made which is no longer operational **Facility Risk Assessment** ▪ Hazard Threat (Gangway) – inadequate control as they didn't identify the transfer of personnel ▪ Storage Facility – insufficient identification of risk potential with	**13 A (1) (a) & (b)** **13 A (1) (a) & (b)**

<u>**INSPECTION REPORT**</u>

Date Inspected : March 07th ,08th and 09th
Facility : Paria Fuel Trading Company Limited
OSHA : Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh
Facilitators : Mr Randolph Archbald and Mr Joel Lutchmansingh

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	regards to a fire hazard. Insufficient control method – housekeeping required ▪ Undefined work yard; walkways, driveway, work yard surface- inadequate control measure identified as there was an implemented traffic management plan **Servicing of Fire Extinguisher at HSE Workshop** ▪ Dismantling of fire extinguisher – SOP control measure was not seen **HSE Risk Assessment Procedure** ▪ The risk assessment procedure did not identify the risk with regards to person not in his employment **Connecting and disconnecting of hoses on Lorena B** ▪ Risk assessment not suitable nor sufficient – -all significant hazards were not identified	

INSPECTION REPORT

Date Inspected : **March 07th ,08th and 09th**
Facility : **Paria Fuel Trading Company Limited**
OSHA : **Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh**
Facilitators : **Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	Access to Paria use of roadways Road Tank Wagon Enters enter/exit Lower La Carriere ▪ There is no risk rating with regards to the various operations at the facility **PAP Bond** ▪ Hydrocarbon Vapours - Insufficient control measures identified ▪ Hydrogen Liquid – MOC not identified as an existing control within the assessment **Risk Assessment – Vehicles in Tank Farm** ▪ All significant hazards were not identifiedfor the task **Servicing on P-4038 at Pump house 13** ▪ Insufficient hazards and existing control measures identified ▪	
Electrical	1. The establishment has not been inspected and certified by the Electrical Inspectorate Division as having met the relevant electrical codes.	**6 (1)**

INSPECTION REPORT

Date Inspected : **March 07th ,08th and 09th**
Facility : **Paria Fuel Trading Company Limited**
OSHA : **Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh**
Facilitators : **Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	2. There was no Emergency Power Provisions provided at the facility	**6 (2)(a)**
Maintenance	1. The third party inspection report for the winches revealed all failed the inspection (Professional Institute Services Limited). In addition, no preventative maintenance records were seen for the said winches. Failure to maintain and inspect the winches may increase the likelihood of malfunctioning and failure of safety components in this equipment and may consequently lead to bodily injury to operators and others in close vicinity 2. There were no preventative maintenance records for the Doosan compressor albeit requested. Failure to conduct maintenance on the compressor may increase the likelihood of malfunctioning and failure of safety components in this equipment and may consequently lead to bodily injury to operators and others in close vicinity	**6 (2) (a)** **6 (2) (a)**
Marine	1. There was no load bearing/stability reports for all quay side and jetty areas at the facility. Failure to address can increase the risk of bodily injury and damage to property	**8 (4)**

INSPECTION REPORT

Date Inspected : **March 07^{th} ,08^{th} and 09^{th}**
Facility : **Paria Fuel Trading Company Limited**
OSHA : **Mr Dion Lawrence, Mr Warren Ali, Mr Kerwin Durity and Ms Lisa Ramlalsingh**
Facilitators : **Mr Randolph Archbald and Mr Joel Lutchmansingh**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT (Ch88:08)
	in the event of any structural failure	
	2. There was no top side and subsea reports for all berthing areas at the facility.	8 (4)
	Port Facility	
	▪ There was no risk assessment for the facility	13 A (1) (a) & (b)
	▪ The Standard Operating Procedures for the area are currently in draft format	6 (1)
	▪ There is no documented procedure with regards to vetting of vessel for health and safety	6 (1)
Other	1. The accident report database did not include contractor accident involving Sunil Sudan	6 (1)

---End of Report---

Levels 4 & 5
DUKE PLACE, 50-54 DUKE STREET
PORT OF SPAIN
Telephone No.1 (868) 299-0300 Ext. 2072 Fax: 1(868) 623-5905 – website: http:// www.osha.gov.tt

OSHA / COMP (5): 1/7/59

March 25, 2022

Mr. Mushtaq Mohammed
General Manager,
Paria Fuel Trading Company Limited,
Southern Main Road,
Point-A-Pierre.

Dear Mr. Mohammed,

Re: Inspection of the Paria Fuel Trading Company Limited *(Offshore Services Dock Yard/ PAP Bond B)*, located at Southern Main Road, Point-A-Pierre.

Reference is made to the above inspection that was conducted on **March 15, 2022.** The purpose of the inspection was to ensure compliance with the Occupational Safety & Health (OSH) Act Chapter 88:08.

Present during the inspection were:

OSH AGENCY:

NAME	POSITION
Mr. Dion Lawrence	Safety and Health Inspector
Mr. Warren Ali	Safety and Health Inspector
Mr. Kerwin Durity	Safety and Health Inspector

FACILITATORS:

NAME	POSITION	ORGANISATION
Mr. Paul Yearwood	HSE Coordinator	Paria Fuel Trading Company Limited
Mr. Garraway	PAP Bond Supervisor	Paria Fuel Trading Company Limited

Ms. Gina Perrotte	Mechanical Engineer	Kenson

An inspection report detailing the instances of non-compliance with the OSH Act is attached for your immediate attention. Please be informed that failure to address the findings may result in the risk of bodily injury and damage to equipment and the environment.

It is expected that these findings will be addressed and a report on the status of the corrective measures submitted to the OSH Agency within twenty one (21) working days of receipt of this letter.

Also, be advised that a re-inspection of the establishment will be conducted within three (3) months of receipt of this letter to ensure compliance.

Kindly note that failure to effectively address the findings in the inspection report could result in enforcement action by the OSH Agency. Furthermore, pursuant to Section 83(1) of the OSH Act, contravention of any provision or failure to comply with any duty, instruction or directive issued therein is deemed a safety and health offence and is subject to the jurisdiction of Section 72 of the OSH Act and the Industrial Court.

For further information or clarification on the above please contact Mr. Kerwin Durity at 688-8535 or send an email to kerwin.durity@osha.gov.tt

Yours respectfully,

....

Mr. Kerwin Durity
Safety and Health Inspector

Inspection Report

Date Inspected: March 15, 2022
Company: Paria Fueling Trading Limited
Facility: Southern Main Road, Point-A-Pierre
OSH Agency: Messer's Dion Lawrence, Warren Ali & Kerwin Durity
Facilitators: Messer's Paul Yearwood, Garraway & Ms. Gina Perrotte

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
Systems/Policies Procedures	1. Pipes were improperly stored on non-metal hose within the **Offshore Services Dock Yard**. Failure to develop and implement a safe system of work and provide employees with the necessary information, instruction and training pertaining to laydown operation can lead to employees adopting unsafe procedures and practices which can result in bodily injuries.	**6(2) (a) & 6(2)(d)**
	2. There was no evidence that HSE audits/inspections were conducted within the **Offshore Services Dock Yard**. Failure to conduct inspections to identify non-conformances to health and safety requirements may result in hazards not being identified and the relevant controls not in place.	**6(2)(a)**
	3. There was no internal verification/audits for RTW's entering the compound **PAP Bond Area.** This can result in possible faulty vehicles entering the compound which in turn can lead to fires given the hazard classification for the area. Thereby resulting in injury to persons and property damage.	**6(2)(a)**
	4. There was no emergency plan in writing based on a risk assessment made in accordance with section 13A at the **Offshore Services Dock Yard.** This can result in employees not being familiar with the procedure to be followed in the event of an emergency.	**8(2) (b) and 6(2)(a)**

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CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	5. There was no risk assessment presented for review for the activities within the Offshore Service Dock Yard. Failure to identify all significant hazards, assess and effectively control the relevant risk associated with same, may lead to bodily injury	**13A(1)(a) & (b) and 6(2)(a)**
	6. There was no traffic management plan for the area.	**6 (2)(a) &6(2)(d)**
Preventative Maintenance	1. The **PAP Bond** truck scale certification was past its service date (March 14, 2022). Failure to address may increase the likelihood of failure and consequently lead to bodily injury to operators and others in close vicinity.	**6(2)(a)**
Electrical	1. Duct tape was used to secure the 220Volts electrical wiring on a lighting tower located in the vicinity of the southern perimeter fence of the **Offshore Services Dock Yard**. This condition, if left unabated can result in electrical fires due to its fire-resistant inabilities, thereby resulting in property damage and bodily injury.	**6(2)(a)**
	2. There was no electrical switch on the pump for the Ron 92 Fuel located in the **Bond B Gantry Area**. Furthermore, the current system to isolate same is via the valves outside the Bond Area or at Pump House No1. This situation can result in delays in the isolation process in the event of an emergency.	**6 (2) (a)**
	3. There was a damaged electrical socket in the Bond Area.	**Electrical Regulations (3) and 6(2)(a)**
	4. The electrical distribution panel in the NP Contractor Office was not labelled to indicate the number of phases, frequency and voltage so as to warn employees about electrical hazards that can endanger them.	**6 (2) (d)**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
Access and Egress	1. There was a large depression on the roadway at the PAP Bond exit gate. RTW operators were observed precariously maneuvering their vehicles to minimize entry and violent vibration of the vehicles. Such conditions, if left unabated can result in injuries to RTW operators, fires, explosions and environmental issues due to loss of containment from overturning vehicles.	**6 (2) (a), 6 (2) (e), 7 (1) and 9 (a)**
Fire & Emergency Response	1. There were no functional checks conducted for the sprinkler system in the PAP Bond Area.	**6 (2) (a)**
Other	1. Obsolete equipment and other items were not timely removed from the Offshore Services Dock Yard Area. This can hinder egress in case of emergencies and thereby resulting in injury and damage to property 2. The water tanks were not labelled in the PAP Bond Area	**6(2)(a) & 6(2)(e)** **Welfare Regulations 2 (3) 6(2)(d)**

END OF REPORT

Levels 4 & 5
DUKE PLACE, 50-54 DUKE STREET
PORT OF SPAIN
Telephone No.1 (868) 299-0300 Ext. 2072 Fax: 1(868) 623-5905 – website: http:// www.osha.gov.tt

OSHA / COMP (5): 1/7/59

March 31, 2022

Mr. Mushtaq Mohammed
General Manager,
Paria Fuel Trading Company Limited,
Southern Main Road,
Point-A-Pierre.

Dear Mr. Mohammed,

Re: Inspection of the Paria Fuel Trading Company Limited *(Lube Oil Jetty/Port and Marine Maintenance Department/Marine Stores/Lube Oil Blending Shed/No. 20 Fire Pump House /Boat Shed- Workshop, Dye StorageArea, Jetty)*, located at Southern Main Road, Point-A-Pierre.

Reference is made to the above inspection that was conducted on **March 14, 2022.** The purpose of the inspection was to ensure compliance with the Occupational Safety & Health Act Chapter 88:08 ("the OSH Act").

Present during the inspection were:

OSH AGENCY:

NAME	POSITION
Mr. Dion Lawrence	Safety and Health Inspector
Mr. Warren Ali	Safety and Health Inspector
Mr. Kerwin Durity	Safety and Health Inspector

FACILITATORS:

NAME	POSITION	ORGANISATION
Mr. Paul Yearwood	HSE Coordinator	Paria Fuel Trading Company Limited

Mr. Rene Nimblette	PP Ops Oil Stocks/ Operations	Paria Fuel Trading Company Limited
Mr. Hassan Mohammed	Facilities Engineer (Mechnical)	Paria Fuel Trading Company Limited
Mr. Sharaz Hosein	Facilities Engineer (Mechnical)	Paria Fuel Trading Company Limited
Ms. Gina Perrotte	Mechanical Engineer	Kenson

An inspection report detailing the instances of non-compliance with the OSH Act is attached for your immediate attention. Please be informed that failure to address the findings may result in the risk of bodily injury and damage to equipment and the environment.

It is expected that these findings will be addressed and a report on the status of the corrective measures submitted to the OSH Agency within twenty one (21) working days of receipt of this letter.

Also, be advised that a re-inspection of the establishment will be conducted within three (3) months of receipt of this letter to ensure compliance.

Kindly note that failure to effectively address the findings in the inspection report could result in enforcement action by the OSH Agency. Furthermore, pursuant to Section 83(1) of the OSH Act, contravention of any provision or failure to comply with any duty, instruction or directive issued therein is deemed a safety and health offence and is subject to the jurisdiction of Section 72 of the OSH Act and the Industrial Court.

For further information or clarification on the above please contact Mr. Kerwin Durity at 688-8535 or send an email to kerwin.durity@osha.gov.tt

Yours respectfully,

....

Mr. Kerwin Durity
Safety and Health Inspector

<u>Inspection Report</u>

Date Inspected: March 14, 2022
Company: Paria Fueling Trading Limited
Facility: Southern Main Road, Point-A-Pierre
OSH Agency: Messer's Dion Lawrence, Warren Ali & Kerwin Durity
Facilitators: Messer's Paul Yearwood, Joel Hassan Mohammed, Sharaz Hosein, Rene Nimblette & Ms. Gina Perrotte

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	<u>Lube Oil Jetty</u>	
Preventative Maintenance	1. There was no hard barrier to prevent persons from accessing the defunct Berth 7.	**6(2)(a)**
	2. The horizontal bars in the western hand rail at the end of the jetty showed signs of severe corrosion. If left unabated, the integrity of this structure can become compromised which presents a hazard for persons traversing in this area.	**6(2)(a), 6(2)(e) & 8(4)**
	3. There was no preventative maintenance records for the air-condition units within the Trinity caravans. Failure to address same can lead to ill health to occupants of the industrial establishment if persons become exposed to contaminants.	**6(2)(a)**
	4. Loosely suspending plastic roofing sheeting were observed on the defunct conveyor system. If left unabated said items can fall on persons traversing the walkway below thereby resulting in injuries.	**6(2)(a) & 8(4)**
	5. There was no evidence of load bearing capacity report for the jetty area. failure to address can increase the risk of bodily injury and damage to property	**6 (2)(a)**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	6. Corrosion was observed on the bollards and barriers on the jetty area	**6 (2) (a) & 8(4)**
Electrical	1. Electrical receptacle cans within the Trinity caravans were observed without their covers. Such conditions, if left unabated can result in electrical shock and bodily injury to persons from accidental contact with live electricity.	**6(2)(a)**
	2. The following were observed in the electrical distribution panel: a) The panel box was not labelled to indicate the number of phases, frequency and voltage of the electrical power supply so as to warn employees about electrical hazards that can endanger them. b) There were missing breaker filler plates. This can cause persons to accidentally come into contact with the live electricity	**6 (2) (a) and 6 (2) (d)**
	3. There was no Ground Fault Circuit Interrupter (GFCI) installed in the Launch Station Lunch Room	**6 (2) (a)**
Access and Egress	1. Holes and broken tiles were observed on the floors within the Trinity caravans. Such conditions present the risk of bodily injury to persons traversing this area.	**6(2)(a) & 6(2)(e)**
Chemical Safety	1. Fuel was observed to be stored in an unsuitable plastic bottle. Such conditions can result in an inappropriate release of vapors, fires, explosions which may result in damage to persons and property.	**6(2)(a) & 6(2)(b)**
	2. There were no chemical safety data sheets (CSDS) provided for hazardous chemical stored at the facility. The failure to have unexpired CSDS available may lead to employees being unaware of the risks associated with the use of these chemicals.	**6(3)(b)**

012711

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	3. There were no chemical spill kits in the **Lube Oil Jetty Area**. Failure to address same can result in spill not being properly contained, controlled, cleaned-up.	**6 (2) (a)**
Lighting	1. There were non-functional light bulbs and missing light bulb diffusers throughout the establishment. Such conditions exposes persons to the health risks associated with glare from a direct source. Additionally it presents the risk of bodily injury to employees associated with coming into contact with exposed lighting fixtures.	**6 (2)(a) & 33 (2)(a)**
	Port and Marine Maintenance Department	
Electrical	1. The following were observed at the electrical distribution panel: a) The panel box was not labelled to indicate the number of phases, frequency and voltage of the electrical power supply so as to warn employees about electrical hazards that can endanger them. b) There were missing breaker filler plates. This can cause persons to accidentally come into contact with the live electricity	**6(2)(a) & 6(2)(d)**
	2. The electrical outlet in proximity to the sink (less than four feet) was not GFCI type. This can result in the risk of electric shock to persons.	**6 (2) (a)**
Access and Egress	1. There were no demarcation or signage indicating "Low Head Room" in the passageway leading from the **Rotating Office**. Such conditions present the risk of bodily injury to persons traversing this area.	**6(2) (d) & 6(2)(e)**
General Duty	1. Poor housekeeping was observed at the external storage area as items were stored on the floor. Such conditions present the risk of bodily injury to employees associated with tripping and falling while traversing the area.	**6 (2) (a), 6(2)(e) & 31(b)**

012712

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	2. There were no chucks for the metal pipes stored on the racks. Such conditions presents the risk of bodily injury and damaged to property related to the improper storage of such	**6 (2) (b)**
Fire and Emergency Response	1. There were non-functional emergency lighting fixtures. If left unabated this may result in disorientation/delay of employees due to the inability to visually identify exit routes during a fire/emergency evacuation. 2. The foam containers in the fire box located in the lube oil jetty were empty. Failure to address same can compromise the emergency response in the event of an emergency.	**6(2)(a) & 27 (5)** **6 (2) (a)**
Other	1. Obsolete chain hoist were not timely removed from the premises or tagged as not in service.	**6(2)(a)**
Preventative Maintenance	1. A function test was conducted on Caterpillar Forklift XCN 946 and the following were observed: ▪ No reverse alarm ▪ Horn non-functional	**6 (2) (a)**
	Marine Stores	
Systems/Policies Procedures	1. Employees were not provided with such training as is necessary to ensure, the safety and health at work of his employees, such as, training in manual handling and ladder safety. 2. There was no risk assessment for the area. Failure to conduct an annual assessment and to identify all hazards for the activities conducted at the industrial establishment and to assess and effectively control the relevant risk may lead to bodily injury and ill health	**6(2)(d)** **13 A 1 (a)**
Fire and Emergency Response	3. There was no site specific emergency response plan. Failure to ensure that an emergency plan is developed based on a risk assessment made in accordance with Section 13A may result in persons not being	**8(2) (b)**

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	familiar with their course of action in an emergency situation	
Preventative Maintenance	1. There were no secondary means of containment for the Industrial Gear Oil 320 *(stored in 55 gallons drums)* within the Lube Oil Storage Area. Such conditions can consequently lead to safety and health risks to persons associated with exposure to such.	**6 (2) (a), 6 (2) (b) and 7 (1)**
	2. There were significant cracks observed on the quay side (measuring fifty (50') in length and sixty three (63') in width) on the eastern end of the Boat Shed Work Shop Area that may compromise its structural integrity. Further to such, a section of the quay side was sloped downwards, consistent with the cracks observed	**6 (1), 6 (2) (a), 6 (2) (e), 7 (1) and 8 (4)**
	3. A section of the quay side's lower column was submerged in the sea and resting on an electrical line.	**6 (1), 6 (2) (a), 6 (2) (e), 7 (1) and 8 (4)**
	4. There was no record of any load bearing capacity/stability reports conducted for the quay side area at the facility	**6 (1), 6 (2) (a), 6 (2) (e), 7 (1) and 8 (4)**
Access and Egress	5. There were items such as (boxes and materials) obstructing the passageway. Such conditions poses a hazard in an emergency and can potentially cause trips and fall injuries to persons traversing this area.	**6(2)(e)**
Housekeeping	1. Poor housekeeping was observed as there was build-up of dust and cobweb on the floor area. Failure to address same can lead to ill health to occupants of the industrial establishment if persons become exposed to contaminants	**31(a)**
	Boat Shed Workshop	
Preventative Maintenance	1. The in-service lead-acid battery charging area is located obliquely above the underground used oil containment unit that	**6(2)(a)**

012714

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	currently contains a quantity of used oil and water. Battery charging can generate its own flammable gases, as such, this operation conducted in such close proximity to the used oil containment unit increases the likelihood of fires and explosions from sparks emanating from the operation.	
	2. There were no means of secondary containment for the Navipol Dye and other chemicals *(stored in 55 gallons drums)* within the south east boundary of the boat shed. Such practices can eventually lead to pollutants entering into the environment from product runoff and consequently presents a health risk to persons and damage to the environment	**6(2)(a), 6(2)(b), 7(1) and 9(a)**
	3. There was no evidence of preventative maintenance and annual inspection for the PM Hydraulic crane. Failure to address the issues identified above will expose persons to the risk of serious bodily injury and/or death.	**6(1), 6(2) (a) and 6(2) (b)**
	4. There was no site specific emergency response plan. Failure to ensure that an emergency plan is developed based on a risk assessment made in accordance with Section 13A may result in persons not being familiar with their course of action in an emergency situation	**8(2) (b)**
General Duty	1. Poor housekeeping of items was observed in the maintenance area, further to such, access was restricted to the electrical panel box. Such condition can hamper emergency response specifically for isolation purposes	**6(2)(b) and 6(2) (e) 31(b)**
	2. There were no secondary containment for the oil drums located on the external of the Boatshed Area. Such condition, if left unabated, can eventually cause the contents of the storage containers (if compromised), to leach and enter the areas, in close proximity to the storage area. This will consequently lead, to safety and health	**6 (2) (b)**

012715

CATEGORY	FINDINGS	NON-COMPLIANCE WITH APPLICABLE SECTIONS OF THE OSH ACT Chapter 88:08
	risks, both to persons and damage to the marine environment 3. Poor housekeeping was identified in the open **Yard Storage Area** as barrels and other items were haphazardly stored. Such conditions present the risk of bodily injury to employees associated with tripping and falling while traversing the area 4. There was no facility risk assessment for the area. Failure to conduct an annual assessment and to identify all hazards for the activities conducted at the industrial establishment and to assess and effectively control the relevant risk may lead to bodily injury and ill health	**6 (2) (a) 6(2)(e) & 31(b)** **13 A**
Electrical	1. Electrical receptacle cans within the workshop were observed without their covers. Such conditions, if left unabated can result in electrical shock and bodily injuries to persons from accidental contact with the live electricity 2. There were no circuit directory in the electrical panel box. Failure to have suitable labelling can delay response time for isolation purposes so as to prevent danger.	**6(2)(a)** **6 (2) (d)**
Fire Pump House		
General Duty	1. The overhead diesel storage tank was not labelled to indicate the capacity, prohibiting smoking and naked lights and the fuel content.	**6 (2) (d)**

END OF REPORT

012716

Gretel Baird

From: Archbald, Randolph
Sent: Monday, 21 February 2022 10:52 am
To: Rampersadsingh, Terrence; Wei, Michael; Yearwood, Paul
Subject: FW: Incident Report - un-Permitted Barge movement
Attachments: WI Meeting w Supervisors_18FEB2022.pdf

Please see last update from LMCS.

From: Kazim Ali <lmcsltd@gmail.com>
Sent: Friday, February 18, 2022 12:08 PM
To: Archbald, Randolph <Randolph.Archbald@paria-tt.com>
Subject: Re: Incident Report - un-Permitted Barge movement

mail originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know 1

Good day,

In response to your questions (LMCS responses in blue):
"

Based on the Incident Report Form, Mr. Guerra acted alone and seems to be fully responsible for the breach. Further, LMCS has removed Mr. Guerra from a supervisory role which will prevent a recurrence from him directly.

Yes. Corrective Actions 1 & 2 have already been implemented as of today, the 18th. Corrective Actions 3 & 4 have yet to be scheduled.

Q1 What will LMCS be implementing to prevent a recurrence from any other supervisor?

A1 From a Control of Work standpoint: Our other current Supervisors have been appraised of the Incident and the investigation findings. They have been reminded of the PTW process and their own training in this system. This has thus far been communicated verbally. It is our practice to hold a dedicated Safety Talk to review Incidents and findings, and this will be documented once it occurs at the restart of work.
From a PTW Process standpoint: Our other current PTW signatories (a Supervisor and LMCS' Operations Director) are currently being re-evaluated for this role through Paria's own PTW Evaluation. An additional batch of signatory candidates are also currently being evaluated after recent Training. These persons will act as on-site resources for checks / auditing of the PTW process implementation on LMCS' behalf.

Q2 Will there be some sort of oversight by management on Permit required activities?

A2 The oversight that has existed thus far has been through personal intervention of Management on site. Each day's work is discussed and planned the day before, with LMCS Managers/Supervisors and with LMCS Managers/Paria. At the start of each work day, either the HSE Manager, the Operations Director, or the Managing Director, or some combination of those, is on site overseeing Permitting.
The normal practice is that Management be appraised on the plan of action for the day while at OSSD. This is not documented as communication is directly person-to-person. It will be insisted on in future that such communication

is made for ALL works, through phone contact if no one is on-site to report to directly. Further, it shall be a requirement going forward that NO WORK, including mobilization, is to take place without direct acknowledgement and approval of at least one Manager. Communication of this requirement is documented in attachment.

Q3 Will self-check or Checklist system be implemented?

A3 As indicated in *A1*, the checks on-site will be a range of personnel also PTW trained, followed by verification by Management as described in *A2*. A checklist can be created, but we feel that the Permit itself already serves as the most powerful control document in the existing system and another form recapping the same requirements as already documented there is of little value.

Q4 Will the crew be empowered and trained to prevent breaches whether deliberate or inadvertent?

A4 The crew is already empowered through LMCS' STOP Work policy (see below excerpt from HSE Manual). Training of this was part of rollout of the LMCS HSE Management System and is brought back up intermittently through Toolbox Talks and the on-boarding process. A reminder of this Policy shall be conspicuously posted on-site prior to restart of works.

4.6.1. STOP WORK POLICY (LMCS-HSE-PRD-SWP-00)

Purpose

LMCS intends to empower employees to partner with the company to ensure all work is conducted in a safe manner. LMCS will not tolerate any short cuts in the execution of tasks. To meet this vision, employees must be empowered to stop unsafe work whenever it is observed. This procedure is separate from the Refusal of Unsafe Work procedure in section 4.6.3 of this manual.

Scope

This process applies to ALL LMCS operations.

Responsibilities

- *Management has a responsibility to listen to employees and investigate all cases where work is stopped for a safety concern.*
- *Management will ensure that all tasks are properly planned and risk assessed prior to commencement.*
- *Employees are responsible for bringing to the attention of the supervisor any unsafe situation they observe and having the job stopped. This is known as a "time out for safety". (Refer to Stop Work Record)*
- *Employees are responsible for understanding the task to be executed, participating in the relevant risk assessments, JSA and tool box meetings.*
- *If during the execution of the task, the employee observes an unsafe situation developing, they must raise it to the attention of the supervisor.*
- *Employees are to exercise responsibility when stopping work and not abuse this system.*

Employees who stop work as a nuisance to disrupt operations may place themselves and others at risk. Where it can be shown that the concerns were addressed in the planning phase and the employee was involved, or there is reason to believe that the process is being abused by the employee, they can be referred to the HSE Management Representative for coaching. This coaching is critical as employees must understand that the process is for everyone's *safety and unnecessarily calling a time out for safety can actually place others at risk as well as having negative business impacts.*

Process

- *Once a time out for safety is called, the supervisor will assess the concern;*
- *If the concern is a valid one, the safety measures will be implemented and the Supervisor will engage the HSE Management Representative to determine if the task can proceed or if the risk assessment needs to be revisited*
- *ALL time out for safety events will be reported to the HSE Management Representative and reported in the monthly HSE reports.*
- *The HSE Management Representative will treat each valid time out for safety as an incident and assess it based on its actual and potential impacts. Investigations will be conducted based on this.*

"

"

Regards,

Ahmad Ali

LMCS Ltd.

657-1016 (Office)

491-0341 (Mobile)

On Thu, Feb 17, 2022 at 11:26 PM Archbald, Randolph <Randolph.Archbald@paria-tt.com> wrote:

Thank you very much.

I have a few questions for Mr Ali:

Based on the Incident Report Form, Mr Guerra acted alone and seems to be fully responsible for the breach. Further, LMCS has removed Mr Guerra from a supervisory role which will prevent a recurrence from him directly.

What will LMCS be implementing to prevent a recurrence from any other supervisor?

Will there be some sort of oversight by management on Permit required activities?

Will self-check or Checklist system be implemented?

Will the crew be empowered and trained to prevent breaches whether deliberate or inadvertent?

Please advise how the safety management system will be improved to address this gap.

Randy

From: Kazim Ali <lmcsltd@gmail.com>
Sent: Thursday, February 17, 2022 2:40 PM
To: Rampersadsingh, Terrence <Terrence.Rampersadsingh@paria-tt.com>; Archbald, Randolph <Randolph.Archbald@paria-tt.com>
Subject: Incident Report - un-Permitted Barge movement

Good day,

Following the Incident involving un-Permitted Mobilization of LMCS's Barge this morning, an investigation was done. The following documents were created:

1) an Incident Report Form with relevant findings and recommendations documented, and

2) Mr. Guerra's statement.

Please see both attached for your information.

Regards,

Ahmad Ali

LMCS Ltd.

657-1016 (Office)

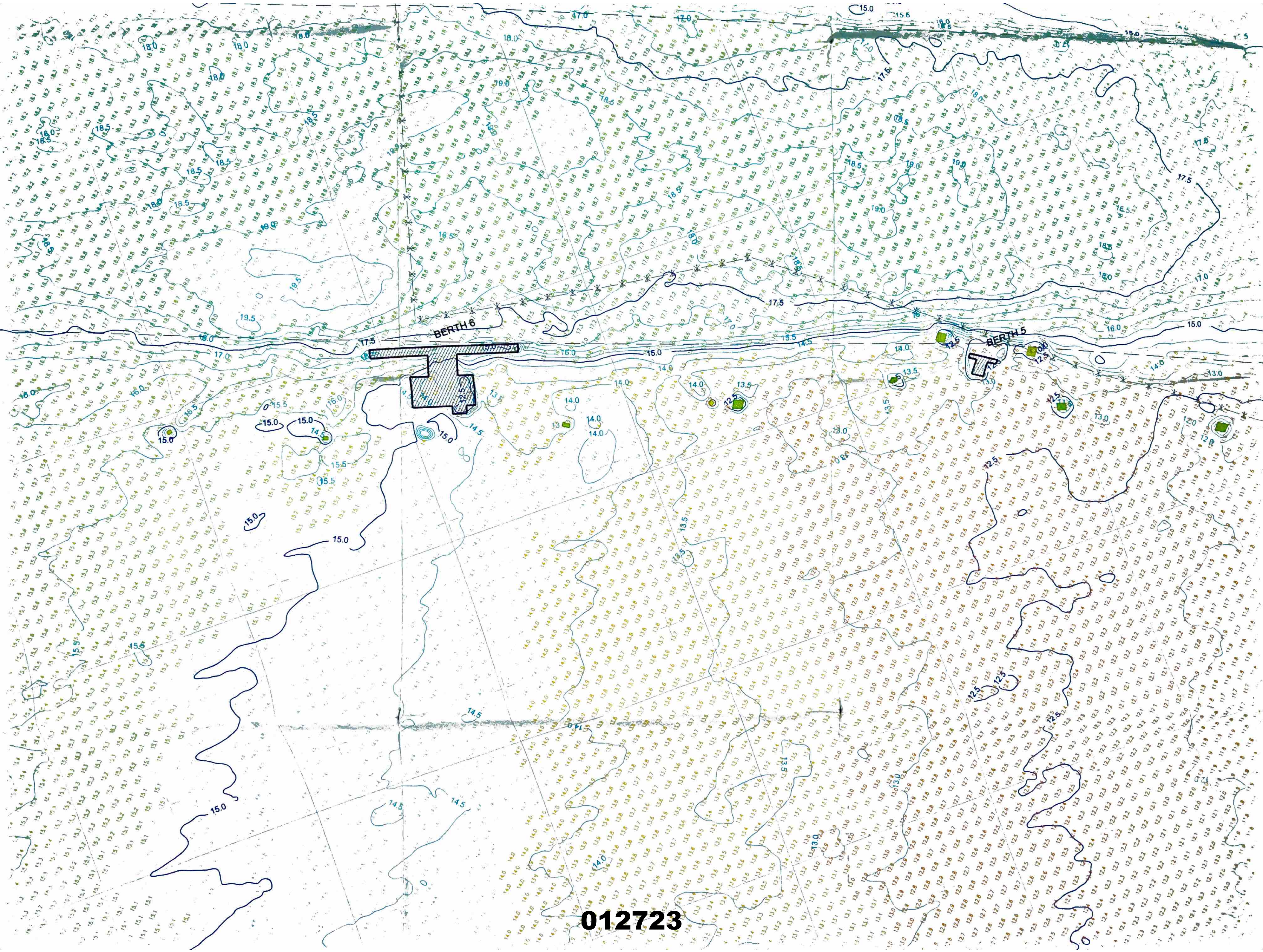
491-0341 (Mobile)

Date and Time: 18 FEB 2022 FRI @ 11:30 a.m. / ~~p.m.~~ **Speaker(s):** R. ALI, K.J. ALI, A. ALI

Topics Discussed: NEW WORK INSTRUCTION: No start of work without notification and authorization from LMCS Management, even with signed Permit.

	NAME		SIGNATURE
1	Ernesto	Acosta	
2	Ishbar	Ali	I Ali.
3	Lockhart	Austin	
4	Dane	Beharry	
5	Christopher	Boodram	
6	Jason	Charles	
7	Daniel	Deonarine	
8	Victor	Dhillpaul	
9	Justin	Duncan	
10	Vishnu	Gangabissoon	
11	Errol	Gonzales	
12	Rudolph	Gonzales	Rudolph Gonzales
13	Dexter	Guerra	
14	Yusuf	Henry	
15	Felix	Hospedales	
16	Beverly	Howe	
17	Steve	Joseph	
18	Fyzal	Kurban	
19	Sunil	Lalsingh	
20	Clint	Mohammed	

	NAME		SIGNATURE
21	Renold	Munroe	
22	Rishi	Nagassar	
23	Christopher	Paul	
24	Steve	Rajkumar	Steve Rajkumar.
25	Dave	Ramjitsingh	
26	Issiah	Rooplal	
27	Anan	Sahadeo	
28	Kenyon	Salazar	
29	Brent	Samaroo	
30	Anand	Singh	
31	Keshan	Singh	
32	Essarie	Warrick	
33	AHMAD ALI		[signature]
34	KAZIM ALI J.		[signature]
35	KAZIM ALI		Kazim [signature]
36			
37			
38			
39			
40			



012723

PETROLEUM COMPANY OF TRINIDAD & TOBAGO

Pointe-a-Pierre, Trinidad, W.I.
Tel: 868-658-4200

FUGRO SURVEY CARIBBEAN INC.

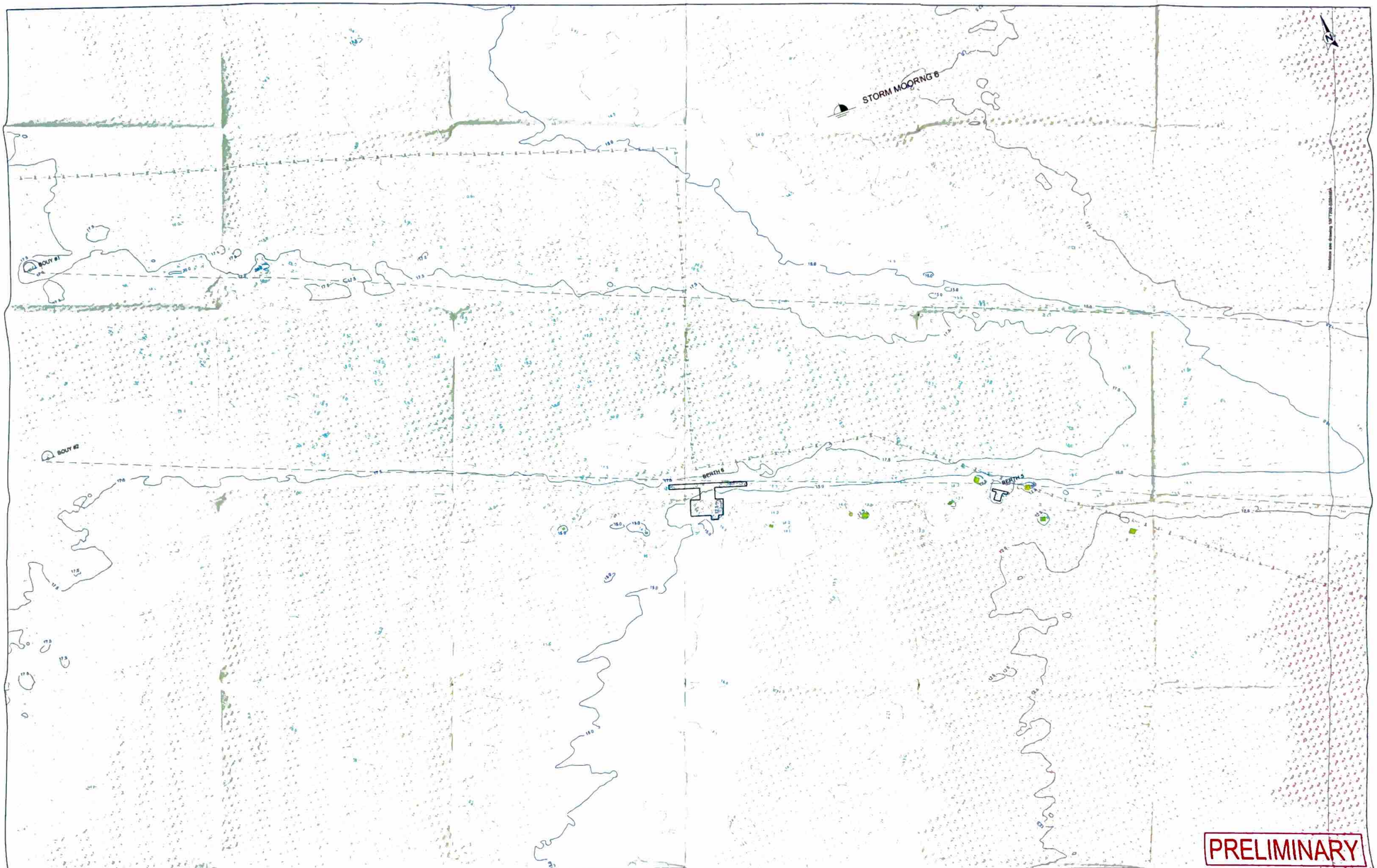
29 Alexandra Street, St. Clair, Trinidad, W.I.
Tel: 1 868 628 3204 Fax: 1 868 628 4570

HAZARD SITE CLEARANCE SURVEY
APPROACH CHANNEL, TURNING BASIN, BERTHING AREAS
BERTH 5 & 6
GULF OF PARIA, WEST COAST
TRINIDAD
BATHYMETRIC CHART

Vessels:	MULTIPLE	Survey Date:	NOV - DEC 2013	Project Ref:	13FT202

Issue No:	Date:	Description:	Interpr:	Drawn:	Chkd:	Appr:
6	29/04/2014	Re-issued for client's comment	BL	RR	TD	AS/BL
7	01/05/2014	Re-issued for client's comment	BL	RR	TD	AS/BL
8	05/05/2014	Re-issued for client's comment	BL	RR	TD	AS/BL

Client Ref:	Drawing No:	Chart:	Rev:	Encl:
-	13FT202-SS014BA	14 of 20	8	0



LEGEND:

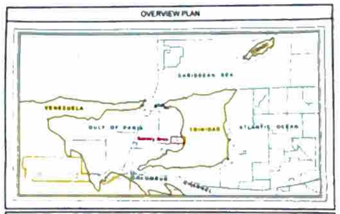
NOTES:

NAVIGATIONAL AID AND STORM MOORING LOCATIONS

GEODETIC PARAMETERS:

SCALE 1 : 1500

OVERVIEW PLAN



012725

PETROLEUM COMPANY OF TRINIDAD & TOBAGO

FUGRO SURVEY CARIBBEAN INC

HAZARD SITE CLEARANCE SURVEY
APPROACH CHANNEL, TURNING BASIN, BERTHING AREAS
BERTH 5 & 6
GULF OF PARIA, WEST COAST
TRINIDAD
BATHYMETRIC CHART

Vessels	MULTIPLE	Survey Date	NOV - DEC 2013	Project Ref	13FT322

Client Ref	Drawing No	Chart	Rev	End
	13FT322-S001-MA	14 of 20	6	0

STANDARD OPERATING PROCEDURES
CONFINED SPACE RESCUE

1.0 PURPOSE

The purpose of this procedure is to establish guidelines for the response of personnel and equipment to confined space rescue incidents. Because confined space rescue operations present a significant danger to the rescuer, the safe and effective management of these operations require special considerations. This procedure identifies some of the critical issues which must be included in managing these incidents.

2.0 SCOPE

This procedure establishes a standard structure and guideline for all HSE Technicians operating at incidents involving confined space rescues. The procedure outlines responsibilities for HSE technicians who provide rescue and medical support for confined space operations within Paria's facility. All other procedures such as the rescue plan shall apply to confined space rescue operations where applicable.

3.0 ROLES AND RESPONSIBILITIES

All employees who are expected to perform confined space work or work around confined spaces are responsible for following the guidance provided within this document, as well as instructions given by their supervisor. Additional title and employee responsibilities for entry into a confined space or permit required confined space may be given under the direction of the HSEQ department and written on the job hazard analysis (JHA) or risk assessment. The following individuals are responsible for ensuring that the directives, components, and maintenance of the company's confined space program are achieved.

3.1 Confined space entry attendant:

- Know the hazards.
- Know the behavioural effects of the hazards.
- Be able to identify the authorized entrants.
- Remain at the entry of the space until relieved.
- Maintain communication with the entrant(s) & rescue team.
- Monitor and evacuate entrant(s) if necessary.
- Summon rescue.

- Warn away unauthorized persons.

NB. The attendant shall not undertake any additional duties that might interfere with these primary duties.

3.2 Confined space entrant:

- Know the hazards associated with confined space entry, and in particular, the hazards associated with the permit required confined space being entered.
- Know how to use all required equipment.
- Know the procedure for communication with the attendant.
- Know how to alert the attendant of hazardous conditions.
- Know how to exit the space if necessary (self-rescue).
- Wear a certified retrieval harness for non-entry rescues.

3.3 Competent person / A.G.T

- Correctly use the instrument to monitor and verify the condition of the confined space.
- Verify the gas testing equipment used are calibrated and maintained in accordance with manufacture's instruction.
- Verify the instruments used to monitor the confined space are functioning.
- Take the appropriate measures in the event a hazardous condition is detected.
- Interpret gas test results.

3.4 HSEQ coordinator

- Implement the principles and practices of occupational safety and health including industrial hygiene and environmental protection programs.
- Understanding of OSHA Standard 29 CFR 1910.146.
- Ability to provide employee training using multiple delivery methods and media.

- Ability to communicate effectively.
- Ability to interact effectively with individuals in a wide range of situations, circumstances, and settings as well as the ability to work effectively with a diverse workforce to achieve stated HSE objectives.
- Ability to interpret and effectively communicate technical documents such as Job Safety Analysis to workers, visitors, and any other appropriate personnel.

4.0 CONSIDERATIONS

OSHA Standard 29 CFR 1910.146 Permit-Required Confined Spaces regulates entry into confined spaces for general industry and the rescue service and shall be considered
the basis for confined space rescue operations. For all intent and purposes, a confined space is defined as:

1. A space large enough for personnel to physically enter.
2. A space not designed for continuous employee occupancy.
3. An area with limited entry and egress.

Confined space incidents may involve injured persons or persons asphyxiated or overcome by toxic substances. Pre-incident planning is an important factor in preparation for these types of incidents. Due to the inherent dangers associated with these operations, there must be continuous re-assessment throughout the incident. A phased approach to confined space rescue operations are therefore imperative.

The OCCUPATIONAL SAFETY AND HEALTH ACT CHAPTER 88:08 Act 1 of 2004 Amended by 3 of 2006 section 25 (3) shall also govern confined space entry operations.

5.0 TRAINING

Training will establish employee proficiency in the duties that are required and shall introduce new or revised procedures necessary for compliance. OSHA 1910.146(g)(4) states that the employer shall certify that the training required has been accomplished. Train affected employees in basic first aid and cardiopulmonary resuscitation (CPR). The employer shall ensure that at least one member of the rescue team or service holding a current certification in first aid and CPR is available. 1910.146(k)(2)(iv) also mentions the importance of ensuring that affected employees practice making permit space rescues at least **once every 12 months**, by means of **simulated rescue operations** in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

6.0 ASSESSMENT

1. Review the work permit and any other information about the confined space.
2. Determine what products were being stored in the confined space and conduct a HazMat assessment.

7.0 PROCEDURAL CONTROL

The responsibility of the rescue team must include:

1. Identifying hazards associated with the confined space and the surrounding areas.
2. Assess the immediate and potential hazards to the rescuers.
3. Make assessments and determine if additional resources are needed.
4. Establishing communications with victim(s) and determine if non-entry retrieval can be made.
5. Activate the rescue plan and a back-up plan.
6. Communication with the contractor and the HSE coordinator.
7. Secure the area and deny entry for all non-rescue personnel.

8.0 RESCUE OPERATIONS

Ventilation

The rescue team must ensure that sufficient ventilation is being carried out within the confined space, taking into considering the effects of positive and/or negative pressure ventilation.

Equipment

Personal Protective Equipment (PPE) shall include helmet, gloves, proper footwear, goggles, fire retardant coveralls, at a minimum. Additional PPE may be indicated by the JHA and the atmospheric assessment. Self-Contained Breathing Apparatus (SCBA) shall be utilized by all rescue entry and back-up personnel.

Rescue team must enter the confined space with:

- Air monitoring device that monitors oxygen levels, flammability, and toxicity.
- Intrinsically safe communication equipment shall also be utilised. If this equipment is not available, entry personnel may use a tagline for communication or a message relay person.
- Intrinsically safe lighting equipment shall be utilised by entry personnel.
- A retrieval system with a back-up system shall be in place. This may include a vertical or horizontal haul system constructed of ropes, pulleys, and other hardware, with a minimum of a 2:1 mechanical advantage.

9.0 CASUALTY REMOVAL

Upon reaching the casualty, conduct a primary survey and initiate C-spine precautions. NOTE: due to the configuration of the confined space, optimum C-spine precautions may not be possible and should be addressed as soon as possible.

- When possible, provide respiratory protection for the victim(s). Rescuers shall not administer pure oxygen to a victim(s) in a confined space that has a potentially flammable atmosphere and rescuers shall not remove their breathing apparatus and give it to the victim(s).
- Conduct a secondary survey of the victim(s), while looking for immediate life-threatening injuries. If conditions permit, entry personnel should attempt to treat serious injuries prior to removal, while considering that it may be more appropriate to remove the victim(s) from danger prior to treatment.
- Properly package the patient for removal from the confined space. This may include using a backboard, SKED, LSP halfback, or similar device designed for extrication. Secure any loose webbing buckles, straps, or device that may hinder the extrication process.

10.0 TREATMENT

- Immediately upon egress, the victim(s) shall be transferred to the ambulance.

- If the victim has been contaminated from product inside the confined space, a thorough decontamination of the victim should be conducted prior to transporting to the hospital.
- Provide ALS level treatment and transportation to a hospital as indicated.
- Remove all tools and equipment used in the rescue/recovery and return to a ready mode. In cases of a fatality, consider leaving everything in place until the investigative process has been completed.
- If entry personnel and/or equipment have been contaminated, proper decontamination procedures shall be followed prior to returning to service.
- Consider a Post Incident Critique with contractors.
- Return to service after turning the scene over to the responsible party and ensuring the scene is secure.

11.0 OTHER CONSIDERATIONS

- Consider the effects of inclement weather.
- Consider the effects of the victim(s), and the co-workers.
- Maintain awareness of the time of day and ensure sufficient lighting is available on the scene if operations extend into the night.
- Notify the OSH agency if there has been a serious injury or death.

Paria Fuel Trading Company Limited

HSEQ

Site Specific Emergency Response Plan

Tank 68	
Date: 10/08/2022	**Work Permit No:**
Location:	**Equipment Name:** Tank 68
Permit details:	

FORSEEABLE EMERGENCIES/HAZARDS

	Asphyxiation		**Gaseous Release**
	Engulfment/Drowning	√	**Fire**
√	**Falls from Height**	√	**Thermal Stress**
√	**Deployed fall arrest situations**	√	**Medical**
	Other		

Type of Rescue		**High Angle**	√	**Low angle**		**Work over water**		**Trench**

SPECIFIC HAZARDS, OBSTACLES TO ENTRY OR RESCUE: Restricted access and egress **(**3 ft manway on the North and East of Tank), uneven terrain, airlines can pose as slip and trip hazards. Radio communications is poor in the area

CONDITIONS/EQUIPMENT REQUIRED FOR RESCUE

RESCUE ROPE	**MAIN**	√	**BELAY**	√	**TAG**	√	**ROPE LENGHT**
HAUL SYSTEM						√	**SKED/ SPINAL BOARD** √
RIGGING PLATE						√	**IMPROVSED/ENGINEERED ANCHOR POINT** √

012732

CARIBINERS	√	PRE-RIGGING REQUIRED	
RESCUE HARNESSES	√	PORTABLE OXYGEN	
PULLEYS	√	SELF CONTAINED BREATHING APPARATUS CYLINDERS; MASKS; AND AUX DEVICES	
ANCHOR SLINGS REQ.	√	CARTRIDGE TYPE RESPIRATORS	
TRIPOD		GAS MONITOR	√
GLOVES, HELMIT, SAFETY GLASSES	√	HEARING PROTECTION	√

Other

RESCUE PLAN DETAILS

(a) In the event of an emergency the following actions will be undertaken:

- An alarm will be raised to alert persons onsite of the emergency.
- All work at height operations will cease immediately. All equipment that could become unstable or present a hazard will be shut down and all suspended loads safely lowered and secured.
- Contact will be made with SOC (658-7233) or Paria's HSE.612-2463 Ext # 2167 personnel informing them of the nature and location of the incident.
- All non-essential personnel will assemble at the predetermined muster point.
- The onsite ERT(s) will leave the staging area, will identify an anchor point (**Hi point on scaffolding/ladder trust**) and rig a main and belay system to lower a rescuer to the casualty and perform a pick off operation.
- Where applicable, the worker will be advised to utilize the trauma straps on his harness to reduce the likelihood of suspension trauma until the rescue effected

(b) In the event of a Low angle rescue the following actions will be undertaken:

The onsite ERT(s) will leave the staging area, initiate rigging where applicable, conduct a gas test and will enter the nearest man way (Northeast or Southwest) to assess and package the casualty pending the arrival of other Paria responders.

- The casualty will be lashed onto a spinal board (C Spine precautions observed) using a combination of webbing and straps or packaged in the sked for the purpose of low profiling.
- The casualty will then be passed through the man way where he or she will be taken to a safe area of refuge where a rapid body scan will be conducted. In cases of severe trauma or bleeding appropriate medical care rendered to prevent deterioration.

• On completion of the rescue effort all hardware and software will be inspected for defects and properly stored at the staging area
Additional Information (delegation of duties, able body Volunteers, preferred means of access/egress)
Completed by: Name (print) Designation: Signature: Date: **Reviewed by** Name (print) Designation: Signature: Date:

Rescue Team Members	

Site Requirements	

- ERT's shall familiarize themselves with the documented emergency procedure, first aid/ emergency equipment and the listed emergency contact numbers.
- ERT's shall revise the rescue plan accordingly with the progress of the work activity.
- The ERT will perform pre use checks on equipment including attachments to ensure that they are fit for purpose, appropriate for the task and suitably rated.
- The onsite ERT will conduct radio communication checks daily and will stage at an appropriate location to ensure that operations onsite are conducted with due regard for safety.

INTERNATIONAL CONSENSUS STANDARDS FOR COMMERCIAL DIVING AND UNDERWATER OPERATIONS

6.3 EDITION

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.
Safety • Education • Communication

012736

Published by:

Association of Diving Contractors International, Inc.
5206 FM 1960 West, Suite 202
Houston, TX 77069
www.adc-int.org

Third Edition	1991
Fourth Edition	1992
Fifth Edition	2004
Sixth Edition	2011
Sixth Edition	2014 (Revision 6.1)
Sixth Edition	2016 (Revision 6.2)
Sixth Edition	2018 (Revision 6.3)

012737

The Mission of the ADCI is:

- **To promote the highest possible level of safety in the practice of commercial diving and underwater operations.**
- **To promote proper and adequate training and education for industry personnel.**
- **To foster open communication within the underwater industry.**
- **To hold all members accountable in adherence to the International Consensus Standards for Commercial Diving and Underwater Operations.**

012738

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RECORD OF CHANGES

This 6.3 edition of the International Consensus Standards for Commercial Diving and Underwater Operations for Commercial Diving and Underwater Operations supersedes the 6.2 edition, dated 2016. A Gap Analysis between editions 6.2 and 6.3 can be accessed on the ADCI website.

ADCI

SECTION 1.0

GENERAL PROVISIONS

Association of Diving Contractors International, Inc.

012754

1.0 GENERAL PROVISIONS

1.1 SCOPE AND APPLICATION

1.1.1 PURPOSE

The purpose of these consensus standards is to provide best industry practices in a clear and complete format in order to contribute to the safety and well-being of all those working in the commercial diving industry, especially commercial divers, tenders, deck support personnel and supervisors.

These consensus standards apply to all types of underwater work, whether inland or offshore, involving commercial diving. It is intended that these standards will complement applicable government rules and regulations as well as supplement industrial codes of safe practice for diving and underwater operations by providing a consensus of industry best practices for underwater diving operations.

Nothing contained in this manual shall be construed to take the place of any law, rule or regulation of any governmental agency.

1.1.2 PRESERVATIVE ACTS

These consensus standards represent the generally applicable standards that apply to normal or typical situations. The ADCI recognizes that variations from these standards may be needed and appropriate where emergency and unanticipated situations arise.

SECTION 2.0

DIVING PERSONNEL MEDICAL AND TRAINING REQUIREMENTS

Association of Diving Contractors International, Inc.

012756

2.0 DIVING PERSONNEL MEDICAL AND TRAINING REQUIREMENTS

2.1 GENERAL

Each person engaged in diving and underwater operations shall possess the necessary qualifications for the job assignment. Designation of skill levels in these standards incorporates three primary elements:

- Technical training
- Field experience
- Demonstrated proficiency

Persons assigned to specific diving and underwater activities shall possess the following:

1. Knowledge and skills gained through a combination of formal training and/or experience in the following:
    - Diving procedures and techniques.
    - Emergency procedures.
    - Physiology and physics as they relate to diving.
    - Diving equipment.
    - First aid and CPR.
2. Familiarity with procedures and proficiency in the use of tools, equipment, devices and systems associated with the assigned tasks.
3. For persons engaged as divers or otherwise exposed to hyperbaric conditions, physical qualifications for such activities must be met as outlined in **Section 2.3 Diver Medical Requirements.** Such physical qualifications must be documented on an ADCI **medical history and physical examination form,** or an equivalent form.
4. For persons who operate decompression chambers, knowledge and experience with chamber operations.

A person lacking the required experience and proficiency outlined above may be assigned a task, under the direction of an experienced and qualified individual, in order to obtain the experience and level of proficiency required.

Personnel trained and certified by recreational agencies such as, but not limited to, the National Association of Underwater Instructors (NAUI), the Professional Association of Diving Instructors (PADI), the Young Men's Christian Association (YMCA) or other such organizations are not sufficiently well-trained to participate in or conduct commercial diving activities without additional formal training from an accredited source.

For contractors operating in the United States, OSHA considers an employer to be in compliance with the diver training requirements of the Code of Federal Regulations for any employed diver with a valid ADCI Commercial Diver Certification Card for the appropriate training level.

2.2 COMMERCIAL DIVING TRAINING REQUIREMENTS

2.2.1 ENTRY-LEVEL QUALIFICATIONS

All personnel entering the profession of commercial diving shall be a high school graduate or equivalent. The entry-level minimum skill designation on the diving crew is a tender/diver. The entry-level tender/diver satisfies the minimum entry-level qualifications of diving proficiency, technical proficiency and experience by successfully completing a formal course of study.

A formal course of study for a tender/diver shall be completed at any accredited school, military school or equivalent whose curriculum, at a minimum, conforms to ANSI/ACDE-01-2009.[2] This standard can be found in the reference section.

The ADCI recognizes some formal training certificates issued from within other nations. Certificates of that nature will be evaluated together with presented documentation such as dive logs/supervisor logs, etc., to determine whether the individual is eligible in all respects for issuance of an ADCI commercial diver card.

The ADCI does not perform as an educational organization and as such does not endorse, certify or accredit any school participating in the training of personnel. Member schools are expected to obtain and preserve appropriate accreditation from agencies under whose jurisdiction their educational requirements must be maintained.

2.2.2 MINIMUM REQUIRED EXPERIENCE AND PROFICIENCY

1. Advancement beyond the designation of tender/diver requires completion of actual participation in commercial diving operations and demonstrated proficiency during working dives.

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2. Field experience is defined as those days spent (offshore, inland lakes, harbors, rivers, etc.) participating as a crew member in diving operations at the level of competency determined by prior training and demonstrated proficiency.
3. Diving proficiency establishes the required minimum number of open-water working dives required to obtain various designations. All dives must be performed during a 24-month period immediately prior to issuance of the designation. Work must be performed during each dive with proper supervision. All dives must have a minimum of 20 minutes bottom time. A number of shorter-duration dives may be combined to equal one dive of the required 20-minute bottom time.
4. **Advancement** to higher designations requires completion of training and experience for all lower designations.

Minimum Qualifications:

- **Entry-Level Tender/Diver**

  Commercial diver training of at least 625 documented hours of formal instruction in subjects set forth in the ANSI Standard.[2]

- **Advanced Certifications**

  As defined in Matrix in Section 3.

- **Others**

  Technical proficiency as appropriate to the specific diving mode as detailed under the ADCI certification card program requirements or appropriate section for these standards.

2.3 DIVER MEDICAL REQUIREMENTS

It is recommended that candidates attending formal commercial diver training programs and schools follow the ADCI medical and examination guidelines outlined in this section.

2.3.1 GENERAL

For persons engaged as divers, or otherwise subjected to hyperbaric conditions, the following ADCI medical examinations (or equivalent) are required:

1. An initial medical examination by a physician qualified to perform commercial diver medical examination following the ADCI recommended guidelines.
2. Examinations are required on an annual basis.
3. A re-examination after a diving-related injury or illness as needed to determine fitness to return to diving duty. For the purposes of these medical requirements all examinations are to be performed only by licensed physicians qualified to perform commercial diver medical examinations. Must have licensed physician signature to be legible and/or stamped, with their medigal designation clearly indicated. Non-physicians are not recognized by the ADCI as being qualified to perform commercial diver medical examinations

2.3.2 PHYSICAL EXAMINATION

1. For persons engaged as divers or otherwise subjected to hyperbaric conditions, the initial exam and periodic medical re-examination will be recorded using the ADC diving medical examination form and will include the following:
   - Work history.
   - The tests required in Section 2, Table 1 as appropriate.
   - Any tests deemed necessary to establish the presence of any of the disqualifying conditions listed in this section.
   - Any additional tests the physician deems necessary.
2. All persons engaged as divers or otherwise subjected to hyperbaric conditions are required to get an annual exam. More frequent or extensive examination(s), including a complete medical re-examination, should be required if there have been any incidents (illness, accidents, etc.) during the course of that year that may have caused a change in the individual's medical condition. The diver is required to notify the diving medical examiner of any changes in his/her medical condition including any change in medications.

2.3.3 RE-EXAMINATION AFTER INJURY OR ILLNESS

1. Any person engaged as a diver, or otherwise exposed to hyperbaric conditions, will have a medical examination following a known diving-related injury or illness that requires hospitalization or known decompression sickness with audio-vestibular, central nervous system dysfunction or arterial gas embolism. Divers experiencing type I decompress sickness that is treated and symptoms resolve with a single treatment table do not need to be seen by a diving medical examiner prior to return to diving.

2. Any person engaged as a diver, or otherwise exposed to hyperbaric conditions, will have a medical evaluation following any non-diving injury or illness that requires any prescription medication, any surgical procedure or any hospitalization.
3. The person should not be permitted to return to work as a diver, or otherwise be subjected to hyperbaric conditions, until he or she is released by a physician recognized by the ADCI to do so.
4. The examining physician should determine the scope of the examination in light of the nature of the injury or illness.

2.3.4 TABLE 1 - MEDICAL TESTS FOR DIVING

Test	Initial	Annual	Comments
History & Physical	X	X	Include predisposition to unconsciousness, vomiting, cardiac arrest, impairment of oxygen transport, serious blood loss or anything that, in the opinion of the examining physician, will interfere with effective underwater work.
Chest X-ray	X	X	PA and lateral (Projection: 14" x 17" minimum) every three years unless medical conditions dictate otherwise.
Bone and Joint X-ray Survey	X		Optional and as medically indicated.
EKG: Standard (12 Leads)	X		Optional initially to establish baseline; annually after age 35; and as medically indicated.
EKG: Stress Test			Required as medically indicated if the Framingham Risk Score indicates risk of >10%.
Spirometry	X	X	Required including FVC, FEV1 and FEF25-75. Tests should be compared with NHANESIII reference values for determining percent of predicted
Audiogram	X	X	Threshold audiogram by pure tone audiometry; bone conduction audiogram as medically indicated.
EEG			Required only as medically indicated.
Visual Acuity	X	X	Required initially and annually.
Color Blindness	X		Required.
Complete Blood Count	X	X	
Routine Urinalysis	X	X	
Pregnancy Test	X	X	Recommended prior to saturation diving.
Sickle Cell Screen	X		Optional.
TB screening	X	X	Optional.
Comprehensive Metabolic Profile	X	X	Optional, including cholesterol and triglycerides required for divers over 40.
Lipid Panel	X	X	Required annually after the age of 35
Framingham Risk Score	X	X	Required annually after the age of 35

2.3.5 PHYSICIAN'S WRITTEN REPORT

A written report outlining a person's medical condition and fitness to engage in commercial diving or other hyperbaric activities should be provided by the examining physician at any time a physical examination is required herein. The written **physical examination form** should be accompanied with a completed copy of the standard **ADCI medical history form**.

The examining physician should be qualified by experience or training to conduct the commercial diver physical examination.

2.3.6 DISQUALIFYING CONDITIONS

A person having any of the following conditions, as determined by a physician's examination, shall be disqualified from engaging in diving or other hyperbaric activities.

- History of seizure disorder other than early childhood febrile conditions.
- Cystic, bullous or cavitary disease of the lungs, significant obstructive or restrictive lung disease and/or spontaneous pneumothorax.
- Chronic inability to equalize sinus and middle ear pressure.
- Significant central or peripheral nervous system disease or impairment.
- Chronic alcoholism, drug abuse or dependence or history of psychosis.
- Hemoglobinpathies associated with comorbidities.
- Any person engaged as a diver, or otherwise exposed to hyperbaric conditions, will have a medical evaluation following any non-diving injury or illness that requires any prescription medication, any surgical procedure or any hospitalization.
- Untreated or persistent/metastatic or other significant malignancies including those that require chemotherapy and/or radiation therapy unless five years after treatment with no evidence of recurrence.
- Hearing impairment in the better ear should be at least 40 dB average in the 500, 1000, and 2000 Hz frequencies.
- Justa-articular osteonecrosis is disqualifying.

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- Chronic conditions requiring continuous control by medication that increases risks in diving.
- Pregnancy.

2.3.7 WITHDRAWAL FROM HYPERBARIC CONDITIONS FOR DIVERS

It shall be determined on the basis of the physician's examination whether a person's health will be materially impaired by continued exposure to hyperbaric conditions. The physician should indicate, in the written report, any limitations or restrictions that would apply to the person's work activities.

2.3.8 MEDICAL RECORD KEEPING

1. An accurate medical record for each person subject to the medical specifications of this section should be established and maintained. The record should include those physical examinations specified herein, including the **ADCI medical history/physical examination forms** and the physician's written report.
2. The medical record shall be maintained for a minimum of five years from the date of the last hyperbaric exposure unless otherwise prescribed by law.

2.3.9 VENOMOUS FISH STINGS

<table>
<tr><th colspan="2">VENOMOUS FISH STINGS</th></tr>
<tr><td>PATIENT CRITERIA:</td><td>Stings from venomous fish include lionfish, scorpionfish and stonefish. Stings that occur in waters with poor visibility and known to have venomous fish should be regarded as potential fish envenomation and treated according to this protocol. While there has been no cases reported in the medical literature of anaphylaxis secondary to lionfish there is a possibility that this may occur after repeated exposures. Anaphylaxis protocols should be followed for symptoms consistent with anaphylaxis. Mild to severe pain may be reported at the site of the puncture wound. Venomous fish toxins are of the neuromuscular type and can cause a variety of other systemic symptoms including headache, nausea, vomiting, abdominal pain or cramping, delirium, seizures, limb paralysis, hyper or hypotension, respiratory distress, dysrhythmia, myocardial ischemia, congestive heart failure, pulmonary edema, tremors, muscle weakness and syncope. Pain that worsens hours or days after initial improvement with hot water treatment may indicate secondary infection. Although painful, local treatment with hot water generally relieves pain in most cases.</td></tr>
<tr><td>REQUIRED ASSESSMENT:</td><td>• Focused History & Physical to include vital signs.
• Examination of the skin for puncture wounds and/or vesicles.
• Auscultation of Lung sounds for wheezing or stridor.
• Document location, distribution of skin lesions and obtain full history of event and any similar past events.
• Measure areas of redness or swelling and record for future reference.
• Strength testing and sensory testing.</td></tr>
<tr><td>INTERVENTION:</td><td>• Currently there is only antivenin for stonefish and it is available only in the lndo Pacific region. If in a region where antivenin is available and the injury is thought to be secondary to stonefish or scorpionfish, consider transport to a facility where it may be administered.
• The venom found in these fish is heat labile and generally responds to hot water treatment. If on an extremity that can be immersed, heat water to a temperature of 113 degrees Fahrenheit (45 degrees Celcius), ideally measured with a thermometer, and immerse the extremity in the water for 15 minutes at a time. Otherwise put towels soaked in hot water and apply to the areas affected.
• Treatment with hot water may be repeated.
• If fish spines are suspected to be present in the tissues, call the medical consultant for further instruction.
• Cleanse the wound with povidone iodine (betadine) and dress with mupirocin or triple antibiotic ointment if mupirocin is unavailable.
• <u>Treatment of mild to moderate pain:</u> Ibuprofen 400mg PO q.i.d. or Acetaminophen 1000 mg PO q.i.d.
• Update diphtheria/tetanus as needed.</td></tr>
<tr><td>ALS:</td><td>Contact Medical Consultant prior to administering Antibiotics or Narcotics
• <u>Pain unresponsive to non-steroidal anti-infammatory agents:</u> May escalate Ibuprofen to 800 mg PO t.i.d. with unresolving symptoms. If no change in symptoms after administering Ibuprofen, narcotic analgesics may be considered.</td></tr>
<tr><td>CLINICAL CONSIDERATIONS:</td><td>Contact Medical Consultant prior to administering Antibiotics or Narcotics
• <u>Secondary infection:</u> Consider antibiotic treatment with Doxycycline 100 mg bid, Ciprofloxacin 500 mg. bid or Trimethoprim/ Sulfa 160/800 mg bid for 10 days.
• <u>Anaphylaxis :</u> Treat according to standard anaphylaxis protocols using epinephrine (Epipen) and repeat if necessary.</td></tr>
<tr><td>CONSULTATION & REFERRAL CRITERIA:</td><td>• Transport will be required for those patients who present with severe symptoms, fever or for those that have pain not responsive to oral medication.
• Transport will be required for those patients that have signs of necrosis.
• Transport may be required for those patients with retained fish spines.
• Transport will be required for areas where antivenin is available for the treatment of systemic symptoms due to stonefish or scorpionfish.</td></tr>
</table>

2.4 MEDICAL GUIDELINES AND RECOMMENDATIONS

2.4.1 INTRODUCTION

The following recommendations are set forth by the ADCI and are intended to be used with the ADCI medical history/physical examination forms. They deal with specific aspects of the subject's physical fitness to dive by item number. These standards are offered with what we believe, in most cases, to be the minimum requirements. The use of these standards is intended to be tempered with the good judgment of the examining physician. Where there is doubt about the medical fitness of the subject, the examining physician should seek the further opinion and recommendations of an appropriate specialist in that field. Particular attention must be paid to past medical and diving history. In general, a high standard of physical and mental health is required for diving. Consequently, in addition to excluding major disqualifying medical conditions, examining physicians should identify and give careful consideration to minor, chronic, recurring or temporary mental or physical illnesses that may distract the diver and cause him or her to ignore factors concerned with his or her own safety or others' safety.

It is recommended that the medical examination be performed by a physician that has completed formal training or has experience in the medical assessment of fitness for commercial diving. Examinations shall not be performed by non-physicians.

The spectrum of commercial diving includes industrial tasks performed from just below the surface to deep saturation diving. Job descriptions and therefore job-limiting disabilities may vary widely. These standards, in general, apply to all divers. Some consideration must be given to the subject's medical history, work history, age, etc. Within commercial diving it may be that a diver is fit to perform some jobs but not others.

There is no minimum or maximum age limit, providing all the medical standards can be met. The ADCI does not issue commercial diver certification cards to persons younger than 18 years of age. Serious consideration must be given to the need for all divers to have adequate reserves of pulmonary and cardiovascular fitness for use in an emergency. The lack of these reserves may possibly lead to the termination of a professional diving career. The examining physician should exercise the appropriate professional judgment to determine whether in particular circumstances additional testing may be warranted. Disqualification for an inability to meet any of these standards must be determined on a case-by-case basis.

Upon application by a company or individual, and with concurrence by the examining physician, particular medical circumstances may justify that a temporary variance be granted. Examining physicians must be familiar with the essential job functions (job description) for each commercial diving physical examination. The examining physician is encouraged to make any recommendations for reasonable accommodations necessary for a person to meet these standards.

The numbered items within these standards refer to boxes on the ADCI medical history/physical examination form. These forms are available for download on the ADCI website.

If any further clarification of this recommended standard is desired, please contact the ADCI.

2.4.2 ADCI PHYSICAL EXAMINATION STANDARDS

Patient history is recorded on pages 2-15 through 2-16 of the form set. Pages 2-17 and 2-18 are used to record specific findings during the conduct of the examination.

The following headings refer to and explain the numbered boxes on the **ADCI physical examination form** on pages 2-17 and 2-18. A sample copy of these forms is enclosed in this standard. Use of these forms ensures quality and consistency throughout the commercial diving industry. These forms may be obtained from the ADCI website.

1	**Name**	Record.
2	**Social Security Number or Passport Number**	Record.
3	**Height**	No set limits.
4	**Weight**	The weight limits listed in the maximum allowable weight chart (2.4.9) should apply. If a diver exceeds these limits and the cognizant physician feels the increase is due to muscular build and physical fitness, a variance may be appropriate. A variance may be appropriate for divers who do not meet the weight limits but are at 23% body fat or less as measured by impedance or hydrostatic fat testing. Furthermore, individuals who fall within these weight limits but who present an excess of fatty tissue should be disqualified.
5	**Body Fat**	Optional. According to US Navy, 23% for males, 34% for females.
6	**Body Mass Index (BMI)**	Optional. Calculation for BMI = $\frac{\text{weight in pounds x 703}}{\text{height in inches}^2}$. The maximum BMI allowable according to the U.S. Navy height and weight table is 28.
7	**Temperature**	The diver should be free of any infection/disease that would cause an abnormal temperature.
8	**Blood Pressure**	The resting blood pressure should not exceed 140/90 mm Hg. In cases of apparent hypertension, repeated daily blood pressure determinations should be made before a final decision is made. The blood pressure should be controlled without target organ damage. Beta blockers are not acceptable. Low-dose diuretics are acceptable. Medications required to control blood pressure should be noted on the physical exam form.
9	**Pulse/Rhythm**	Persistent tachycardia, arrhythmia except of the sinus type, or other significant disturbance of the heart or vascular system should be evaluated and may be disqualifying.
10	**General Appearance/ Hygiene**	Should be good.
11	**Distant Vision**	Vision must be tested with and without correction when applicable. Should have vision corrected to 20/40, in both eyes. Monocular vision is not necessarily disqualifying for commercial diving. Divers who have had vision corrective surgery should be restricted from diving until cleared by a qualified diving physician and ophthalmologist.
12	**Near Vision**	Correctable to 20/40.
13	**Color Vision**	Record. Color blindness does not disqualify for diving, but diver must have color vision specific for duties.
14	**Field of Vision**	Should be normal, with any discrepancies documented. A minimum of 85 degrees field of vision is required.
15	**Contact Lenses**	Record if used. Appropriate lenses for diving may be used (gas permeable/fenestrated hard lens). Vision must be recorded with and without contact lenses.
16	**Head, Face and Scalp**	Some causes for rejection may include: a) Deformities of the skull in the nature of depressions, exostosis, etc., of a degree that would prevent the individual from wearing required equipment. b) Deformities of the skull of any degree associated with evidence of disease of the brain, spinal cord or peripheral nerves. c) Loss or congenital absence of the bony substance of the skull.

17	**Neck**	Conditions affecting the neck must not impair the diver to cause insufficient range of motion. The causes for rejection may include: a) Cervical ribs if symptomatic. b) Congenital cysts of bronchial cleft origin or those developing from the remnants of the thyroglossal duct, with or without fistulous tracts. c) Fistula, chronic draining, of any type. d) Spastic contraction of the muscles of the neck of a persistent and chronic nature. e) Neural impingement.
18	**Eyes**	Active pathology or previous eye surgery may be cause for restriction or rejection. Divers who have had vision corrective surgery should be restricted from diving until cleared by a qualified diving physician and ophthalmologist. History of cataract surgery with intraocular lens implant is not disqualifying.
19	**Fundus**	Optional. No pathology.
20	Through # 24	The following conditions are disqualifying: a) Acute disease including vestibular disease. b) Chronic serious otitis. c) Active otitis media. d) Current perforation of the tympanic membrane. e) PE tubes in place. f) Any significant nasal or pharyngeal respiratory obstruction. g) Chronic sinusitis if not readily controlled. h) Speech impediments due to organic defects. i) Inability to equalize pressure due to any cause. j) Recurrent or persistent vertigo. k) Recent piercings are disqualifying until healed. If Eustachian tube dysfunction is suspected, then referral or testing should be done. Adequately repaired or healed round window ruptures that have no significant residual deficits may be approved for diving.
25	**Mouth and Throat**	a) Candidate should have a high degree of dental fitness; any abnormalities of dentition or malformation of the mandible likely to impair the diver's ability to securely and easily retain any standard equipment mouthpiece should disqualify. b) Removable dentures should not be worn while diving. c) Severe dental caries is disqualifying until repaired.
26	**Chest (include breasts)**	Note any chest deformities, breast abnormalities or masses.
27	**Lungs**	Pulmonary: Congenital and acquired defects that may restrict pulmonary function, cause air entrapment, or affect the ventilation-perfusion or balance shall be disqualifying for both initial training and continuation. Obstructive or restrictive pulmonary functions require further evaluation. Pulmonary disease requiring medication use may be disqualifying. History of recurrent or spontaneous pneumothorax is disqualifying.
28	**Heart (thrust, size, rhythm, sounds)**	Any evidence of heart disease or arrhythmias other than sinus arrhythmias must be fully investigated. For evaluation purposes, Bruce protocol functional stress testing through stage III must be to at least 10 METS without evidence of ischemia. Pacemakers and implantable cardiac defibrillators are disqualifying. PFO repairs are not disqualifying. Routine PFO testing is not recommended. Coumadin or any anticoagulants, antiplatet medications and aspirin (except low dose aspirin) are considered disqualifying. Ejection fractions must be at least 40% if measured.
29	**Pulse**	Record. Peripheral pulses should be regular, full and symmetric and less than 100.

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30	**Vascular System (varicosities, etc.)**	Cardiovascular system: The cardiovascular system shall be without significant abnormality in all respects as determined by physical examination and tests as may be indicated. Evidence of symptomatic arteriosclerosis, severe varicose veins and marked symptomatic hemorrhoids may be disqualifying.
31	**Abdomen and Viscera**	a) Active peptic ulceration should be disqualifying until treated and healing has been documented. History of gastrointestinal bleeding may be disqualifying from diving and is disqualifying from saturation diving. b) Any other chronic gastrointestinal disease (e.g., ulcerative colitis, cholelithiasis) may be cause for rejection. c) Crohn's disease may be disqualifying. d). Hepatitis may be disqualifying. e) Colostomies should be disqualified for saturation diving.
32	**Hernia (all types)**	All inguinal or femoral hernias are disqualifying until repaired. Ventral hernias more than one cm must be repaired prior to diving.
33	**Endocrine System**	Diabetics controlled only with diet and exercise and with Hgb A1C < 7.0 are acceptable. History of thyroid disease adequately controlled with medication is acceptable to dive. Any other endocrine disorders requiring medication may be disqualifying.
34	**G-U System (genital-urinary)**	a) Gonococcal disease, syphilis, chlamydia and genital herpes will disqualify until adequately treated. b) Evidence or history of nephrolithiasis must be fully investigated and treated and may be disqualifying. c) Any renal insufficiency or chronic renal disease may be disqualifying. d) History of kidney stones may be disqualifying for surface and saturation diving. Divers with a history of kidney stones should have periodic evaluation by a urologist to determine the presence of stones. e) Evidence or history of urinary dysfunction or retention must be fully investigated and treated.
35	**Upper Extremities (strength, ROM)**	Any impairment of musculoskeletal function should be carefully assessed against the general requirements that would interfere with the individual's performance as a diver. Amputations may be disqualifying. Orthopedic internal fixation hardware is not disqualifying if the fracture site is healed.
36	**Lower Extremities, Except Feet**	Any impairment of musculoskeletal function should be carefully assessed against the general requirements that would interfere with the individual's performance as a diver. Amputations may be disqualifying. Orthopedic internal fixation hardware is not disqualifying if the fracture site is healed.
37	**Feet**	Any impairment of musculoskeletal function should be carefully assessed against the general requirements that would interfere with the individual's performance as a diver.
38	**Spine**	Any impairment of musculoskeletal function should be carefully assessed against the general requirements that would interfere with the individual's performance as a diver. Neural impingement or nerve root displacement is considered disqualifying even if asymptomatic.
39	**Skin and Lymphatic System**	Active, acute or chronic disease of the skin or lymphatic system may be disqualifying. Tattoos must be fully healed prior to diving.
40	**Anus and Rectum**	Any conditions that interfere with normal function (e.g., stricture, prolapse, severe hemorrhoids) may be disqualifying.
41	**Sphincter Tone**	Note and record.
	Neurological Exam (42-49)	A full examination of the central and peripheral nervous system should show normal function, but localized minor abnormalities, such as patches of anesthesia, are allowable provided generalized nervous system disease can be excluded. Any history of seizure (apart from childhood febrile convulsions, oxygen toxicity or withdrawal seizures) is disqualifying. Intracranial surgery, loss of consciousness of more than 30 to 45 minutes, and severe head injury involving more than momentary unconsciousness or concussion, may be disqualifying. If the severity of head injury is in doubt, special consultation and studies should be considered. All neurodegenerative conditions are disqualifying.

42	**Cranial Nerves**	Examine, evaluate and record.
43	**Reflexes**	Should be symmetrical and free from pathology. Document any abnormalities. Pathological reflexes should be evaluated. Asymmetrical reflexes should be documented.
44	**Cerebellar Function**	Test and record.
45	**Strength and Tone of Muscles**	Examine and record. Note any atrophy or loss of tone.
46	**Propioception/ Stereognosis**	Examine and record.
47	**Nystagmus**	Do and record. Congenital nystagmus is not necessarily disqualifying. End point lateral gaze nystagmus is considered normal.
48	**Sensations and Vibration**	Test and record. Vibration should be tested using a 128 Hz tuning fork. Two point discrimination should be tested at the thumb (C6), middle finger (C7) and the little finger (C8) and should be discernable at 5 mm.
49	**Romberg**	Do and record. May perform Romberg for up to two minutes.
50	**Miscellaneous Remarks and Dermatome Diagram**	Record findings and comments.
51	**Urinalysis**	Includes color pH, specific gravity, glucose, albumin and micro, and all results should be within normal limits.
52	**Blood Tests**	Hematology: Any significant anemia or history of hemolytic disease must be evaluated; when due to a variant hemoglobin state, it shall be disqualifying.
53	**Spirometry**	All divers must have periodic spirometry to establish Forced Expiratory Volume at one (1) second (FEV1), Forced Vital Capacity (FVC)), and FEF 25-75 recording best of three measurements using American Thoracic Society standards. FEV1 and FVC should both be 75% or over using NHANES reference values. If either or both are below 75%, then the diver should be referred for functional stress testing under Bruce protocol to at least 10 METS.
54	**X-ray/Imaging**	a) 14 x 17 chest: PA and lateral every three years. No pathology within normal limits. b) Lumbar/sacral spine (optional on new hire). c) Long bones (optional): Any lesions, especially juxta-articular, should be evaluated to determine patient's fitness to dive. d) MRI (optional): Neural impingement or nerve root displacement on MRI examinations are disqualifying.
55	**Electrocardiogram**	ECG examinations: Resting standard 12 lead ECG are optional on new hire examinations and required annually after the age of 35. Exercise stress tests should be considered and may be indicated after the age of 40.
56	**Audiogram Pure Tone**	A hearing loss in either ear of 40 dB in the range of 500, 1000 and 2000 Hz may be an indication for referral of the candidate to a specialist for further opinion, unless the examining doctor is convinced that such a hearing loss is unlikely to be significantly increased by continued diving activities. Doubts about function of labyrinths require specialized examination. Monaural hearing is not disqualifying. Hearing ability must be adequate to perform job duties.
57	**Comprehensive Metabolic Panel**	Optional.
58	**Hemoglobin A1C**	Required for any history of diabetes.
59	**Lipid Panel**	Required for Framingham Risk Calculation. Must be done on divers 35 years and older.
60	**Drug Screen**	Recommended.

2.4.3 ADCI MEDICAL HISTORY AND EXAMINATION FORMS

ADCI

Association of Diving Contractors International

MEDICAL HISTORY FORM

Employer			Job Title			Date
1. Last Name	First Name	Middle Name	2. Email Address	3. Date of Birth	4. Gender	5. Last 4 No. of SSN
6. Address (Number, Street)	7. City		8. State	9. Zip Code	10. Area Code – Phone Number ( )	
11. Emergency Contact Person – Relationship – Address – Telephone Number					12. Cell Phone Number ( )	

13. MEDICAL HISTORY: Have you ever had or been treated for (positive answers must be explained below):

Yes	No		Yes	No		Yes	No	
☐	☐	Convulsions or Seizures	☐	☐	Cardiac Angiogram or ECHO	☐	☐	Shoulder Injury
☐	☐	Epilepsy	☐	☐	PFO Repair	☐	☐	Elbow Injury
☐	☐	Concussion or Head Injury	☐	☐	High Blood Pressure	☐	☐	Arm/wrist/hand Injury
☐	☐	Disabling Headaches	☐	☐	Asthma or Wheezing	☐	☐	Hip/Leg/Ankle Injury
☐	☐	Loss of Balance/Dizziness	☐	☐	Coughing up Blood	☐	☐	Knee Injury or “Trick Knee”
☐	☐	Severe Motion Sickness	☐	☐	Tuberculosis	☐	☐	Foot Trouble or Injuries
☐	☐	Unconsciousness	☐	☐	Shortness of Breath	☐	☐	Dislocations
☐	☐	Fainting Spells	☐	☐	Chronic Cough	☐	☐	Swollen Joints
☐	☐	Wear Contacts/Glasses	☐	☐	Pneumothorax	☐	☐	Broken Bones or Fractures
☐	☐	Color Vision Defect	☐	☐	Lung Disease or Surgery	☐	☐	Varicose Veins
☐	☐	Eye Disease or Injury	☐	☐	Gallbladder Disease or Stones	☐	☐	Muscle Disease or Weakness
☐	☐	Eye Surgery	☐	☐	Stomach Trouble or Ulcers	☐	☐	Numbness or Paralysis
☐	☐	Hearing Loss	☐	☐	Stomach Bleeding	☐	☐	Sleep Disorders
☐	☐	Ear Disease or Injury	☐	☐	Frequent Indigestion	☐	☐	Diabetes
☐	☐	Ear Surgery	☐	☐	Jaundice	☐	☐	Goiter or Thyroid Disease
☐	☐	Perforated Eardrum	☐	☐	Liver Disease or Hepatitis	☐	☐	Blood Disease
☐	☐	Difficulty Clearing	☐	☐	Rectal Bleeding/Blood in Stools	☐	☐	Anemia: Sickle Cell or Other
☐	☐	Nose Bleed	☐	☐	Hemorrhoids (Piles)	☐	☐	Skin Rash or Disease
☐	☐	Airway Obstruction	☐	☐	Gas Pains	☐	☐	Staph Infections
☐	☐	Hay Fever or Allergies	☐	☐	Crohn’s Disease/Ulcerative Colitis	☐	☐	Tumor or Cancer
☐	☐	Chest Pain	☐	☐	Rupture or Hernia	☐	☐	Claustrophobia
☐	☐	Heart Murmur	☐	☐	Kidney Disease	☐	☐	Mental Illness/Depression/Anxiety
☐	☐	Rheumatic Fever	☐	☐	Kidney Stones	☐	☐	Nervous Breakdown
☐	☐	Heart Attack	☐	☐	Protein, Sugar or Blood in Urine	☐	☐	Any Sexually Transmitted Disease
☐	☐	Abnormal Heart Rhythm	☐	☐	Joint Pain/Arthritis	☐	☐	Contagious Disease
☐	☐	Heart Disease	☐	☐	Back Strain or Injury	☐	☐	Prior Military Service
☐	☐	Cardiac Stent or Angioplasty	☐	☐	Spine Problems	☐	☐	Other Illness or Injury or Any Other
			☐	☐	Herniated Disc or Sciatica			Medical Condition
		For Females ONLY	☐	☐	Painful Menses			
☐	☐	Irregular Menses	☐	☐	Pregnancy			Last Menstrual Period ____________________

PLEASE EXPLAIN THE DETAILS OF EACH ITEM CHECKED YES ____________________

14. LIST ALL SURGERIES ____________________ YEAR

15. LIST ALL HOSPITALIZATIONS ____________________ YEAR

16. LIST ALL INJURIES ____________________ YEAR

17. LIST ALL MEDICATIONS, PRESCRIPTION OR OVER THE COUNTER

18. ANSWER THE FOLLOWING QUESTIONS:

Every Item Checked Yes Must Be Fully Explained Below	YES	NO		YES	NO
Do you have any physical defects or any partial disabilities?			Have you ever resigned, been terminated, or changed jobs for medical reasons?		
Have you ever been rejected or rated for insurance, employment, license, or armed forces for health reasons?			Have you ever been dismissed from employment because of excess use of drugs or alcohol?		
Have you ever had illnesses, injuries, or lost time accidents from any work that you have done?			Do you have any allergies or reactions to food, chemicals, drugs, insect stings, or marine life?		
Have you been advised to have a surgical operation or medical treatment that has not been done?			Are you presently under the care of a physician? Give physician’s name and address on the next page.		

COMMENTS: ____________________

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19. My Personal Physician is:

Name ______

Address ______

City, State ______

Phone Number ______

20. DIVING HISTORY **How long have you been commercial diving?** ______

Surface Air Diving History

Maximum Depth Surface Air ______

Maximum Depth Surface Mixed Gas ______

Longest Bottom Time Air ______

Longest Bottom Time Mixed Gas ______

Saturation Diving History

	Yes	No
Heliox	☐	☐
Trimix	☐	☐
Nitrox	☐	☐

Maximum Depth ______

Maximum Duration (Days) ______

21. DIVING EXPERIENCE (Number of years experience):

Name of Diving School

Air ____

Mixed Gases ____

Saturation ____ ______

22. INDICATE THE NUMBER OF DECOMPRESSION INCIDENTS
If None put 0 (Zero) **List any residuals**

Bends, pain only ___ ______

Bends, neurological ___ ______

Chokes ___ ______

Inner ear ___ ______

23. IN DIVING HAVE YOU HAD A HISTORY OF: (Provide details of dates and severity)

	Yes	No	Details
Gas Embolism	☐	☐	
Oxygen Toxicity	☐	☐	
CO_2 Toxicity	☐	☐	
CO Toxicity	☐	☐	
Ear/Sinus Squeeze	☐	☐	
Ear Drum Rupture	☐	☐	
Deafness	☐	☐	
Lung Squeeze	☐	☐	
Near Drowning	☐	☐	
Asphyxiation	☐	☐	
Vertigo (Dizziness)	☐	☐	
Pneumothorax	☐	☐	
Nitrogen Narcosis	☐	☐	
Loss of Consciousness	☐	☐	

24. Have you been involved in a diving accident (decompression sickness or others) since your last physical examination? ☐Yes ☐No

25. Date of last physical examination: ______

For what company or organization were you last examined? ______

Name of Physician who performed your last exam ______

Address of Physician ______

City, State ______

26. Have you ever had any of the following? If so, give approximate date:

Yes	No		Give Date
☐	☐	Chest X-Ray	
☐	☐	Longbone Series	
☐	☐	Back (Spine) X-Ray	
☐	☐	MRI	
☐	☐	Pulmonary Function Studies	
☐	☐	Audiogram	
☐	☐	EKG	
☐	☐	Exercise (Stress) EKG	

27. Physician Remarks: ______

I CERTIFY THAT I HAVE REVIEWED THE FOREGOING INFORMATION SUPPLIED BY ME AND THAT IT IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE. I UNDERSTAND THAT LEAVING OUT OR MISREPRESENTING FACTS CALLED FOR ABOVE MAY BE CAUSE FOR REFUSAL OF EMPLOYMENT OR SEPARATION FROM THE COMPANY. I AUTHORIZE ANY OF THE DOCTORS, HOSPITALS, OR CLINICS MENTIONED ABOVE TO FURNISH THE COMPANY MEDICAL EXAMINER WITH A COMPLETE TRANSCRIPT OF MY MEDICAL RECORD FOR PURPOSES OF PROCESSING MY PHYSICAL EXAM.

______ ______
Date **Signature**

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ADCI

Association of Diving Contractors International
PHYSICAL EXAMINATION FORM

Employer	Date	Date of Birth	Age
1. Last Name	First Name	Middle Name	2. Last 4 No. of SSN or PASSPORT No.
3. Height (inches)	4. Weight (pounds)	5. Body Fat (%) (Optional)	6. BMI (Optional)

7. Temperature	8. Blood Pressure	9. Pulse/Rhythm	10. General Appearance/Hygiene	11. Build
	/			

12. Distant Vision:	13. Near Vision: Jaeger / Near Vision Corrected	14. Color Vision (Test Performed and Results)
R. 20/______ Corr. to 20/______	R. 20/______ R. 20/______	
L. 20/______ Corr. to 20/______	L. 20/______ L. 20/______	

15. Field of Vision (Degrees) R ° L ° | 16. Contact Lenses ☐ Yes ☐ No

NORMAL	ABNORMAL	Check each item in appropriate column (enter NE for Not Evaluated)	REMARKS
		17. Head, Face, Scalp	
		18. Neck	
		19. Eyes	
		20. Ears – General (internal and external canal)	
		21. Eustachian Tube Function	
		22. Tympanic Membrane	
		23. Nose (Septal Alignment)	
		24. Sinuses	
		25. Mouth and Throat	
		26. Chest	
		27. Lungs	
		28. Heart (Thrust, Size, Rhythm, Sounds)	
		29. Pulses (Equality, etc.)	
		30. Vascular System (Varicosities, etc.)	
		31. Abdomen and Viscera	
		32. Hernia (All Types)	
		33. Endocrine System	
		34. G-U System	
		35. Upper Extremities (Strength, ROM)	
		36. Lower Extremities (Except Feet)	
		37. Feet	
		38. Spine	
		39. Skin, Lymphatics	
		40. Anus and Rectum	
		41. Sphincter Tone	

NEUROLOGICAL EXAMINATION

42. CRANIAL NERVES

		NORMAL	ABNORMAL	NE
I	Olfactory			
II	Optic			
III	Oculomotor			
IV	Trochlear			
V	Trigeminal			
VI	Abducens			

		NORMAL	ABNORMAL	NE
VII	Facial			
VIII	Auditory			
IX	Glossophayrngeal			
X	Vagus			
XI	Spinal Accessory			
XII	Hypoglossal			

43. REFLEXES

DEEP TENDON

	Left 0	1	2	3	4	Right 0	1	2	3	4
Triceps										
Biceps										
Patella										
Achilles										

PATHOLOGICAL

	Left Present	Left Absent	Right Present	Right Absent
Babinski				
Hoffman				
Ankle Clonus				

SUPERFICIAL

	Present	Absent	NE
Upper Abdomen			
Lower Abdomen			
Cremasteric			

44. CEREBELLAR FUNCTION

	0	1	2	3	4
Ataxia					
Tremor (intention)					

	Normal	Abnormal
Finger to Nose		
Heel to Shin (Sliding)		
Rapidly Alternating Movements		

45. MUSCLE STRENGTH TONE

	1	2	3	4	5	Normal	Abnormal
Right Upper Extremity							
Left Upper Extremity							
Right Lower Extremity							
Left Lower Extremity							

46. PROPIOCEPTION

	Left Normal	Left Abnormal	Right Normal	Right Abnormal
Joint Position Sense				
Stereognosis				
Vibratory Sensation				

47. NYSTAGMUS

	Present	Absent
End Point Lateral Gaze		
Pathological		

48. SENSATION

	Normal	Abnormal
Hot		
Cold		

	Normal	Abnormal
Sharp		
Soft		

Two Point Discrimination	
Normal	
Abnormal	

49. ROMBERG

Absent	
Present	

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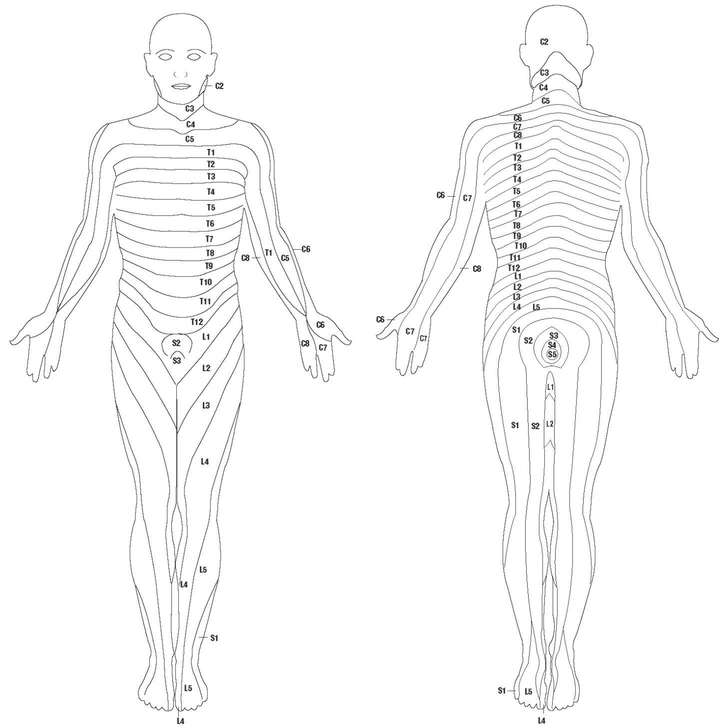
50. MISCELLANEOUS REMARKS



LABORATORY FINDINGS

51. Urinalysis

Color ____________
Appearance ____________
Sp. Gravity ____________
Ph ____________
Microscopic Normal ☐ Abnormal ☐ (See report)

	0	1+	2+	3+	4+
Sugar					
Blood					
Ketones					
Bilirubin					
Protein					

52. Blood Tests

CBC
Normal ☐
Abnormal ☐

Sickle Cell ☐ Pos ☐ Neg

Attach Reports
RPR ☐ Pos ☐ Neg

53. Cardiac Risk Score

No. of Points ________

10 year risk ________

54. Pulmonary Function

FVC ____________
FEV1 ____________
FEV1/FVC ____________

55. X-ray/MRI

	Normal	Abnormal	(Describe)
Chest	☐	☐	
Lumbar Spine	☐	☐	
Long Bones	☐	☐	
MRI	☐	☐	

56. Electrocardiogram

Static ____________
Exercise Stress ____________

57. Audiogram

Hz	500	1000	2000	3000	4000	6000	8000
Left							
Right							

58. Comprehensive Metabolic Panel Attach Report
Normal ☐
Abnormal ☐

Lipid Panel (if done)
Normal ☐
Abnormal ☐

Comments:

59. Drug Screen

☐ Not collected
☐ Collected, results sent to employer

Work Status:

☐ Fit for diving
☐ Cleared for supervisor
☐ Cleared for topside work only
☐ Cleared with restrictions: ____________
☐ Further evaluation needed: ____________
☐ Unfit for diving : ____________
☐ Unfit

Comments: ____________

Examinee Name ____________
Physician Signature ____________
Physician Name ____________
Address ____________
Phone Number ____________
Date of Examination ____________

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2.4.4 NEUROPSYCHIATRIC

The nature of diving duties requires a careful appraisal of the individual's emotional and temperamental fitness. Personality disorders, bipolar disorders, psychosis, instability and anti-social traits shall be disqualifying. Any psychiatric condition requiring medication may be disqualifying. Temporary situational depression may be approved on low-dose antidepressants that do not affect seizure thresholds or have any side effects of CNS depression. Any past or present evidence of psychiatric illness shall be cause for rejection unless the examining doctor can be confident that it is of a minor nature and unlikely to recur.

Particular attention should be paid to any past or present evidence of alcohol or drug abuse. The diver may not be taking steroids or any illicit substances. Any abnormalities should be noted in block No. 52 of the physical examination form.

Past or current symptoms of neurological disorder or organic disease of the nervous system shall be disqualifying. No individual with a history of any form of epilepsy, or head injury with sequelae, or personality disorder shall be accepted. Neurotic trends, emotional adjustment, shall be disqualifying. Stammering or other speech impediment that might become manifest under excitement is disqualifying. Intelligence must be at least normal. Any abnormalities should be noted in block No. 52 of the physical examination form.

2.4.5 MEDICATION

The following medications are disqualifying:

1. Amphetamines (including lisdexamfetamine dimesylate) and designer drugs (substituted methylenediosyphenethylamines including MDMA, MMDA, FLEA, EDMA, EFLEA, MDOH, EBDB, MDEA, 5-methyl-MDA and others)
2. Marijuana and synthetic forms of marijuana
3. Phencylidine (PCP)
4. Cocaine
5. Opioids, naturally occurring and synthetics
6. Phosphodiesterase inhibitors such as erectile dysfunction medications
7. Immunosuppressants not recommended in saturation diving
8. Tramadol
9. All antidepressants except low dose sertraline used for mild situational depression
10. All antipsychotic medications
11. Muscle relaxants
12. All forms of insulin
13. Oral hypoglycemic medication
14. Anticoagulants or platelet inhibitors
15. Benzodiazepines
16. Barbiturates
17. Anxiolytic and/or hypnotic medications
18. Nictotine patches – must be removed while diving
19. Varenicline
20. Bupropion
21. Beta blockers

2.4.6 DISCLAIMER

Because of the lack of medical literature concerning commercial diving, these guidelines were developed as a consensus among diving physicians and are intended for only that purpose. The diving medical examiner may use discretion in deviating from these guidelines on an individual basis given the circumstances.

2.4.7 BMI TABLES

BMI Table										
Height (inches)	BMI									
	19	20	21	22	23	24	25	26	27	28
	Body Weight (pounds)									
58	91	96	100	105	110	115	119	124	129	134
59	94	99	104	109	114	119	124	128	133	138
60	97	102	107	112	118	123	128	133	138	143
61	100	106	111	116	122	127	132	137	143	148
62	104	109	115	120	126	131	136	142	147	153
63	107	113	118	124	130	135	141	146	152	158
64	110	116	122	128	134	140	145	151	157	163
65	114	120	126	132	138	144	150	156	162	168
66	118	124	130	136	142	148	155	161	167	173
67	121	127	134	140	146	153	159	166	172	178
68	125	131	138	144	151	158	164	171	177	184
69	128	135	142	149	155	162	169	176	182	189
70	132	139	146	153	160	167	174	181	188	195
71	136	143	150	157	165	172	179	186	193	200
72	140	147	154	162	169	177	184	191	199	206
73	144	151	159	166	174	182	189	197	204	212
74	148	155	163	171	179	186	194	202	210	218
75	152	160	168	176	184	192	200	208	216	224
76	156	164	172	180	189	197	205	213	221	230

BMI Table										
Height (Centimeters)	BMI									
	19	20	21	22	23	24	25	26	27	28
	Body Weight (kilograms)									
147.3	41.3	43.5	45.4	47.6	49.9	52.2	54.0	56.2	58.5	60.8
149.9	42.6	44.9	47.2	49.4	51.7	54.0	56.2	58.1	60.3	62.6
152.4	44.0	46.3	48.5	50.8	53.5	55.8	58.1	60.3	62.6	64.9
154.9	45.4	48.1	50.3	52.6	55.3	57.6	59.9	62.1	64.9	67.1
157.5	47.2	49.4	52.2	54.4	57.2	59.4	61.7	64.4	66.7	69.4
160.0	48.5	51.3	53.5	56.2	59.0	61.2	64.0	66.2	68.9	71.7
162.6	49.9	52.6	55.3	58.1	60.8	63.5	65.8	68.5	71.2	73.9
165.1	51.7	54.4	57.2	59.9	62.6	65.3	68.0	70.8	73.5	76.2
167.6	53.5	56.2	59.0	61.7	64.4	67.1	70.3	73.0	75.7	78.5
170.2	54.9	57.6	60.8	63.5	66.2	69.4	72.1	75.3	78.0	80.7
172.7	56.7	59.4	62.6	65.3	68.5	71.7	74.4	77.6	80.3	83.5
175.3	58.1	61.2	64.4	67.6	70.3	73.5	76.7	79.8	82.6	85.7
177.8	59.9	63.0	66.2	69.4	72.6	75.7	78.9	82.1	85.3	88.5
180.3	61.7	64.9	68.0	71.2	74.8	78.0	81.2	84.4	87.5	90.7
182.9	63.5	66.7	69.9	73.5	76.7	80.3	83.5	86.6	90.3	93.4
185.4	65.3	68.5	72.1	75.3	78.9	82.6	85.7	89.4	92.5	96.2
188.0	67.1	70.3	73.9	77.6	81.2	84.4	88.0	91.6	95.3	98.9
190.5	68.9	72.6	76.2	79.8	83.5	87.1	90.7	94.3	98.0	101.6
193.0	70.8	74.4	78.0	81.6	85.7	89.4	93.0	96.6	100.2	104.3

2.4.8 BODY FAT TABLE AND BODY FAT PERCENTAGES COMPARISON TABLE

Body Fat Percentages Comparison Table		
Fat Level	**Men (%)**	**Women (%)**
Very Low	7-10	14-17
Low	10-13	17-20
Average	13-17	20-27
High	17-25	27-31
Very High	above 25	above 31

2.4.9 MAXIMUM ALLOWABLE WEIGHT CHART

Maximum Allowable Weight Chart		
Males Weight in Pounds	**Height (inches)**	**Females Weight in Pounds**
170	60	170
176	61	174
182	62	179
188	63	182
194	64	187
200	65	192
206	66	196
212	67	200
218	68	204
225	69	209
230	70	212
235	71	217
241	72	222
247	73	225
253	74	230
259	75	234
265	76	239
271	77	243
277	78	248
283	79	252
289	80	255

2.4.10 RETURN TO DUTY AFTER DIVING RELATED INCIDENTS

ADCI Recommendations on Return to Diving	
Diving Related Incident	**Time to return to diving**
Simple pain only with complete resolution after single treatment table	24 to 72 hours
Pain only needing more than one treatment table for complete resolution	7 days
Altered sensation in limbs resolvable by one treatment table	7 days
Motor or other neurological deficit resolvable by one treatment table	28 days
Neurological injury needing several treatment tables to resolve	4 to 6 months
Pulmonary barotrauma resolved	3 months
Pneumothorax resolved (other than spontaneous)	3 months
Vestibular decompression sickness	4 to 6 months
Round window rupture	6 months after repair
Central nervous system oxygen toxicity (after complete evaluation)	7 days
Perforated tympanic membrane	6 weeks after healed
Other ENT barotrauma	Determined by examiner

All cases except simple pain only decompression sickness resolved by a single treatment table must be cleared by medical examination from a qualified diving medical examiner before return to diving.

Persistent neurological deficits following diving related incidents are generally disqualifying.

2.4.11 FRAMINGHAM CARDIAC RISK CALCULATOR

The ADC recognizes that cardiac events are second only to drowning as a cause of death while diving. Rather than using an age based criteria for further cardiac screening, the Physicians Diving Advisory Committee is now recommending a risk based approach using the Framingham data. The cardiac risk calculators for men and women are provided below. If the cardiac risk is calculated to be 10% or greater then further testing such as an exercise stress test is recommended.

Cardiac Risk Calculator - MEN

Total Cholesterol	Age 20-39	Age 40-49	Age 50-59	Age 60-69	Age 70-79
<160	0	0	0	0	0
160-199	4	3	2	1	0
200-239	7	5	3	1	0
240-279	9	6	4	2	1
280+	11	8	5	3	1

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Age	Points
20-34	-9
35-39	-4
40-44	0
45-49	3
50-54	6
55-59	8
60-64	10
65-69	11
70-74	12
75-79	13

HDL	Points
60+	-1
50-59	0
40-49	1
<40	2

Systolic BP	If Untreated	If Treated
<120	0	0
120-129	0	1
130-139	1	2
140-159	1	2
160+	2	3

Age	Smoker	Non-smoker
20-39	8	0
40-49	5	0
50-59	3	0
60-69	1	0
70-79	1	0

Enter No of Points	
Age	
Total Chol	
HDL Chol	
Sys B/P	
Smoking	
Total	

Determine Risk → From Chart

Point Total	10-Year Risk
<0	<1%
0	1%
1	1%
2	1%
3	1%
4	1%
5	2%
6	2%
7	3%
8	4%
9	5%
10	6%
11	8%
12	10%
13	12%
14	16%
15	20%
16	25%
17 or more	≥30%

Determine Risk
From Chart

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Cardiac Risk Calculator - WOMEN

Total Cholesterol	Age 20-39	Age 40-49	Age 50-59	Age 60-69	Age 70-79
<160	0	0	0	0	0
160-199	4	3	2	1	1
200-239	8	6	4	2	1
240-279	11	8	5	3	2
280+	13	10	7	4	2

Age	Points
20-34	-7
35-39	-3
40-44	0
45-49	3
50-54	6
55-59	8
60-64	10
65-69	12
70-74	14
75-79	16

HDL	Points
60+	-1
50-59	0
40-49	1
<40	2

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Systolic BP	If Untreated	If Treated
<120	0	0
120-129	1	3
130-139	2	4
140-159	3	5
160+	4	6

Age	Smoker	Non-smoker
20-39	9	0
40-49	7	0
50-59	4	0
60-69	2	0
70-79	1	0

Enter No of Points	
Age	
Total Chol	
HDL Chol	
Sys B/P	
Smoking	
Total	

Point Total	10-Year Risk
<9	<1%
9	1%
10	1%
11	1%
12	1%
13	2%
14	2%
15	3%
16	4%
17	5%
18	6%
19	8%
20	11%
21	14%
22	17%
23	22%
24	27%
25 or more	≥30%

Determine Risk
From Chart

SECTION 3.0

DIVING PERSONNEL RESPONSIBILITIES, QUALIFICATIONS AND CERTIFICATIONS

Association of Diving Contractors International, Inc.

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3.0 DIVING PERSONNEL RESPONSIBILITIES, QUALIFICATIONS AND CERTIFICATIONS

Titles, duties, responsibilities and capabilities of personnel engaged in commercial diving and underwater operations will vary widely. The employer is responsible for assigning personnel to a diving or underwater operation and will ensure all personnel are qualified by training and/or experience to perform the tasks assigned. The certification designations in this section indicate the minimum duties and responsibilities of dive team members. NOTE: Personel who hold a recognized current DMT certification will not be required to also hold First Aid/CPR/AED/O2 Provider qualifications.

3.1 COMMERCIAL DIVER CERTIFICATION PROGRAM

Certification cards issued by recreational agencies are not recognized as qualifying an individual to perform commercial diving activities in the absence of additional formal commercial diving training from an accredited source.

3.1.1 GENERAL REQUIREMENTS

Member companies of the ADCI employ persons to perform as certified commercial divers in the following categories:

- Entry-level tender/diver.
- Air diver.
- Mixed-gas diver.
- Saturation diver.
- Air-diving supervisor.
- Mixed-gas diving supervisor.
- Saturation-diving supervisor.
- Life-support technician.
- Saturation technician.

These individuals must be properly trained in accordance with the current edition of the **ADCI International Consensus Standards for Commercial Diving and Underwater Operations** and will then continue their path of career progression through on-the-job training and demonstrated field and leadership experience. All ADCI general member company diving personnel need to hold a current ADCI certification card reflective of the assigned tasks to be performed. This certification card needs to be obtained within 90 days of employment with a general member company.[1]

3.1.2 QUALIFICATIONS AND CERTIFICATIONS

Diplomas issued by a civilian or military educational organization are for the purpose of attesting that an individual has received the necessary basic formal training to enter a vocational field. Such instruments should not be used to verify that the graduate can perform in the field without further on-the-job training and experience with actual demonstration of competency.

3.1.3 SCOPE AND APPLICABILITY

ADCI has established a program whereby properly trained commercial divers, life-support technicians can obtain a certification card that indicates their qualification and competency level as defined in the **ADCI International Consensus Standards for Commercial Diving and Underwater Operations.**

With the exception of the entry-level tender/diver certification, certification cards issued under this program will be valid for a period of five years from date of issue. Cards can be obtained only by presentation of acceptable documentation that the individual for whom the card is requested has recorded evidence of having completed the requisite training and on-the-job experience necessary to support card issue at the appropriate level of classification.

3.1.4 CERTIFICATION AND TRAINING MATRIX
International Endorsement Certification Matrix

CERTIFICATION AND TRAINING MATRIX									
REQUIREMENT	ENTRY-LEVEL TENDER/ DIVER	AIR DIVER	AIR-DIVING SUPERVISOR	MIXED-GAS DIVER	MIXED-GAS DIVING SUPERVISOR	BELL/SAT DIVER	BELL/SAT DIVING SUPERVISOR	NITROX SUPERVISOR	LIFE-SUPPORT TECHNICIAN
Formal Training	625 hours ANSI/ ACDE -01-2015 or recognized equivalent, with required depth and bottom time requirements with commercial or military SCUBA								
Field Days		100	200	100 Air 50 Mixed Gas	350 Air or Mixed Gas	200 Air or Mixed Gas	100 days as Mixed Gas and/ or Air Diving Supervisor		100 Days as an Assistant LST
Working Dives		30	50	50 – Air 10 – Mixed Gas	150 Air or Mixed Gas	100 Air or Mixed Gas and 10 Bell Runs			
Operations on System						30 Working **Days**			
Assistant Supervisor Training Field			30 Working Days		30 Working Days		60 Working Days		
EXAM			EXAM REQUIRED		EXAM REQUIRED		EXAM REQUIRED	EXAM REQUIRED	EXAM REQUIRED

3.1.5 DOCUMENTATION ACCEPTED

1. ADCI certification cards may be requested by ADCI member companies by certifying that the person for whom the card is requested fully qualifies to perform duties in the diver classification requested. Member companies are required to have on file, and to retain for a period of five years, copies of information that show evidence that the individual for whom the card is requested does, in fact, possess the necessary training, field experience and required number of working dives.

2. It is recommended that all divers maintain a personal commercial diver log book (ADCI Commercial Diver Log Book or equivalent) to detail hyperbaric exposures.

3. Individual personnel seeking to obtain an ADCI certification card are required to have verifiable evidence necessary to support the application and will, in the case of the diving supervisor level, be required to obtain and provide verifiable endorsements from ADCI (**or other certification authorities recognized by the ADCI**) member companies for whom they shall have records of performance as an assistant diving supervisor or diving supervisor.

4. ADCI Associate Member Commercial Diving Schools:

   Application for the entry-level certification cards may be made by filing with ADCI a listing of the members of each class together with their **assigned identifying numbers**, their dates of birth and a photograph of each member that meets the requirements of this standard. Certification cards will be prepared for each individual identified and returned to the requestor. The cards may be issued ONLY to individuals who actually graduate. Any card furnished to the school for issue to an individual who DOES NOT graduate will be returned to ADCI for disposal and removal of information from the master database.

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5. Non-ADCI Member Commercial or Government/Military Diving Schools:

   Application for entry-level certification cards for non-ADCI member commercial or government/military diving schools will be accepted under the following provisions:

   a. That they be formally recognized as an accredited school by a government body.

   b. That the course of instruction offered generally parallels that of the Association of Commercial Diving Educators as recognized in the ADCI International Consensus Standards for Commercial Diving and Underwater Operations to comprise not less than **625** hours of formal instruction in the subjects set forth therein or, as appropriate, the contents of this standard addressed to training and education.

   c. That the course of instruction offered will in all cases parallel that established in the American National Standards Institute document ANSI/ACDE-01-2009; the Secretariat, the Association of Commercial Diving Educators (ACDE); or formal procedures recognized by this association and considered to be at least equal to the procedures necessary for application by a member company of ADCI.

3.1.6 CARD ISSUE

The ADCI commercial diver (or other appropriate) certification card will be a 2 1/8-inches x 3 3/8-inches, .030-inch-thick plastic laminated card suitably identified as issued by the ADCI. In the event that a color photo cannot be furnished, a black and white photo will be considered acceptable. With the exception of the entry-level tender/diver certification, all ADCI certification cards, are valid for five years from the date of issuance. The entry-level tender/diver certification card is valid for two years from the date of issuance.

A photograph of the bearer will be laser-scanned onto the card, and the card itself will be protected from being changed or counterfeited by a holographic overlay that is affixed onto the card prior to it being top-coated with a Duraguard™ finish.

3.1.7 DATABASE MAINTENANCE

The ADCI will maintain a database of certified card recipients based upon card issue. The database will contain the sequential number for each card, the name, a unique identifier provided by the applicant, as well as the date of issue and the expiration date for all cards issued.

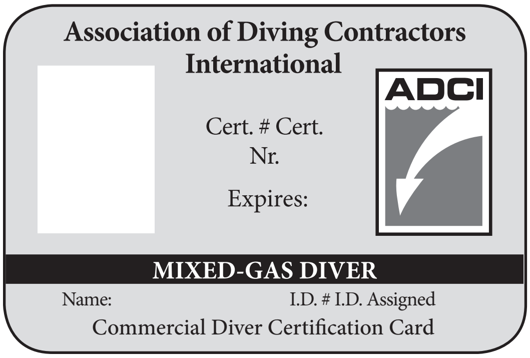
The database information will be maintained confidential. Its existence will be used as a verification tool for replacement of lost cards, renewal of cards, and as a means of generally tracking the numbers of certified commercial divers within industry. The format and content of the database will not be released or changed without ADCI Board of Directors approval.

3.1.8 PHOTO INSTRUCTIONS FOR COMMERCIAL DIVER CERTIFICATION CARDS

1. Photo should be taken against a light background color.
2. Photo should be taken of subject with full-face view from a distance of approximately 4 feet from the camera lens.
3. Full-color photograph is preferred.
4. Identify photograph by writing subjects' name below the photo on the bottom margin.
5. Do not apply a paper clip directly to the face of the photograph.

Please remember that the photo will be trimmed to 1.25 inches in height and 1.0 inches wide. Ensure that the submitted photograph is consistent with the ability to have that size photograph laser-scanned onto the certification card.

FRONT SIDE


Association of Diving Contractors International

Cert. # Cert. Nr.

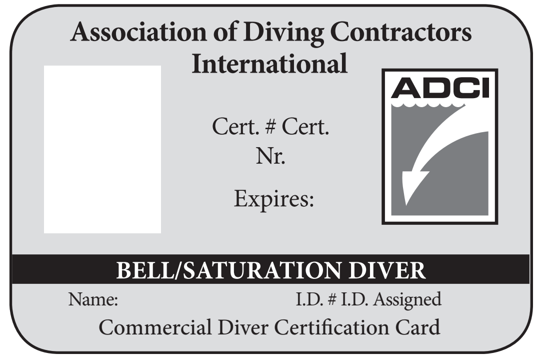
Expires:

MIXED-GAS DIVER

Name: I.D. # I.D. Assigned

Commercial Diver Certification Card

MIXED-GAS DIVER


Association of Diving Contractors International

Cert. # Cert. Nr.

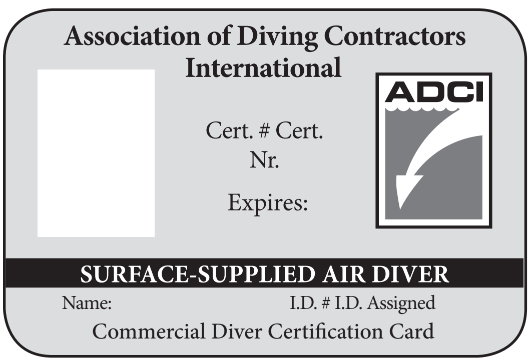
Expires:

BELL/SATURATION DIVER

Name: I.D. # I.D. Assigned

Commercial Diver Certification Card

BELL/SATURATION DIVER


Association of Diving Contractors International

Cert. # Cert. Nr.

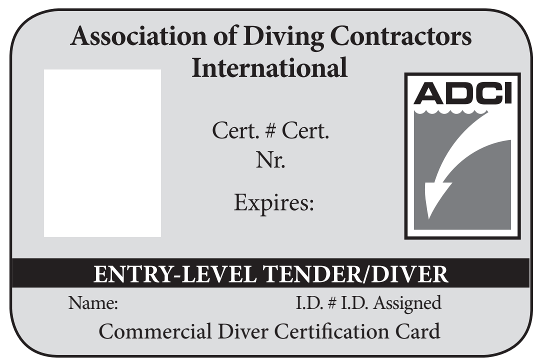
Expires:

SURFACE-SUPPLIED AIR DIVER

Name: I.D. # I.D. Assigned

Commercial Diver Certification Card

SURFACE-SUPPLIED AIR DIVER


Association of Diving Contractors International

Cert. # Cert. Nr.

Expires:

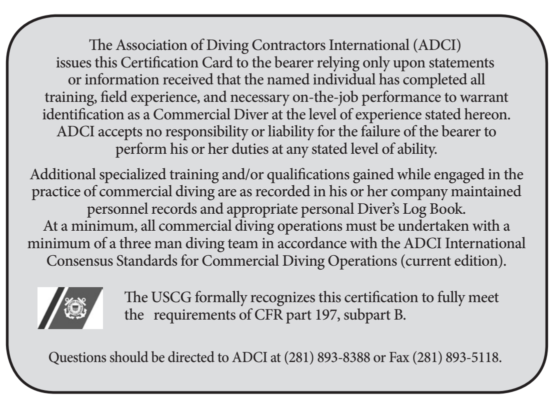
ENTRY-LEVEL TENDER/DIVER

Name: I.D. # I.D. Assigned

Commercial Diver Certification Card

ENTRY-LEVEL TENDER/DIVER

BACK SIDE


The Association of Diving Contractors International (ADCI) issues this Certification Card to the bearer relying only upon statements or information received that the named individual has completed all training, field experience, and necessary on-the-job performance to warrant identification as a Commercial Diver at the level of experience stated hereon. ADCI accepts no responsibility or liability for the failure of the bearer to perform his or her duties at any stated level of ability.

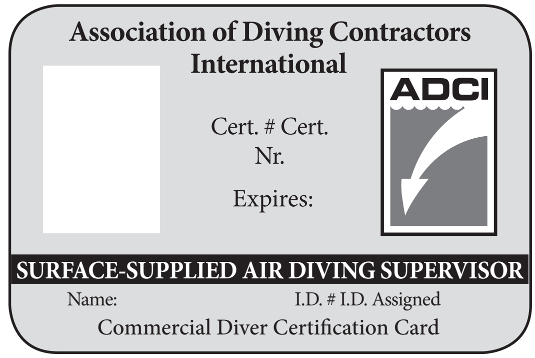
Additional specialized training and/or qualifications gained while engaged in the practice of commercial diving are as recorded in his or her company maintained personnel records and appropriate personal Diver's Log Book. At a minimum, all commercial diving operations must be undertaken with a minimum of a three man diving team in accordance with the ADCI International Consensus Standards for Commercial Diving Operations (current edition).

The USCG formally recognizes this certification to fully meet the requirements of CFR part 197, subpart B.

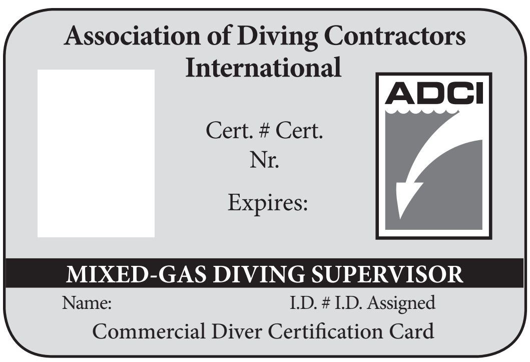
Questions should be directed to ADCI at (281) 893-8388 or Fax (281) 893-5118.

FRONT SIDE

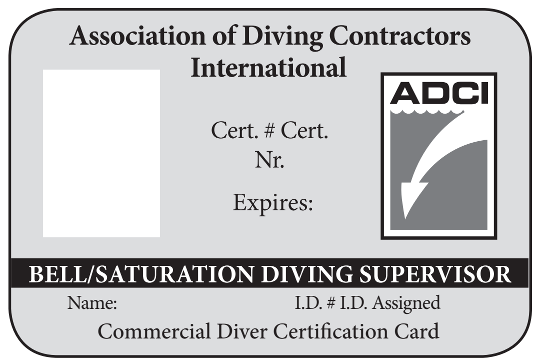
LIFE-SUPPORT TECHNICIAN



SURFACE-SUPPLIED AIR DIVING SUPERVISOR



MIXED-GAS DIVING SUPERVISOR



BELL/SATURATION DIVING SUPERVISOR

3.1.9 APPLICATIONS

COMMERCIAL DIVER CERTIFICATION CARD APPLICATION

The Association of Diving Contractors International
5206 FM 1960 West, Suite 202
Houston, TX 77069

New Application _____

Renewal _____

APPLICATION FROM ADCI MEMBER COMPANY **(rev. 1/2009)**

Name	**Passport Number or Other Numerical Identifier**	**Photograph Number**	**CLASSIFICATION** Entry-level Tender/Diver (2 years) Air Diver Mixed-gas Diver Bell/Sat Diver	

NOTE: All applications must be submitted on their respective exam and certification pplications (new combined application).

In making this application, I understand and acknowledge that the ADCI is relying in full upon my statement that the individual(s) for whom card issue is requested has met the training and experience criteria of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations. By such action, I specifically release the ADCI from any and all liability, which may extend to the issue and use of the requested card(s) to the individual(s) identified above.

I further understand that validity of the requested commercial diver card(s) is as noticed at www.adc-int.org and that prior to expiration, a replacement card must be obtained by submission of a revised application form to note any changes. I verify that all applicants for whom commercial diver certification cards are requested properly maintain a commercial diver log book, and that the log book is available for verification of the level of certification requested.

Applications for certification can be submitted only for personnel permanently employed by the submitting general member company. Associate member schools applying for graduating students do not fall into this category.

On behalf of the following persons, I do hereby apply for the issue of ADCI commercial diving certification cards:

______________________________ ______________________________

Company Company Address

______________________________ ______________________________

Signature (Company Representative)

______________________________ ______________________________

Printed Name (Company Representative)

______________________________ ______________________________

Date Email

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COMMERCIAL DIVER CERTIFICATION CARD APPLICATION

The Association of Diving Contractors International
5206 FM 1960 West, Suite 202
Houston, TX 77069

New Application _____

Renewal _____

INDIVIDUAL APPLICATION (Rev. 1/2009)

______________________ Name (Please Print) ______________________ Passport Number or Other Numerical Identifier ______________________ Address		**Classification** Entry-Level Tender/Diver (2 years) Air Diver Mixed-gas Diver Bell/Sat Diver	

NOTE: All applications must be submitted on their respective exam and certification applications (new combined application).

In making this application, I understand and acknowledge that the ADCI is relying in full upon my statement that the individual for whom card issue is requested is fully qualified to receive same by having met the training and experience criteria of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations. By such action, I specifically release the ADCI from any and all liability, which may extend to the issue and use of the requested card to the individual identified above.

I further understand that validity of the requested certification card is as noticed at www.adc-int.org and that prior to expiration, a replacement card must be obtained by submission of a revised application form to note any changes.

To support the validity of this request for a commercial diver certification card, I offer the following evidence that I am fully qualified to bear and display such a card:

1. Copies of my diver's log book for the period ______________ 20___ through __________ 20___.
2. A copy of my diploma or certificate of course completion from ____________________________.
3. A listing of all commercial diving companies for whom I have worked: (Use separate sheet if necessary).

______________________ ______________________ ______________________

______________________ ______________________ ______________________

4. If applying for a supervisor card: Satisfactory completion of supervisor certification exam and documentation of qualifications must be submitted.
5. Photo required for new applicants

______________________ ______________________ ______________________

Printed Name Phone Email

______________________ ______________________

Signature Date

012784

COMMERCIAL DIVER CERTIFICATION CARD APPLICATION

The Association of Diving Contractors International **New Application _____**
5206 FM 1960 West, Suite 202
Houston, TX 77069 **Renewal _____**

INDIVIDUAL REPLACEMENT APPLICATION (LOST OR STOLEN CARD ONLY) (rev. 1/2009)

______________________ Name (Please Print) ______________________ Passport Number or Other Numerical Identifier ______________________ Address		**Classification** Entry-Level Tender/Diver (2 years) Air Diver Air-Diving Supervisor Mixed-gas Diver Mixed-gas Diving Supervisor Bell/Sat Diver Bell/Sat Diving Supervisor Life-support Technician	

In making this application, I understand and acknowledge that the ADCI is relying in full upon my statement that the individual for whom card issue is requested is fully qualified to receive same by having met the training and experience criteria of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations. Through this action, I specifically release the ADCI from any and all liability, which may extend to the issue and use of the requested card to the individual identified above.

I further understand that validity of the requested commercial diver certification card is as noticed at www.adc-int.org and at the expiration of same, a new card may be applied for if so desired by presentation of all required documentation.

______________________________ ______________________________

Printed Name Phone Email

______________________________ ______________________________

Signature Date

012785

SUPERVISOR EXAM AND CERTIFICATION APPLICATION

(NEW COMBINED APPLICATION) (rev. 1/2009)

The Association of Diving Contractors International
5206 FM 1960 West, Suite 202
Houston, TX 77069

APPLICANT INFORMATION

Full Name: ____________________ ____________________ ____________________
Last First M.I.

Address: ____ ____________________
Street Address Apartment/Unit #

____ ____________ ____________
City State ZIP Code

Phone: (_____) ____________________ Email Address: ________________________________

Passport Number or Other ID Number: ____

Supervisor Test and Certification Applied for: ☐ Air Diving ☐ Mixed-gas ☐ Bell/Sat

COMPANY

Proctor: ______________________________ Job Title: ____________________

Company: ______________________________ Phone: (_____) ____________________

Address: ____

____

Email: ____

Proctoring Location: ____

If you agree to the terms of the two statements below, please check both boxes.

☐ I understand that taking and passing this examination does NOT automatically guarantee issuance of an ADCI supervisor's certification card and that issuance of any requested ADCI supervisor's certification card will be based upon examination performance, as well as the training and experience criteria of the ADCI International Consensus Standards for Commercial Diving Operations, Section 2.0.

☐ I certify that the person taking the actual final exam is the candidate whose name appears on this application.

____ ____________________
Signature Date

012786

LIFE-SUPPORT TECHNICIAN EXAM AND CERTIFICATION APPLICATION

(NEW COMBINED APPLICATION) (rev. 1/2009)

The Association of Diving Contractors International
5206 FM 1960 West, Suite 202
Houston, TX 77069

APPLICANT INFORMATION

Full Name: ________________ ________________ ________________
Last First M.I.

Address: ________________________________ ________________
Street Address Apartment/Unit #

________________________________ ________________ ________________
City State ZIP Code

Phone: (_____) ________________ Email Address: ________________________

Passport Number or Other ID Number: ________________________________

COMPANY

Proctor: ________________________ Job Title: ________________

Company: ________________________ Phone: (_____) ________________

Address: ____

____

Email: ____

Proctoring Location: ____

If you agree to the terms of the two statements below, please check both boxes

☐ I understand that taking and passing this examination does NOT automatically guarantee issuance of an ADCI Life-support technician certification card and that issuance of any requested ADCI LST certification card will be based upon examination performance, as well as the training and experience criteria of the ADCI International Consensus Standards for Commercial Diving Operations, Section 2.0

☐ I certify that the person taking the actual final exam is the candidate whose name appears on this application.

____ ____________________
Signature Date

012787

3.2 ENTRY-LEVEL TENDER/DIVER

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.2.1 RESPONSIBILITIES

The tender/diver is assigned by the diving supervisor or designated diving person in charge (DPIC) to perform various duties, which may include:

- Continuously tend a diver.
- Preparate and support the dive until its completion.
- Support any in-water decompression as required.
- Assist the diver in dressing and undressing.
- Confirm that the diver's equipment is functioning properly and inform the diving supervisor that the diver is ready.
- Tend the diver's umbilical (keeping at least one hand on the umbilical at all times) and be aware of the diver's depth and location at all times. Set up and operate all equipment as directed by the diving supervisor, DPIC or his or her representative.
- Perform routine maintenance on diving equipment.
- Repair such equipment as he or she is qualified to check-out to repair.
- Assist in topside work as required or directed.
- Be alert for and immediately report conditions that may be hazardous or unsafe.
- Maintain certification in first aid and CPR.
- Properly operate a decompression chamber as required for decompression or treatment as directed.
- Maintain communication with the chamber occupants.
- Properly complete all paperwork as required by employer policy and/or governmental regulations.
- Do not perform any other task while operating the chamber.
- Perform tasks as a diver or standby diver when directed by the supervisor. A tender/diver who dives shall be subject to the duties and responsibilities of a diver within the limitations of his or her assignment.
- When required, ride the chamber with the diver during decompression or treatment. This inside tender/diver must be familiar with and alert for the symptoms of oxygen toxicity.
- Report to the diving supervisor any recent medical treatment or illness so that a proper determination can be made concerning fitness and/or ability to dive.
- Immediately report all symptoms or suspected symptoms of DCS to the diving supervisor as early and accurately as possible.
- Report to the diving supervisor any defect or malfunction of the diving equipment provided for the diving operation.
- Read, understand and comply with all employer's policies and applicable governmental regulations, as they relate to their qualifications or performance while engaging in diving operations.

In the event a tender/diver is assigned a task for which he or she does not feel qualified either by training and/or experience, he or she shall immediately inform the diving supervisor, DPIC or his or her representative.

3.2.2 QUALIFICATIONS AND CERTIFICATIONS

- ADCI Entry-level/tender diver certification card.
- Before being exposed to hyperbaric conditions, the tender/diver must be medically certified as "fit to dive."
- Valid CPR and first aid certification.
- High school graduate or equivalent and no less than 18 years old.

3.2.3 CERTIFICATION CARD DESCRIPTION

All graduates of ADCI member schools who complete a commercial diver training-program consisting of a minimum of 625[2] hours of formal instruction in accordance with the provisions of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations, including reference to the American National Standard for Divers (ANSI) Secretariat of the Association of Commercial Diving Educators (ACDE), are eligible.

This card will be issued to all graduates of recognized commercial diver training-programs consisting of 625[2] hours. Non-members of ADCI may apply to receive this type of certification card by presenting evidence that they have attended a recognized course of formal instruction consistent with the provisions of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations.

3.2.4 CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix.**)

3.3 SURFACE-SUPPLIED AIR DIVER

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.3.1 RESPONSIBILITIES

The diver is assigned by the supervisor to perform specific tasks in the water and topside.

A diver must be medically certified as fit to dive, have completed a formal commercial diving course of instruction, have detailed knowledge of diving theory and practice, and have a full understanding of the diving equipment in use and of the tasks assigned. All divers shall be in possession of an up-to-date diver's log book, which can be used to establish levels of experience.

Each diver, while carrying out his or her duties and responsibilities, shall:

- Accomplish all tasks assigned by the diving supervisor. In the event the diver is assigned a task for which he or she does not feel competent either by training and/or experience, the diver shall immediately inform the diving supervisor.
- Have adequate knowledge, training and familiarization with all life-support and ancillary equipment designated to the diving operations.
- Read, understand and comply with all employer's policies and applicable governmental regulations, as they relate to their qualifications or performance while engaging in diving operations.
- Have reviewed and be familiar with the Job Hazard Analysis (JHA).
- Maintain a high level of physical fitness.
- Comply with all commands or instructions from the diving supervisor or designated diving person in charge (DPIC) during the conduct of diving operations.
- Ensure that the deepest depth attained during his or her dive has been established before ascent.
- Safely transition from the water to the decompression chamber without avoidable delay.
- Act as a standby diver when directed to do so. Be capable and qualified to carry out all of the duties and responsibilities of the diver as set forth above. (The standby diver is the individual possessing the required training and experience to enter the water at the diving station in order to render assistance to a stricken diver). While acting as a standby diver, the diver shall:
  - a) Have attached his or her diving helmet or mask to the standby diver's umbilical in a wrench-tight status and then check for proper flow of breathing medium and for adequate communications. The diving helmet or mask shall be ready to be donned by the standby diver when directed by the diving supervisor. The standby diver shall remain in the immediate vicinity of the diver water entry location and be ready to enter the water when directed by the diving supervisor.
  - b) Remain at the station throughout the entire dive, to include all in-water decompression.
  - c) Constantly remain abreast of events of the dive.
  - d) Not be assigned any tasks that might interfere with duties as a standby diver while there is a diver in the water.
- Act as a chamber operator as required by the diving supervisor.
- Comply with regulations or instructions concerning the use, maintenance, repair and testing of all diving equipment provided for the operation.

- Report to the diving supervisor any recent medical treatment or illness so that a proper determination can be made concerning fitness and/or ability to dive.
- Immediately report all symptoms or suspected symptoms of DCS to the diving supervisor as early and accurately as possible.
- Report to the diving supervisor any defect or malfunction of the diving equipment provided for the diving operation.
- Follow safe diving practices at all times during the diving operation whether on deck or in the water. Bring to the attention of the diving supervisor any questionable items. Be alert for the safety of others as well as himself/herself.
- Assist in the training of new personnel or tender/divers.
- Remain awake and in the vicinity of the decompression chamber for at least one hour following treatment or a hyperbaric exposure outside the no-decompression limits.
- Know and observe the rules for flying after diving or traveling to altitudes higher than the dive site.
- Ensure that diving equipment has been correctly maintained, prepared and tested before each dive. This requirement should never be delegated to others.
- Ensure that medical certificates are up-to-date and recorded in the diver's log book.

3.3.2 QUALIFICATIONS AND CERTIFICATION

- ADCI diver certification card for the level of proficiency.
- Before being exposed to hyperbaric conditions, the diver must be medically certified as "fit to dive."
- Valid CPR and first aid certification.

3.3.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued byADCI to applicants who have:

Completed a formal course of instruction at a recognized commercial diving school, military training or equivalent consisting of at least 625[2] hours of instruction.

a) Completed at least 100 field days participating in commercial diving operations.
b) Completed at least 30 working dives.

3.3.4 CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix.**)

3.4 SURFACE-SUPPLIED AIR DIVING SUPERVISOR

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.4.1 RESPONSIBILITIES

A qualified person shall be identified in writing as the diving supervisor for each diving operation. The diving supervisor is in charge of the planning and execution of the diving operation, including the responsibility for the safety and health of the dive team.

The diving supervisor shall posses the proper ADCI supervisor certification card and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

In carrying out these responsibilities, the diving supervisor's duties shall include, but not necessarily be limited to, the following:

- Be fully cognizant of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed, and the employer's basic safe practices/operations manual. See that all rules and regulations are followed.
- Have adequate knowledge, training and familiarization with all life-support and ancillary equipment designated to the diving operations.
- While actually on duty, be in immediate control and available to implement emergency procedures. The diving supervisor is not permitted to dive unless another qualified diver is present who has also been appointed and designated to assume responsibility.

- The diving supervisor must also ensure, prior to commencing a diving operation, in addition to parties directly involved in the diving operation, that masters of craft, pilots of submersibles, harbor masters, managers of offshore installations, pipelines, civil engineering sites, inland waterways, and all persons responsible for anything that affects the diving operation are advised that diving or underwater operations are to be undertaken.
- Ensure diving operations are carried out from a suitable and safe location on the surface.
- Develop or modify and produce pre- and post-dive checklists for the operation.
- Develop and implement emergency/contingency procedures.
- Be aware of the procedures to follow to obtain medical support in the event of an accident, either diving or non-diving related. Ensure a two-way communication system is available at the dive location to obtain emergency assistance.
- Facilitate a Job Hazard Analysis for each task undertaken.
- Establish a dive plan ensuring that sufficient breathing mixtures, supplies and proper equipment are available for safe and timely completion of the job task.
- Assign the duties of all members of the dive team and personally direct them throughout the diving operation.
- Personally inquire if all personnel on the dive team are qualified and physically able to perform tasks assigned. Make an assessment of the physical condition of the divers prior to each dive to determine if any physical impairment is present that would be detrimental to the diver's health and safety in the water or under hyperbaric conditions.
- Ensure that the diving equipment designated for use is:
  - Suitable for the planned diving operation.
  - Compliant with regulatory requirements for the diving mode used.
  - Inspected prior to each dive and is in good working order.
- Ensure that all relevant operating instructions, manuals, decompression tables, treatment schedules and regulatory publications are available at the dive location and are maintained to reflect current changes and/or developments.
- Ensure the detailed briefing of his or her diving team and support personnel, including:
  - Tasks to be undertaken.
  - Unusual hazards or environmental conditions.
- Maintain a depth, bottom time and breathing mix profile at the dive location for each diver during the dive.
- Ensure that each diver is continuously tended while in the water.
- Ensure the dive is terminated when:
  - The diver requests termination.
  - The diver fails to respond to communication or communication is lost between the diver and dive team members at the dive location.
  - Communication is lost between the vessel operator and the diving supervisor during liveboating operations.
  - The diver begins to use his or her diver-carried reserve breathing gas supply.
  - Weather or site conditions are degrading to the extent that diver safety may be compromised.
- Ensure after every dive:
  - The physical condition and wellbeing of the diver is checked by visual observation and verbal questioning.
  - The diver is instructed to report any physical problems or symptoms of decompression sickness or arterial gas embolism.
  - The diver is advised of the location of the nearest operating decompression chamber and is acquainted with the dangers of flying after diving or traveling to altitudes higher than the dive site.
- Ensure after any treatment or dive outside the no-decompression limits:
  - The diver is instructed to remain awake and in the vicinity of a decompression chamber for at least one hour.
  - A trained dive team member is available to operate the decompression chamber.
- Report all accidents or incidents involving personnel as required by employer's rules and relevant governmental regulations.
- Maintain and submit reports required by employer and relevant governmental regulations concerning diving operations and equipment maintenance (testing or repair).
- View and ensure accuracy of diver's personal log book and affix signature to properly record activities.

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3.4.2 QUALIFICATIONS AND CERTIFICATIONS

- Successful completion of the ADCI supervisor exam.
- ADCI supervisor certification card for the diving mode.
- Before being exposed to hyperbaric conditions, the supervisor must be medically certified as “fit to dive.”
- Valid CPR and first aid certification.

3.4.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued by ADCI to certified air divers who have:

a) Successfully completed the ADCI air-diving supervisor’s certification examination.

b) Completed an additional 100 field days participating in commercial diving operations during which they shall have performed at least 50 working dives and performed a minimum of 30 days as an assistant surface-supplied air-diving supervisor.

3.4.4. CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix.**)

3.5 HeO_2/MIXED-GAS DIVER

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.5.1 RESPONSIBILITIES

The diver is assigned by the supervisor to perform specific tasks in the water and topside.

A diver must be medically certified as “fit to dive,” have completed a formal commercial diving course of instruction, have detailed knowledge of diving theory and practice, and have a full understanding of the diving equipment in use and of the tasks assigned. All divers shall be in possession of an up-to-date diver’s log book, which can be used to establish levels of experience.

Each diver, while carrying out his or her duties and responsibilities, shall:

- Accomplish all tasks assigned by the diving supervisor. In the event the diver is assigned a task for which he or she does not feel competent either by training and/or experience, the diver shall immediately inform the diving supervisor.
- Have adequate knowledge, training and familiarization with all life-support and ancillary equipment designated to the diving operations.
- Read, understand and comply with all employer’s policies and applicable governmental regulations, as they relate to qualifications or performance while engaging in diving operations.
- Maintain a high level of physical fitness.
- Comply with all commands or instructions from the diving supervisor or designated diving person in charge (DPIC) during the conduct of diving operations.
- Ensure that the deepest depth attained during the dive has been established before the ascent.
- Safely transition from the water to the decompression chamber without avoidable delay.
- Act as a standby diver when directed to do so. Be capable and qualified to carry out all of the duties and responsibilities of the diver as set forth above. (The standby diver is the individual possessing the required training and experience to enter the water at the diving station in order to render assistance to a stricken diver). While acting as a standby diver, the diver shall:
    a. Have attached his or her diving helmet or mask to the standby diver’s umbilical in a wrench-tight status and then check for proper flow of breathing medium and for adequate communications. The diving helmet or mask shall be ready to be donned by the standby diver when directed by the diving supervisor. The standby diver shall remain in the immediate vicinity of the diver water entry location and be ready to enter the water when directed by the diving supervisor.
    b. Remain at the station throughout the entire dive, to include all in-water decompression.
    c. Constantly remain abreast of events of the dive.
    d. Not be assigned any tasks that might interfere with the duties of a standby Ddver while there is a diver in the water.
- Act as a chamber operator as required by the diving supervisor.
- Comply with regulations or instructions concerning the use, maintenance, repair and testing of all diving equipment provided for the operation.

- Report to the diving supervisor any recent medical treatment or illness so that a proper determination can be made concerning fitness and/or ability to dive.
- Immediately report all symptoms or suspected symptoms of DCS to the diving supervisor as early and accurately as possible.
- Report to the diving supervisor any defect or malfunction of the diving equipment provided for the diving operation.
- Follow safe diving practices at all times during the diving operation whether on deck or in the water. Bring to the attention of the diving supervisor any questionable items. Be alert for the safety of others as well as himself or herself.
- Assist in the training of new personnel or tender/divers.
- Remain awake and in the vicinity of the decompression chamber for at least one hour following treatment or a hyperbaric exposure outside the no-decompression limits.
- Know and observe the rules for flying after diving or traveling to altitudes higher than the dive site.
- Ensure that the diving equipment has been correctly maintained, prepared and tested before each dive. This requirement should never be delegated to others.

3.5.2 QUALIFICATIONS AND CERTIFICATIONS

- ADCI diver certification card for the level of proficiency.
- Before being exposed to hyperbaric conditions, the diver must be medically certified as “fit to dive.”
- Valid CPR and first aid certification.

3.5.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued by ADCI to certified HeO_2/MIXED-GAS divers who have:

a. Completed at least 100 field days as an air diver.
b. Completed at least 50 working dives as an air diver.
c. Completed at least 50 field days participating in surface mixed-gas diving operations during which they shall have:
    - Performed at least 10 working mixed-gas dives.

3.5.4. CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix.**)

3.6 HeO_2/MIXED-GAS DIVING SUPERVISOR

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.6.1 RESPONSIBILITIES

A qualified person shall be designated as the diving supervisor for each diving operation. The diving supervisor is in charge of the planning and execution of the diving operation, including responsibility for the safety and health of the dive team.

The diving supervisor shall posses the proper ADCI supervisor certification card and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

In carrying out these responsibilities, the duties shall include, but not necessarily be limited to, the following:

- Be fully cognizant of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed and the employer’s basic safe practices/operations manual. See that all rules and regulations are followed.
- Have adequate knowledge, training and familiarization with all life-support and ancillary equipment designated to the diving operations.
- While actually on duty, be in immediate control and available to implement emergency procedures. The diving supervisor is not permitted to dive unless another qualified diver is present who has also been appointed and designated to assume responsibility.

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- The diving supervisor must also ensure, prior to commencing a diving operation, in addition to parties directly involved in the diving operation, that masters of craft, pilots of submersibles, harbor masters, managers of offshore installations, pipelines, civil engineering sites, inland waterways, and all persons responsible for anything that affects the diving operation are advised that diving or underwater operations are to be undertaken.
- Ensure diving operations are carried out from a suitable and safe location on the surface.
- Develop or modify and produce pre- and post-dive checklists for the operation.
- Develop and implement emergency/contingency procedures.
- Be aware of the procedures to follow to obtain medical support in the event of an accident, either diving or non-diving related. Ensure a two-way communication system is available at the dive location to obtain emergency assistance.
- Perform a job safety analysis for each task undertaken.
- Establish a dive plan ensuring that sufficient breathing mixtures, supplies and proper equipment are available for safe and timely completion of the job task.
- Assign the duties of all members of the dive team and personally direct them throughout the diving operation.
- Personally verify that all personnel on the dive team are qualified and physically able to perform tasks assigned. He or she must make an assessment of the physical condition of the divers prior to each dive to determine if any physical impairment is present that would be detrimental to the divers' health and safety in the water or under hyperbaric conditions.
- Ensure that the diving equipment designated for use is:
  - Suitable for the planned diving operation.
  - Compliant with regulatory requirements for the diving mode used.
  - Inspected prior to each dive and is in good working order.
- Ensure that all relevant operating instructions, manuals, decompression tables, treatment schedules and regulatory publications are available at the dive location and are maintained to reflect current changes and/or developments.
- Ensure the detailed briefing of his or her diving team and support personnel, including:
  - Tasks to be undertaken.
  - Unusual hazards or environmental conditions.
- Make modifications to standard procedures or safety procedures necessitated by the specific diving operation.
- Maintain a depth, bottom time and breathing mix profile at the dive location for each diver during the dive.
- Ensure that each diver is continuously tended while in the water.
- Ensure the dive is terminated when:
  - The diver requests termination.
  - The diver fails to respond to communication or communication is lost between the diver and dive team members at the dive location.
  - Communication is lost between the vessel operator and the diving supervisor during liveboating operations.
  - The diver begins to use his or her diver-carried reserve breathing gas supply.
  - Weather or site conditions are degrading to the extent that diver safety may be compromised.
- Ensure after every dive:
  - The physical condition and wellbeing of the diver is checked by visual observation and verbal questioning.
  - The diver is instructed to report any physical problems or symptoms of decompression sickness or arterial gas embolism.
  - The diver is advised of the location of the nearest operating decompression chamber and is acquainted with the dangers of flying after diving or traveling to altitudes higher than the dive site.
- Ensure after any treatment or dive outside the no-decompression limits:
  - The diver is instructed to remain awake and in the vicinity of a decompression chamber for at least one hour.
  - A trained dive team member is available to operate the decompression chamber.
- Report all accidents or incidents involving personnel as required by employer's rules and relevant governmental regulations.
- Maintain and submit reports required by employer and relevant governmental regulations concerning diving operations and equipment maintenance, testing or repair.
- View and ensure accuracy of diver's personal log book and affix signature to properly record activities.

3.6.2 QUALIFICATIONS AND CERTIFICATIONS

- Successful completion of the ADCI supervisor exam.
- ADCI supervisor certification card for the diving mode.
- Before being exposed to hyperbaric conditions, the supervisor must be medically certified as "fit to dive."
- Valid CPR and first aid certification.

3.6.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued by ADCI to certified mixed-gas divers who have:

a. Successfully passed the ADCI HeO_2/mixed-gas diving supervisor's certification examination.
b. Completed at least 350 field days as an air or mixed-gas diver.
c. Completed at least 150 working dives as an air or mixed-gas diver.
d. Completed at least 30 working days as an assistant mixed-gas diving supervisor.
e. Individual is also qualified to work as an air diving supervisor.

3.6.4. CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix.**)

3.7 BELL/SATURATION DIVER

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.7.1 RESPONSIBILITIES

The diver is assigned by the supervisor to perform specific tasks in the water and topside.

A diver must be medically certified as fit to dive, have completed a formal commercial diving course of instruction, have detailed knowledge of diving theory and practice, and have a full understanding of the diving equipment in use and of the tasks assigned. All divers shall be in possession of an up-to-date diver's log book, which can be used to establish levels of experience.

Each diver, while carrying out his or her duties and responsibilities, shall:

- Accomplish all tasks assigned by the diving supervisor. In the event the diver is assigned a task for which he or she does not feel competent, either by training and/or experience, the diver shall immediately inform the diving supervisor.
- Have adequate knowledge, training and familiarization with all life-support and ancillary equipment designated to the diving operations.
- Read, understand and comply with all employer's policies and with applicable governmental regulations as they relate to qualifications or performance while engaging in diving operations.
- Maintain a high level of physical fitness.
- Comply with all commands or instructions from the diving supervisor or designated diving person in charge (DPIC) during the conduct of diving operations.
- Act as a standby diver when directed to do so. Be capable and qualified to carry out all of the duties and responsibilities of the diver as set forth above. (The standby diver is the individual possessing the required training and experience to enter the water at the diving station in order to render assistance to a stricken diver). While acting as a standby diver, the diver shall:
    a. Have attached his or her diving helmet or mask to the standby diver's umbilical in a wrench-tight status and then check for proper flow of breathing medium and for adequate communications. The diving helmet or mask shall be ready to be donned by the standby diver when directed by the diving supervisor. The standby diver shall remain in the immediate vicinity of the diver water entry location and be ready to enter the water when directed by the diving supervisor.
    b. Monitor bell manifold and applicable analyzers.

Constantly remain abreast of events of the dive.

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- Comply with regulations or instructions concerning the use, maintenance, repair and testing of all diving equipment provided for the operation.
- Report to the diving supervisor any recent medical treatment or illness so that a proper determination can be made concerning fitness and/or ability to dive.
- Immediately report all symptoms or suspected symptoms of DCS to the diving supervisor as early and accurately as possible.
- Report to the diving supervisor any defect or malfunction of the diving equipment provided for the diving operation.
- Follow safe diving practices at all times during the diving operation whether on deck or in the water. Bring to the attention of the diving supervisor any questionable items. Be alert for the safety of others as well as himself or herself.
- Assist in the training of new personnel or tender/divers.
- Know and observe the rules for flying after diving or traveling to altitudes higher than the dive site.

3.7.2 QUALIFICATIONS AND CERTIFICATIONS

- ADCI diver certification card for the level of proficiency.
- Before being exposed to hyperbaric conditions, the diver must be medically certified as "fit to dive."
- Valid CPR and first aid certification.

3.7.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued by ADCI to certified divers who have:

a. Completed at least 200 field days as an air or mixed-gas diver.
b. Completed at least 100 working dives as an air or mixed-gas diver.
c. Performed for at least 30 working days in support of bell/saturation diving operations.
d. Performed at least 10 bell runs.

3.7.4. CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix.**)

3.8 BELL/SATURATION DIVING SUPERVISOR

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[1]

3.8.1 RESPONSIBILITIES

A qualified person shall be designated as the diving supervisor for each diving operation. The diving upervisor is in charge of the planning and execution of the diving operation, including responsibility for the safety and health of the dive team.

The diving supervisor shall posses the proper ADCI supervisor certification card and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

In carrying out these responsibilities, the diving supervisor's duties shall include, but not necessarily be limited to, the following:

- Be fully cognizant of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed and the employer's basic safe practices/pperations manual. See that all rules and regulations are followed.
- Have adequate knowledge, training and familiarization with all life-support and ancillary equipment designated to the diving operations.
- While actually on duty, be in immediate control and available to implement emergency procedures.
- Ensure diving operations are carried out from a suitable and safe location on the surface.
- Develop or modify and produce pre- and post-dive checklists for the operation.
- Develop and implement emergency/contingency procedures.
- Be aware of the procedures to follow to obtain medical support in the event of an accident, either diving or non-diving related. Ensure a two-way communication system is available at the dive location to obtain emergency assistance.

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- Perform a Job Safety Analysis for each task undertaken.
- Establish a dive plan ensuring that sufficient breathing mixtures, supplies and proper equipment are available for safe and timely completion of the job task.
- Assign the duties of all members of the dive team and personally direct them throughout the diving operation.
- Personally verify that all personnel on the dive team are qualified and physically able to perform tasks assigned. He or she must make an assessment of the physical condition of the divers prior to each dive to determine if any physical impairment is present that would be detrimental to the divers' health and safety in the water or under hyperbaric conditions.
- Ensure that the diving equipment designated for use is:
  - Suitable for the planned diving operation.
  - Sufficient to regulatory requirements for the diving mode used.
  - Inspected prior to each dive and is in good working order.
- Ensure that all relevant operating instructions, manuals, decompression tables, treatment schedules and regulatory publications are available at the dive location and are maintained to reflect current changes and/or developments.
- Ensure the detailed briefing of his or her diving team and support personnel, including:
  - Tasks to be undertaken.
  - Unusual hazards or environmental conditions.
- Make modifications to standard procedures or safety procedures necessitated by the specific diving operation.
- Maintain a depth, bottom time and breathing mix profile at the dive location for each diver during the dive.
- Ensure that each diver is continuously tended while in the water.
- Ensure the dive is terminated when:
  - The diver requests termination.
  - The diver fails to respond to communication or communication is lost between the diver and dive team members at the dive location.
  - Communication is lost between the vessel operator and the diving supervisor during liveboating operations.
  - The diver begins to use his or her diver-carried reserve breathing gas supply.
  - Weather or site conditions are degrading to the extent that diver safety may be compromised.
- Ensure after every dive:
  - The physical condition and wellbeing of the diver is checked by visual observation and verbal questioning.
  - The diver is instructed to report any physical problems or symptoms of decompression sickness or arterial gas embolism.
  - The diver is advised of the location of the nearest operating decompression chamber and is acquainted with the dangers of flying after diving or traveling to altitudes higher than the dive site.
- Ensure after any treatment or dive outside the no-decompression limits:
  - The diver is instructed to remain awake and in the vicinity of a decompression chamber for at least one hour.
  - A trained dive team member is available to operate the decompression chamber.
- Report all accidents or incidents involving personnel as required by employer's rules and relevant governmental regulations.
- View and ensure accuracy of diver's personal log book and affix signature to properly record activities.
- Ensure prior to each bell run:
  - All bell checks are performed, internally and externally, and recorded.
  - All pertinent vessel or facility operators are properly notified.
  - All support equipment and personnel are prepared for the operation.
  - Clear communications are established with vessel operators, DP operators, ROV operators, crane operators and any other pertinent operational personnel.

- Ensure the bell run is terminated when:
  - Vessel is unable to or in danger of losing station keeping ability (weather or mechanical failure).
  - There is loss of hot water, gas, primary electrical power or any other life-support equipment
  - The atmosphere in the bell cannot be controlled (e.g., buildup of CO2).
  - Weather, sea or external conditions endangering the bell.
  - There is loss of clear communication with critical operation personnel such as the DP vessel operator on a DP diving vessel.
  - There is loss of the DP alert system on a DP vessel.
  - The DP officer issues a yellow or red light on a DP vessel.
  - There is danger to topside crew preventing or degrading the performance of bell retrieval operations such as an approaching weather front or lightning.
  - Primary communication with the bell is lost.
  - There is a suspected or confirmed presence of hydrocarbon gas in the bell.
  - Any time that the safety and wellbeing of the saturation divers warrants termination.
- Ensure after each bell run:
  - Any maintenance or repairs are performed to bring all redundant systems back on line.
  - Perform proper record keeping relative to LARS performance and upcoming maintenance issues.
  - Debrief deck crew regarding any issues encountered during bell recovery.
  - The deck foreman, LST and sat techs are fully aware of any maintenance or repair issues and preparations are being made to be ready for the next bell run.

3.8.2 QUALIFICATIONS AND CERTIFICATIONS

- Successful completion of the ADCI supervisor exam.
- ADCI supervisor certification card for the diving mode.
- Before being exposed to hyperbaric conditions, the supervisor must be medically certified as "fit to dive."
- Valid CPR and first aid certification.

3.8.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued byADCI to certified divers who have:

a. Successfully completed the ADCI bell/saturation diving supervisor's certification examination.

b Completed at least 100 field days as a mixed-gas diving supervisor.

c Performed for at least 60 days as an assistant bell/saturation diving supervisor.

3.8.4. CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix**).

3.9 LIFE-SUPPORT TECHNICIAN

All ADCI general member company diving personnel need to hold a current ADCI certification reflective of the assigned tasks to be performed.[2]

3.9.1 RESPONSIBILITIES

The life-support technician is utilized in the saturation diving mode and reports directly to the diving supervisor. The life-support technician must possess the knowledge and ability to perform the duties listed below within the scope of the assignment.

This knowledge and skill will have been obtained by a combination of on-site experience and training. It is required that life-support technicians maintain a personal log book that includes the details of their work experience and qualifications. The duties and responsibilities of life-support technicians will vary depending on the diving mode employed, but at a minimum they shall control and constantly monitor the hyperbaric environment and system in which divers live while saturation diving. Their duties in this diving mode include, but are not limited to:

- Maintain proper atmosphere (e.g., correct levels of oxygen, carbon dioxide and other gasses) and pressure in the saturation complex according to employer's policy and as directed by the diving supervisor.
- Maintain proper environment (i.e., temperature and humidity) at levels suitable for current depth as the diver's comfort dictates.
- Decompress divers according to established schedules as directed by the diving supervisor.
- Maintain communication with divers.
- Calibrate, at regular intervals, all monitoring instruments that require, by their design, periodic calibration, or at any time the accuracy of the instrument is suspect.
- Maintain an accurate record of events, in the form of a saturation log, pertaining to the diving system. All readings taken and actions during the shift must be entered in the log.

<u>The information in the saturation log shall include:</u>

- Oxygen and carbon dioxide readings.
- Depth changes and temperature and humidity readings.
- Gas changes and BIBS usage details.
- Carbon dioxide scrubber changes.
- Medical lock runs, with record of items locked in or out.
- Individual diver's sleep cycles.
- Showers, flushes and drains.
- Calibration of instruments.
- Bell on and off systems and crew TUPs.
- Changes to settings on the environmental control system and record of equipment status.
- Chamber hygiene and disinfection and diver's ear prophylaxis.
- Any event outside normal chamber routines.
- Any articles entering the system.

- Maintain the diver's requirements within the diving complex. All matters that concern the diver's safety and well being are promptly carried out. These include such items as food, drinks, entertainment, personal hygiene, laundry and sanitary matters, etc.
- Be aware at all times of all items being sent in or out of the system, and supervise all such operations. Prevent prohibited items from entering the system.

- Advise the diving supervisor of the diver's status at regular intervals or as conditions dictate.
- Be alert for emergencies.
- Keep traffic in the control van to a minimum.
- Conduct such operations as may be required or directed by the diving supervisor.
- Perform assigned diving supervisor tasks. Be responsible to ensure that all gasses to be used during the dive have been properly analyzed and have been receipted for and logged in before being placed online.
- Maintain adequate supply of the correct breathing mixture to the diver.
- Maintain correct supply over-pressure for depth and apparatus.
- Have standby banks ready.
- Follow the tables in use correctly and accurately.
- Switch breathing mixtures at the proper time and depth.
- Record gas consumption data as directed.
- Assist in the maintenance of all diving equipment.
- Assist in the training of tender/divers and new personnel.
- Report any potentially unsafe situations or conditions to the diving supervisor.
- Maintain certification in first aid and CPR, and have a through working knowledge of emergency procedures and the diagnosis and treatment of decompression sickness.
- Be aware at all times of the actions carried out by personnel temporarily under his or her supervision. The life-support technician must be informed beforehand of any activity to be carried out on the diving complex, its support equipment, or in the near vicinity by other personnel.

3.9.2 QUALIFICATIONS AND CERTIFICATIONS

- Training and experience applicable to the equipment under their charge.
- A working knowledge and understanding of the physics and physiology of diving.
- Basic understanding of saturation theory and safe operations.
- Specific certification and training as required by industry, regulatory agencies and manufacturers.
- Valid CPR and first aid certification.

3.9.3 CERTIFICATION CARD DESCRIPTION

This type of card will be issued byADCI to personnel who have:

a. Successful completion of the ADCI life-support technician exam
b. Performed at least 100 field days as an assistant life-support technician.

3.9.4. CERTIFICATION CARD REQUIREMENTS

(Requirements located in Section 3.1.4: **Certification and Training Matrix**).

SECTION 4.0

DIVING MODES: DEFINITIONS, REQUIREMENTS AND GUIDELINES

Association of Diving Contractors International, Inc.

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4.0 DIVING MODES: DEFINITIONS, REQUIREMENTS AND GUIDELINES

4.1 GENERAL INTRODUCTION

All equipment and manning levels referenced in Section 4 should be considered the recommended minimum for approaching ALL diving applications, which is based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

The specific operations procedures vary with the type of diving mode employed. Prior to mobilization, a project risk assessment/hazard identification process or dive plan shall be performed to determine the type of diving mode to be employed, equipment needed and job manning requirements.

Prior to the commencement of any diving operation, a Job Hazard Analysis shall be completed and all members of the dive team, including master of the vessel (as well as other involved personnel) shall be present at a pre-dive safety meeting.

MAXIMUM DEPTH FOR SELF-CONTAINED DIVING (SCUBA) – 100 FSW (30 MSW)

MAXIMUM DEPTH FOR SURFACE-SUPPLIED AIR DIVING – 190 FSW (57.91 MSW)

MAXIMUM DEPTH FOR SURFACE-SUPPLIED MIXED GAS DIVING ($He0_2$) – 300 FSW (91.44 MSW)

4.2 SELF-CONTAINED DIVING (SCUBA)

All equipment and manning levels referenced in Section 4 should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

Scuba procedures should not be used for the conduct of commercial diving operations except where it can be shown to be more safe and efficient than the alternative modes of diving. The following are minimum requirements for self-contained diving operations.

4.2.1 MINIMUM PERSONNEL REQUIREMENTS

Commercial scuba diving 0-100 fsw (0-30 msw) with no decompression:

- One diving supervisor.
- One Diver.
- One tender/diver who shall be properly equipped and capable of performing the duties of a standby diver. When two (2) divers are in the water, an additional member must be added to the dive team to act as a surface standby diver.
- At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs.

4.2.2 OPERATIONAL GUIDELINES

1. Two-way audio-communications between the diver and topside are required.
2. The planned time of a scuba diving operation shall not exceed either the no decompression limits or the air supply duration of the cylinders exclusive of the reserve supply. The cylinder pressure shall be determined immediately before each dive. Dive depths shall not exceed 100 fsw (30 msw).
3. Scuba dives shall not be conducted against currents exceeding one knot.
4. Scuba dives shall not be conducted in enclosed or physically-confining spaces.
5. During all scuba dives, a standby diver shall be available while a diver is in the water.
6. Scuba divers shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

7. Diving on scuba will only be allowed during daylight hours.
8. All divers on scuba shall wear a buoyancy compensator and whistle or other audio signaling device.
9. During periods of low or poor surface visibility, the diver shall also carry a lighted beacon.
10. Scuba divers shall be equipped with a diver-carried EGS.
11. Scuba divers shall be equipped with a submersible pressure gauge (tank contents gauge).

Diver worn/carried emergency gas supply (bailout) must have a minimum calculated four-minute supply at the anticipated depth. Refer to Section 6: Diver Worn or Carried Emergency Gas Supply.

4.2.3 MINIMUM EQUIPMENT REQUIREMENTS

1. Each diver shall be equipped with a knife, diving wristwatch and depth gauge.
2. Full face masks with through water communication to the surface (supervisor), with diver-to-diver communications a desirable option.
3. A weight belt with a quick release that is appropriate for the suit and depth of the dive shall be worn.
4. A buoyancy compensator device (BCD) should be used to secure the cylinders to the diver and provide underwater buoyancy compensation or surface buoyancy as needed. If a dry suit is being worn by the diver, then a cylinder harness with a quick release may be worn to secure the cylinders to the diver.
5. An emergency O_2 administration kit (readily available for the treatment of diver{s}).

4.3 SURFACE-SUPPLIED AIR DIVING

All equipment and manning levels should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

At no time shall any member of the dive team be asked to perform an activity that prevents that person from the immediate and continuous performance of dive supervisor's assigned duties and responsibilities.

During the planning phase of the intended operation, a Job Hazard Analysis (JHA) should be conducted to ensure that all factors necessary to support the highest levels of safety have been considered. The JHA should include a method for the safe recovery of an incapacitated diver.

At least one qualified dive team member assigned to each dive crew must be fully competent, equipped and designated to perform the duties of a standby diver in order to render emergency assistance to a regularly assigned diver. If the nature of the work does not subject the second diver in the water to the same hazard as the primary diver, (e.g., deep ditch cave in from hand jetting, etc.), the second diver in the water can serve as the standby diver. Additionally, the second/standby diver must remain in close proximity to the primary diver. NOTE: EACH WORKING DIVER MUST BE CONTINUOUSLY TENDED BY A SEPARATE DIVE TEAM MEMBER.

Individuals other than a member of the dive team may be used to physically tend cables and/or lines entering the water. These individuals must at all times be immediately responsive to direction from the diving supervisor or designated person in charge.

If diving operations are conducted in a physically confining space, refer to Penetration Diving in Section 5.

Volume tanks are only required for air dives or chamber operations utilizing an LP compressor. Operations utilizing only HP/bottled air supplies do not require a volume tank.

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4.3.1 SURFACE-SUPPLIED AIR DIVING 0-100 fsw (0-30 msw) WITH NO DECOMPRESSION

The following are minimum requirements for surface-supplied air diving operations:

1. Minimum Personnel

"At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs." l

The minimum number of personnel comprising a dive team is never less than three; however, planning must take into consideration not only the direct requirements of the work to be performed, but also additional factors either known or suspected that may lead to complications during the conduct of the intended operation. Merely because a dive team comprised of three persons may be adequate during one operation does not mean the same number of persons will be sufficient to accommodate the requirements of another operation.

Diving contractor management and diving supervisors must carefully consider manning levels of the dive team. Although regulations may permit diving with a minimum crew of three persons, that level of manning is strictly under optimal conditions. For example, any time commercial diving operations are intended to take place in a remote location, or where an air gap from the diving station to the water exceeds 15 feet (4.6 m), at least a fourth member of the dive team should be considered.

Shallow Operations with Large Crews

When a diving operation takes place in less than 100 fsw (30 msw) and the on-shift crew size is eight or more, then a diving supervisor who is not part of the diving rotation must be part of the crew.

4.3.1.1 Minimum Personnel Requirements

- One air-diving supervisor.
- One diver.
- One tender/diver who shall be properly equipped and capable of performing the duties of a standby diver.
- At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs.

a. Diving Supervisor

- A qualified person shall be designated as the diving supervisor for each diving operation. The diving supervisor is in charge of the planning and execution of the diving operation, including the responsibility for the safety and health of the dive team.
- The diving supervisor shall possess the proper ADCI supervisor certification card and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

b. Diver

Must have training and/or experience in the following areas:

- Air-diving procedures and techniques.
- Emergency procedures.
- Diving accident treatment procedures.
- Proper operation and use of all equipment related to air diving including decompression chambers.
- Use of air-diving equipment
- Familiarity with the type of work engaged in.

c. Tender/Diver

- Must have the same qualifications as an Air Diver, with a lower level of experience required.

NOTE: An additional dive crew member is normally required when any diving operation is conducted that has an increased likelihood of diver entrapment or potential for rendering the diver unconscious or incapacitated from chemical, physical, electrical or topside hazards, such as, but not limited to, the following when present or planned:

- During the conduct of the job hazard analysis, the diving supervisor must consider whether the use of any surface-tended equipment by the diver will require an additional individual to tend associated cables or hoses. This includes hand jetting, water blasting, cutting and welding, the use of any pneumatic or hydraulically operated tool, or the use of underwater video or sonar equipment requiring a power or data cable not affixed to the diver's umbilical.

- Diving in remote locations where assistance from non-diving crew personnel is not immediately available within communication range of the diving supervisor may require additional members to be added to the dive team.

4.3.1.2 Operational Guidelines

1. The approximate depth of each dive shall be determined prior to the start of operations.
2. The breathing mixture supplied to the diver must be composed of a mixture of gasses that is appropriate for the depth of the dive. When using mixed gas or enriched air, all gasses must be analyzed before they goes on-line for O^2 content and for proper mixture necessary to support the maximum depth of the planned dive.
3. Each diver shall be continuously tended while in the water by a separate dive team member.
4. Each diving operation shall have a primary breathing gas supply sufficient to support all divers for the duration of the planned dive, including decompression.
5. Except when heavy gear (e.g., MK V type equipment) is worn, a diver-worn or carried emergency gas supply (EGS) shall be utilized.
6. If no decompression chamber is on site, the nearest manned operational chamber should be known, and an evacuation plan should be in place.

4.3.1.3 Minimum Equipment Requirements

- Two independent air sources (and volume tanks if applicable) to support two divers.
- Topside secondary air source.
- Adequate supply of gasses for the planned dive profile.
- Two hose groups consisting of:
  - Air hose.
  - Strength member/strain relief. (The strength member may be the entire hose assembly, if so designed.)
  - Communications cable.
  - Pneumofathometer hose.
- One set of air decompression and treatment tables.
- One control station consisting of:
  - Communication systems.
  - Depth gauges and gas distribution system with the capability to supply and control two divers at the maximum work depth.
- Two time-keeping devices.
- One basic first aid kit with means of manual resuscitation (pocket mask or others). Local regulatory authorities may require additional equipment and training
- Emergency O_2 administration kit.
- Two Sets of divers' personal diving equipment consisting of:
  - Helmet or mask.
  - Diver-worn EGS.
  - Weight belt if needed.
  - Protective clothing.
  - Tools as required.
  - Safety harness.
  - Knife.
- Spare parts as required.
- Dive sheets, safe practices manual, first aid handbook and written JHA applicable to job.

4.3.2 SURFACE-SUPPLIED AIR DIVING 0-100 fsw (0 – 30 msw) WITH PLANNED DECOMPRESSION

4.3.2.1 Minimum Personnel Requirements

- One air-diving supervisor.
- One diver.
- One standby diver.

- Two tender/divers.
- At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs.

a. Diving Supervisor

- A qualified person shall be designated as the diving supervisor for each diving operation. The diving supervisor is in charge of the planning and execution of the diving operation, including the responsibility for the safety and health of the dive team.
- The diving supervisor shall posses the proper ADCI supervisor certification card and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

b. Diver

Must have training and/or experience in the following areas:

- Air diving procedures and techniques.
- Emergency procedures.
- Diving accident treatment procedures.
- Proper operation and use of all equipment related to air diving, including decompression chambers.
- Use of air diving equipment.
- Familiarity with the type of work engaged in.

c. Tender/Diver

- Must have the same qualifications as an Air Diver, with a lower level of experience required.

4.3.2.2 Operational Guidelines

1. The approximate depth of each dive shall be determined prior to the start of operations.
2. All breathing media other than air shall be verified for proper composition prior to being placed on-line.
3. A decompression chamber shall be ready for use at the dive location and accessible by the diver within the allowed time frame as prescribed by the decompression schedule.
4. Each diver shall be continuously tended while in the water by a separate dive team member.
5. Each diving operation shall have a primary breathing gas supply sufficient to support all divers for the duration of the planned dive, including decompression, as well as a secondary independent breathing gas supply.
6. Except when heavy gear (e.g., MK V type equipment) is worn, a diver-worn or carried emergency gas supply (EGS) shall be utilized.

4.3.2.3 Minimum Equipment Requirements

- Two independent air sources (and volume tanks if applicable) to support two divers.
- Dive station emergency air source.
  - One double-lock decompression chamber and adequate air source to recompress the chamber to 165 fsw.
  - Adequate supply of gasses for the planned dive profile and a potential treatment.
- Two hose groups consisting of:
  - Air hose.
  - Strength member/strain relief. (The strength member may be the entire hose assembly, if so designed.)
  - Communications cable.
  - Pneumofathometer hose.
- One set of air decompression and treatment tables.
- For planned in-water decompression:
  - Third source of diver's emergency air supply, in addition to diver's umbilical and EGS.
- One control station consisting of:
  - Communication systems.
  - Depth gauges and gas distribution system with the capability to supply and control two divers at the maximum work depth.
- Two time-keeping devices.
  - One basic first aid kit with bag-type manual resuscitator with transparent mask and tubing.

- Two sets of diver's personal diving equipment consisting of:
  - Helmet or mask.
  - Diver-worn EGS.
  - Weight belt if needed.
  - Protective clothing.
  - Tools as required.
  - Safety harness.
  - Knife.
  - Spare parts as required.
  - Dive sheets, safe practices manual, first aid handbook and written JHA applicable to job.

4.3.3 SURFACE-SUPPLIED AIR DIVING 101-190 fsw (30 – 57 msw)

4.3.3.1 Minimum Personnel Requirements

- One air-diving supervisor.
- One diver.
- One standby diver.
- Two tender/divers.
- At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs.

a. Diving Supervisor

A qualified person shall be designated as the diving supervisor for each diving operation. The diving supervisor is in charge of the planning and execution of the diving operation, including the responsibility for the safety and health of the dive team.

The diving supervisor shall posses the proper ADCI supervisor certification card and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

b. Diver

Must have training and/or experience in the following areas:

- Air diving procedures and techniques.
- Emergency procedures.
- Diving accident treatment procedures.
- Proper operation and use of all equipment related to air diving, including decompression chambers.
- Have experience in the use of air diving equipment.
- Familiarity with the type of work engaged in.

c. Tender/Diver

- Must have the same qualifications as an air diver, with a lower level of experience required.

4.3.3.2 Operational Guidelines

1. The approximate depth of each dive shall be determined prior to the start of operations.
2. The breathing mixture supplied to the diver must be composed of a mixture of gases that is appropriate for the depth of the dive. When using mixed gas or enriched air, all gasses must be analyzed for proper mixture necessary to support the maximum depth of the planned dive or decompression.
3. A decompression chamber shall be ready for use at the dive location and accessible by the diver within the allowed time frame as prescribed by the decompression schedule.
4. Each diver shall be continuously tended while in the water by a separate dive team member.
5. Each diving operation shall have a primary breathing gas supply sufficient to support all divers for the duration of the planned dive, including decompression.
6. Except when heavy gear (e.g., MK V type equipment) is worn, a diver-worn or carried emergency gas supply (EGS) shall be utilized.

4.3.3.3 Minimum Equipment Requirements

- Two independent air sources and volume tanks to support two divers.
- Dive station emergency air source.
- One double-lock decompression chamber and adequate air source to recompress the chamber to 165 fsw.
- Adequate supply of gasses for the planned dive profile and a potential treatment.
- Two hose groups consisting of:
  - Air hose.
  - Diver-worn EGS
  - Strength member/strain relief. (The strength member may be the entire hose assembly, if so designed.)
  - Communications cable.
  - Pneumofathometer hose.
- One set of decompression and treatment tables.
- For planned in water decompression:
  - One diving stage or other support platform.
  - Third source of diver's emergency air supply, in addition to diver's umbilical and EGS.
- One control station consisting of:
  - Communication systems.
  - Depth gauges and gas distribution system with the capability to supply and control two divers at the maximum work depth.
- Two time-keeping devices.
- One basic first aid kit with bag-type manual resuscitator with transparent mask and tubing.
- Two sets of diver's personal diving equipment consisting of:
  - Helmet or mask.
  - Weight belt if needed.
  - Protective clothing.
  - Tools as required.
  - Safety harness.
  - Knife.
- Spare parts as required.
- Dive sheets, safe practices manual, first aid handbook and written JHA applicable to job.

4.4 ENRICHED-AIR DIVING (NITROX)

4.4.1 DEFINITION

Nitrogen-oxygen diving (also called enriched-air or NITROX diving) is a technique whereby the O_2 percentage in the breathing mixture is elevated above 21 percent, and the balance of N_2 is reduced proportionately. Due to the reduction in the nitrogen content in the breathing mixture, a diver may work deeper or longer without decompression than a diver breathing air and maintain the same N^2 uptake.

<u>Advantages of nitrogen-oxygen (NITROX) diving over air diving:</u>

- Extended bottom times for no-decompression diving.
- Reduced decompression time.
- Reduced residual nitrogen in the body after a dive.
- Reduced possibility of decompression sickness.
- Reduced nitrogen narcosis.

<u>The disadvantages include:</u>

- Increased risk of CNS oxygen toxicity.
- Long duration dives can result in pulmonary oxygen toxicity.

NITROX is most effective in shallow water with a maximum depth of 100 feet. It can significantly extend bottom time depending on the depth used.

4.4.2 GENERAL

The use of NITROX for diving operations has become a routine and accepted practice to improve divers' safety and the effectiveness of diving operations. While the benefits of using NITROX can be significant, the use of any breathing gas in lieu of naturally occurring air brings with it hazards that must be addressed prior to the start of any diving operation.

Dives using NITROX may be used with any schedule from the U. S. Navy Air Decompression tables. Surface decompression using oxygen is not recommended when diving NITROX due to the increased uptake of oxygen during decompression. Should Sur D O^2 be used, particular attention must be given to total oxygen uptake when planning the dive profile.

When selecting the proper NITROX mixture, considerable caution must be used. The maximum depth of the dive must be known as well as the planned bottom time. If a diver's depth and time profile exceeds that allowed for a certain NITROX mixture, the diver is at a greater risk of life-threatening CNS oxygen toxicity as well as the longer-term effects associated with pulmonary oxygen toxicity. The NOAA Dive Manual provides maximum single and 24-hour exposure times for PPO_2 ranges of 0.6 to 1.6. These times must not be exceeded.

EQUIVALENT AIR DEPTH (EAD)

EAD is an accepted form of calculating the diver's equivalent air depth based on the amount of nitrogen in the diving breathing mix. EAD is then used to determine the proper depth profile when selecting the U.S. Navy Air No-Decompression or Air Decompression Table.

EAD may also be tabulated using a look-up table. The NOAA Dive Manual provides equivalent air depths for oxygen percentages between 28 and 40 percent. The U. S. Navy Diving Manual provides equivalent air depths for oxygen percentages from 25 percent to 40 percent.

The EAD is calculated using the formula:

$$EAD = \left(\frac{FN_2}{0.79} * (d + x)\right) - x$$

Another form of the equation can be shown as:

$$EAD = \left(\frac{FN_2 * (d + x)}{0.79}\right) - x$$

Where:

- FN2 is the fraction of nitrogen in the nitrox mix.
- 0.79 is the fraction of nitrogen in air (including the trace gases).
- d is the actual depth in the appropriate units (fsw or msw).
- x is the depth of water equivalent to 1 Bar in the appropriate units (33 fsw or 10 msw).

Using an EAD enables dives on nitrox to be planned using standard air tables. When diving on air, the EAD is the actual depth. On a hypoxic mix (<21 percent O_2), the EAD would be deeper than the actual depth. On a hyperoxic mix (>21 percent O_2), the EAD will be shallower than the actual depth.

4.4.3 REQUIREMENTS

The following requirements, when used with U.S. Navy Air Decompression tables, will greatly reduce the risk to the diver from CNS oxygen toxicity and pulmonary oxygen toxicity.

1. During all diving operations, the diver's on-line gas supply is to be continuously analyzed for O_2 content, with Hi/Lo audio/visual alarms armed if available.
2. Diver's oxygen exposure times shall be tracked for both single exposure and daily dose maximums. It is recommended that the NOAA Oxygen Exposure Chart of the NOAA Dive Manual or equivalent be utilized.
3. Maximum oxygen percentage of the NITROX mix shall be 40 percent (except when used as a decompression or therapeutic media).
4. All NITROX gasses shall be within ± 1 percent of the certified mixture.
5. During all diving operations, there will be a back-up supply of an appropriate NITROX mix online to the diver's gas supply panel, and if a third supply is deemed necessary, this may be air or NITROX. Any stage gas will also contain the same NITROX mix as the diver is breathing.
6. Divers shall wear bailout bottles at all times. The diver's bailout bottle shall be charged with the same NITROX mixture as the primary supply, tested and properly labeled.
7. Although there are a number of variables to take into consideration in the event the diver does breathe air under pressure during the dive (e.g., incorrect gas mixture on line), the following is to be strictly adhered to:

Abort the dive and decompress the diver as though he or she had breathed AIR throughout the entire dive at the actual depth of the dive (not the EAD).

8. Dives shall be planned so that, should a diver be switched to compressed air at any time during the dive, his or her decompression commitment will not exceed the operational planning limits of an air-dive at that depth.
9. When using U.S. Navy tables, round all gas mixtures using the standard rounding rule: where gas mixes at or above 0.5 percent, round up to the next whole percent; and for mixes of 0.1 percent to 0.4 percent, round down to the next whole percent.

4.4.4 TRAINING

All diving supervisors and divers associated with any commercial diving operation using NITROX shall be trained according to an accepted diving industry standard. Recreational training standards by themselves are not considered adequate for commercial operations. All training must be fully documented. The specific training shall include the following topics:

- Definition of nitrox.
- Historical perspective.
- Advantages and limitations.
- Gas laws and calculations.
- Equivalent air depth formulas and tables.
- Physiological aspects of oxygen.
- Gas supply and analysis.
- Equipment considerations.

4.4.5 OPERATIONAL PROCEDURES

4.4.5.1 Repetitive Dives

Repetitive dives may be performed using EAD and the U.S. Navy Air Decompression schedules. Once EAD is determined for a specific dive, the Standard Navy Air tables are used throughout the dive using the EAD.

4.4.5.2 Diving at Altitude

NOAA NITROX diving tables are useable to 1,000 ft. elevation. At higher elevations, use EAD corrected to seal-level equivalent depth per U. S. Navy Dive Tables tables.

4.4.5.3 Omitted Decompression

Follow procedures outlined in the U. S. Navy Dive Manual.

4.4.5.4 Decompression Chamber Requirement

On all dives where decompression is planned, or deeper than 100 feet, or liveboating deeper than 60 feet, a fully operational decompression chamber will be required to be on site.

4.4.6 GAS SUPPLIES

4.4.6.1 NITROX Breathing Gas Certifications and Labeling

All NITROX gas containers shall be certified as to the N_2O_2 mixture by the vendor or dive contractor supplying the gas and be clearly marked by gas mixture percentage on each container.

4.4.6.2 NITROX Mix Testing

Each container of NITROX being placed on-line in support of diving operations must be tested with a calibrated oxygen analyzer by the diver or diving supervisor to confirm gas mixture prior to use

(on-line at the point of distribution-manifold).

4.4.6.3 NITROX Mix Tolerance

All NITROX gasses shall be within +/- 1 percent of the certified mixture.

4.4.6.4 Breathing Gas Purity

Nitrogen or air must be filtered prior to being mixed with oxygen. It is essential that all gasses used in producing a NITROX mixture meet the breathing gas purity standards for oxygen and nitrogen. If air is to be used to produce a mixture, it must meet the purity requirements of oil-free air (oil mist limit 0.1 mg/m3)

4.4.6.5 Cleaning for N_2O_2 Service

Cleanliness and the procedures used to obtain and maintain cleanliness are a concern with NITROX systems. Current NOAA, OSHA and USCG guidelines allow gas mixes with oxygen up to 40 percent to be handled as if they were air, and the commercial industry routinely uses up to 50 percent O_2 at low delivery pressures without formal O_2 cleaning. However, it is recommended that all equipment be cleaned of any visible debris, then scrubbed manually or cleaned ultrasonically with a strong detergent in hot water, then rinsed several times in clean hot water.

4.4.7 THERAPEUTIC PROCEDURES

In the event therapeutic treatment is required following an NITROX dive, the same procedure will be followed as though the diver had made an air dive.

NOTE: The diver's O_2 uptake must be tracked closely should an O_2 treatment table be used.

Primary Reference Documents:

- Current U.S. Navy Diving Manual
- Current U.S. Department of Commerce NOAA Dive Manual

4.5 SURFACE-SUPPLIED MIXED-GAS DIVING (HeO_2)

All equipment and manning levels should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

The following are minimum requirements for surface-supplied mixed-gas (HeO_2) diving operations:

4.5.1 MINIMUM PERSONNEL REQUIREMENTS

- One mixed-gas diving supervisor (not part of the dive rotation).
- One diver.
- One standby diver.
- Two tender/divers.
- At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs.

4.5.2 OPERATIONAL GUIDELINES

1. The appropriate depth of each dive shall be determined prior to the start of operations. Set maximum depth at 300 fsw (91msw).
2. The breathing mixture supplied to the diver must be composed of a mixture of gasses that is appropriate for the depth of the dive. When using mixed gas, all gasses must be analyzed for O_2 content and for proper mixture necessary to support the maximum depth of the planned dive.
3. A decompression chamber shall be ready for use at the dive location and accessible by the diver within the allowed time frame as prescribed by the decompression schedule.
4. Each diver shall be continuously tended while in the water by a separate dive team member.
5. A diver shall be stationed at the underwater point of entry when diving is conducted in an enclosed or physically-confining space.
6. Each diving operation shall have a primary breathing gas supply sufficient to support all divers for the duration of the planned dive, including decompression.
7. Except when heavy gear (e.g., MK V type equipment) is worn, a diver-worn or carried emergency gas supply (EGS) shall be utilized.
8. HeO_2 dives require a designated manifold operator.

Any operation deeper than 165 fsw requires a method for mitigating the uncontrolled ascent of a diver to the surface. This can come in the form of clipping in the diver's umbilical to the stage or bell, or the use of a "golden gate" apparatus.

4.5.3 MINIMUM EQUIPMENT REQUIREMENTS

All HeO_2 operations will require an open bell. In the event that an open bell cannot be deployed due to confined space or accessibility, an alternate supply of emergency gas, excluding the diver's umbilical, shall be supplied.

- Two gas sources to support two divers (Including planned decompression).
- Readily available dive station emergency gas source.
- One double-lock decompression chamber and adequate air source to recompress the chamber to 165 fsw.
- Adequate supply of oxygen for the planned dive profile and a potential treatment.
- Two umbilical groups (reference Section 6: Hoses).
- One set of decompression and treatment tables.
- One open bottom bell and umbilical and launch recovery system with a secondary means of bell recovery for all operations.
- One control station consisting of:
  - Appropriate communication systems with back up (helium scrambler recommended).
  - Depth gauges and gas distribution system with the capability to supply and control two divers and the open bottom bell at the maximum work depth.
- An oxygen analyzer fitted in-line on the downstream gas supply to diver(s) shall have a hi/low visual and/or audio alarms[2].
- Two time-keeping devices.
- One basic first aid kit with bag-type manual resuscitator with transparent mask and tubing.
- Two sets of diver's personal diving equipment consisting of:
  - Helmet or mask.
  - Weight belt if needed.
  - Protective clothing.
  - Tools as required.
  - Safety harness.
  - Knife.
- Spare parts as required.
- Dive sheets, safe practices manual, first aid handbook and written JHA applicable to job.
- Diver-worn EGS

4.6 SATURATION DIVING

All equipment and manning levels identified should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

The following are minimum requirements for saturation diving operations (based upon 24-hour operations and a single bell run). On multi-day projects, consideration should be given to the number of divers in saturation and the maximum bell run duration to ensure adequate rest and to avoid fatigue.

4.6.1. MINIMUM PERSONNEL REQUIREMENTS

- Two bell/saturation supervisors.
- Two saturation divers.
- Two surface standby divers (saturation qualified).
- Two life-support technicians.
- Two saturation technicians.
- Four tender/divers.

(With the exception of the supervisors and technicians, one member of the dive team should be a diver medical technician or equivalent.)

4.6.2. OPERATIONAL GUIDELINES

All saturation diving operations shall have a reserve volume of gas stored at the dive site equivalent to 1.5X the volume required to pressurize the system to deepest planned working dive, after the system is pressurized.

1. The approximate depth of each dive shall be determined prior to the start of operations.
2. A surface standby diver shall be available when the closed bell leaves the dive location until the divers are in the saturation deck chamber.
3. All closed bell operations (lock-off to lock-on) will be conducted with a minimum of two-man bell runs.
4. Independent primary and secondary supplies of gasses shall be provided for the working diver and the bell diver gas sources and volume tanks to support two divers.
5. A copy of the emergency tap code shall be available to the bell occupants and dive control station personnel.
6. There shall be a means and procedure to evacuate divers under pressure during an emergency.
7. The breathing mixture supplied to the diver must be composed of a mixture of gasses that is appropriate for the depth of the dive. When using mixed gas, all gasses must be analyzed for proper mixture necessary to support the maximum depth of the planned dive.
8. A decompression chamber for the surface standby diver shall be ready for use at the dive location and accessible by the diver within the allowed time frame as prescribed by the decompression schedule.
9. There must be a secondary means to recover the bell.
10. There must be a means to monitor the bell atmosphere for hydrocarbons or other contaminants.
11. A means of decontaminating the diver and/or bell atmosphere is required.
12. There must be a way of removing an incapacitated diver from the water into the bell.
13. Humidity and atmosphere shall be controlled and monitored.
14. Hot water temperature and flow to the diver and inside bell heater must be controlled.
15. The working diver shall be tended from the bell by the standby bellman/saturation diver.
16. A diver-worn emergency gas supply (bailout) shall be utilized (reference Section 6: Diver-worn Emergency Gas Supply).

4.6.3. MINIMUM EQUIPMENT REQUIREMENTS

- All PVHO shall be designed and constructed to local regulatory codes and standards.
- LARS and a secondary system to recover the bell.
- All LARS winches with redundant power supply.
- Redundant independent power supplies for system, control console and environmental controls.
- Secondary means to control environmental system.
- All equipment required for surface mixed-gas diving operations.
- Emergency evacuation system (e.g., HRC or SPHL), in addition to the primary bell.[3]

(Also see Section 6.12.3 EMERGENCY EVACUATION SYSTEMS (EES))

See Saturation Diving Inspection and Checklist Protocol in Section 10: ADCI COMPLIANCE AUDIT PROCEDURES for further details on minimum equipment requirements for saturation diving systems.

SECTION 5.0

UNDERWATER OPERATIONS: PROCEDURES, CHECKLISTS AND GUIDELINES

Association of Diving Contractors International, Inc.

5.0 UNDERWATER OPERATIONS: PROCEDURES, CHECKLISTS AND GUIDELINES

5.1 SAFE PRACTICES/OPERATIONS MANUAL

1. Each employer shall develop and maintain a safe practices/operations manual as required by applicable government regulations and the ADCI and shall make this manual available at the dive location to each dive team member. This manual must provide for the safety and health of the divers. Associate Member Schools are required to have their own version of a Safe Practices & Operations Manual, specific to the safety of both the students and instructors. The manual shall be available at the dive location or at each dive station at the school. The safe practices/operations manual shall meet or exceed the requirements of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations.
2. The ADCI International Consensus Standards for Commercial Diving and Underwater Operations may be used as a set of minimum guidelines to assist companies in developing their own specific safe practices/operations manual. Each employer is responsible for completing, modifying and/or complementing any of the procedures, checklists and standards in accordance with applicable governmental regulations and as dictated by specific policies and practices of the employer.
3. The safe practices/operations manual shall, at a minimum, contain the following information:
   a. A copy of applicable government regulations for the conduct of commercial diving or other underwater operations.
   b. For each diving mode engaged in:
      I. Safety procedures and checklists for commercial diving operations.
      II. Assignments and responsibilities of dive team members.
      III. Equipment procedures and checklists.
      IV. Emergency procedures for fire, equipment failure, adverse environmental conditions, medical injury and illness.
4. The ADCI strongly recommends that each safe practices/operations manual contain a definitive statement regarding the use of drugs or alcohol. Such language should include references to applicable governmental regulations regarding drug and alcohol use in the work place. Additionally, such a statement should reference the employer's ADCI-required drug and alcohol program (reference Section 5.3: Drug and Alcohol Screening).

5.2 EMERGENCY AID

1. Each employer shall develop and maintain a list of the available sources of emergency aid, equipment and professional assistance with call signs, phone numbers or other means and instructions for establishing contact with them for locations where operations are conducted. The hours of operation of the nearest hyperbaric facility, along with its chamber capability, i.e. 6 ATA or 165'.
2. Each contractor shall make the contact list available at the company's principal place of business, at the field operations office and to those who may have a need for it to fulfill the company's emergency response plan.
3. The list shall include information necessary to obtain the following types of emergency aid as appropriate for the type of diving or underwater activity conducted:
   - Decompression chamber.
   - Hospital or medical treatment facility.
   - Air or ground transportation.
   - On-call physician.
   - Coast Guard or other national Rescue Coordination Centers.
4. Two-way communications shall be available and accessible at any diving, hyperbaric or other underwater work site in order to engage emergency services as required.

5.3 DRUG AND ALCOHOL SCREENING

1. A pre-employment drug screening program shall be in place.
2. A routine, random and "for cause" drug screening program shall be in place.

5.4 FIRST AID

1. First aid supplies appropriate to the type of operation being conducted shall be provided and kept readily accessible in a clearly marked container at the work site.
2. In addition to any other first aid supplies and standard first aid handbook (or equivalent), a means of manual resuscitation (pocket mask or others) is required. Local regulatory authorities may require additional equipment and training (e.g., emergency O2 administration kit).
3. A recommended list of the contents for a first aid kit is set forth below to reflect what should be considered the **minimum** contents. Each operator should review this list and make additions or substitutions as necessary to ensure that effective and timely first aid can be furnished.
4. Documented inspection of first aid kit contents is required annually.

INVENTORY:

ADCI BASIC FIRST AID KIT (COMMERCIAL DIVING)

PRODUCT NAME	SIZE	QUANTITY
Contents Card	Each	1
Physician Approval Letter	Each	1
Seahorse Case 630	Each	1
WOUND CARE		
Band Aid Assorted Fabric	Each	100
Burn Dressing 4" x 4"	Each	1
Conforming Gauze 2"	Each	2
Conforming Gauze 4"	Each	2
Cotton Pads	Each	10
Cotton Tipped Applicators 3"	100	1
Elastic Bandage 4"	Each	2
Eye Pad Large	Each	6
Gauze Pads 2" x 3"	Each	8
Gauze Pads 3" x 4"	Each	5
Sam Splint	Each	1
Trauma Dressing 8" x 10"	Each	4
Tape Waterproof 3 in 1	Each	1
Triangular Badge	Each	3
EMERGENCY		
Airway Kit Guedel sizes 00-4	Each	1
CPR Pocket Mask	Each	1
Resuscitator Bag Valve Mask with Mask & Tubing	Each	1
SKIN PREPARATIONS		
BZK Antiseptic Towelettes	Each	10
Burn Free Gel U/D	Each	6
Eye Cup Plastic	Each	1
Eye Wash	120ml	1
Hydrocortisone 1% Cream U/D	Each	10
Hydrogen Peroxide Solutions	120ml	1
Povidone Iodine Swabsticks	Each	10
Triple Antibiotic Ointment U/D	Each	10

PRODUCT NAME	SIZE	QUANTITY
INSTRUMENTS & MEDICAL APPLIANCES		
Biohazard Bag 23" x 23"	Each	4
Instant Cold Compress 5" x 7"	Each	2
First Aid Booklet	Each	1
Forceps Splinter 3.5"	Each	1
Gloves Nitrile Large	1 Pair	6
Safety Pins Large	12	1
Trauma Shears	Each	1
For-purpose manufactured tourniquet	Each	1
MEDICATIONS		
Acetaminophen 325mg U/D Tablets	Each	10
Alka Seltzer Tablets	12	1
Ammonia Inhalants	10	1
Antacid Calcium Supplement	150	1
Aspirin 325mg U/D Tablets	Each	10
Bismuth Chewable Tablets (Pepto Bismol)	30	1
Charcoal Activated Liquid	120ml	1
Diphenhydramine 25mg Caplets	24	1
Ear Relief (Alcohol Free)	10ml	1
Guaitussin DM Cough Syrup	120ml	1
Ibuprofen 200mg U/D Tablets	Each	10
Loperamide 2mg Caplets	12	1
Pseudoephedrine 30mg Tablets	24	1
Sting Relief Medicaine Swabs	10	1
NOT FOR USE IN HYPERBARIC CHAMBERS		
Alcohol Preps	10	10
Insect Repellent Pump Spray	2oz	1
Oxymetozaline Nasal Spray	15 ml	1
Sunscreen Lotion (SPF 30)	120ml	1

Disclaimer: This First Aid Kit is compliant with ADCI CS 6.1, ANSI#Z308.1-2009, OSHA#29CFR1910, USCG#46CFR160 & 197, AND USACE EM385-1-1 requirements for both inshore and off shore commercial divers and is Hyperbaric / Decompression Chamber compatible with the exception of the listed items in the NOT FOR USE IN HYPERBARIC CHAMBERS section.

5.6 DESIGNATED DIVING SUPERVISOR

1. A qualified person shall be designated in charge of each diving operation. The responsibilities of such designated persons should include job planning, coordination, record keeping and proper response to any job-related emergency, as well as knowledge of the appropriate governmental regulatory agency regulation. **(Reference Section 3: Diving Personnel Responsibilities, Qualifications and Certifications.)**

All ADCI general member company supervisors must possess a current ADCI supervisor certification card reflecting the level of diving being conducted.[1]

5.7 STANDBY DIVER REQUIREMENT

At least one member of every dive team shall be designated the standby diver and should be suitably prepared to enter the water when directed by the diving supervisor.

Prior to commencement of the operation, the standby diver's equipment shall be fully verified as functioning correctly and thereafter maintained in that condition until completion of the dive. Should the standby diver be required to enter the water, a surface check shall be completed to ensure proper breathing gas supply, bailout function and effective communications before the diver leaves the surface. The standby diver shall utilize the same mode and level of equipment as the primary diver.

5.8 PLANNING AND ASSESSMENT

<u>The planning of a diving or underwater operation shall include a dive operations plan.</u>

During the planning and assessment phases of a diving or underwater operation, before diving operations commence, a plan must be developed to ensure the safe and efficient performance of the work. In either case, the dive operations plan is a critical element of any diving or underwater project.

In general, the operations plan will address such issues as the details relative to the goals and methods for the project, operational sequence, operational safety, crew and equipment requirements, emergency procedures, communications, and regulatory requirements. This list is not finite, and the items to be addressed in the dive operations plan will be uniquely dictated by the specifics of each particular project.

A dive operations plan differs from the Job Hazard Analysis (JHA) in that JHA is focused specifically on project safety only, whereas the dive operations plan is designed to ensure the work is well-understood and properly planned, manned and equipped.

5.8.1 JOB/PROJECT SAFETY

- Dive operations should be planned in accordance with regulatory authorities and ADCI consensus standards.
- An ADCI certified diving supervisor shall be in charge of the diving operation.
- All diving personnel shall be ADCI certified for the task they are assigned.
- An emergency response plan shall be available, posted and reviewed by all personnel.
- A pre-dive safety meeting shall be conducted.
- The job and all tasks shall be defined, reviewed and understood by the dive team and vessel personnel.
- The supervisor will perform a job-specific JHA.

5.8.2 DIVING AND SUPPORT PERSONNEL

- Ensure all divers are trained and experienced for the task they are to perform.
- Verify that all divers are physically and mentally fit to dive.
- Ensure that all personnel on the job have direct communication with all parties directly involved in the dive operation.

5.8.3 EQUIPMENT

- Ensure that dive gear and support equipment has been inspected/checked and ready for dive operations. (See basic example of pre-dive checklist in Section 10: ADCI Compliance Audit Procedures.)
- Ensure all emergency and support equipment has been inspected/checked and is fully functional.
- Ensure all needed methods of communication are available and functioning.
- Ensure all first aid/CPR (resuscitator) equipment and kits, as well as backboard, are well-supplied and available.
- Ensure that all dive flags/shapes/signals are prominently displayed during dive operations.

5.9 JOB HAZARD ANALYSIS (JHA)

(See Section 11: Reference Materials for a sample JHA form.)

Before any underwater task is begun, a job safety analysis (JHA) shall be performed.

The purpose of the JHA is to provide a written document identifying hazards associated with each step of a job and develop solutions that will either reduce, eliminate or guard against hazards. On the JHA, sentences should be short and simple. The ADCI sample JHA form in the Section 11: Reference Materials can be copied and used as is or modified to suit individual company needs.

1. **Sequence of Basic Job Steps**

   Break the job into observable steps. Do not be too general or overly detailed.

   - If the job is complex, break it into several tasks and prepare a JHA for each task.
   - Begin with an active verb, e.g., disconnect, check, invert, assemble, isolate, start, stop, etc.
   - Number each step.

2. **Potential Hazards**
   - Identify possible hazards associated with each step and list that hazard opposite the job step.
   - Consider potential accident causes (strain, sprain, slip, fall, cut, crush, etc.).
   - Consider environmental and health hazards (vapors, gasses, heat, noise, toxicity, etc.).

3. **Recommend Safe Procedures and Protection**
   - Develop solutions for each potential hazard and list the solution opposite the hazard.
   - Detail controls, e.g., ventilate, isolate, allow to cool, secure, guard, train, etc.
   - List personal protective equipment (PPE) required, e.g., gloves, eye protection, respirators, fall protection, etc.

4. **Assign Responsibility**
   - Assign a specific person the responsibility of implementing the safety procedures or protection required.

5. **Personnel Involved**
   - Identify the persons preparing, reviewing and approving the JHA.
   - Distribute the JHA to all personnel involved in the job or task and ensure that each person is familiar with the contents of the JHA.

6. **Revising the JHA**

The JHA should be reviewed and updated whenever new equipment, products or procedures are introduced into the work site. This is especially true if an accident has occurred on a task upon which a JHA has been performed.

5.10 TEAM BRIEFING

1. Before commencing with any underwater operation, the dive team members shall be briefed on:
   - The tasks to be undertaken.
   - Safety procedures for the diving mode.
   - Any unusual hazards or environmental conditions likely to affect the safety of the underwater operation.
   - Any modifications to operating procedures necessitated by the specific underwater operation.
2. Before each dive, the diver shall be instructed to report and record any physical conditions, problems or adverse physiological effects that may render the diver unfit to dive.

5.11 TERMINATION OF DIVE

1. The working interval of a dive shall be terminated when:
   - Directed by the dive supervisor and/or the person in charge.
   - The diver requests termination.
   - The diver fails to respond correctly to communications or signals from a dive team member.
   - Communications are lost and cannot be quickly re-established with the diver, the tender/diver and/or the diving supervisor.
   - In liveboating operations, the person controlling the vessel requests termination.
   - The diver begins to use the diver-carried reserve breathing gas or the dive-location reserve breathing gas.

5.12 POST-DIVE PROCEDURES

1. After the completion of each dive, the diver shall:
   - Be questioned as to his or her physical condition.
   - Be instructed to report any physical problems or adverse physiological effects, including symptoms of decompression sickness or gas embolism.
   - Be advised of the location of an operational decompression chamber.
   - Be alerted to the potential hazards of flying after diving.
   - Be alerted to the potential hazards of traveling to higher elevations from the dive site.
2. After the completion of any dive outside the no-decompression time/depth limits, the following are recommended:
   - Take reasonable steps to have the diver remain awake and in the vicinity of the decompression chamber for at least one hour.
   - Instruct such divers to remain within two hours travel time of the decompression chamber for an additional five hours.
   - Instruct such divers of the hazards of flying after diving.
3. On any dive that results in decompression sickness, proper medical authority should be consulted prior to the diver flying after treatment.

5.13 COMPANY RECORD OF DIVES (DIVE LOG) REQUIREMENTS

Each employer shall establish and maintain a record of each diver's hyperbaric exposure. This record shall contain the following:

- Name and address of the company.
- Location, time and date of diving operations.
- Names of the dive supervisor, diver and tender/diver.
- Depth of dive.
- Bottom time.
- Approximate water temperature and thermal protection used.
- Environmental conditions (approximate sea state, underwater visibility and underwater currents).
- Decompression tables and schedule used.
- Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation.
- Breathing mixture used and composition.
- Type of work performed.
- Type of diving equipment worn.
- Any unusual conditions.
- For each dive for whom decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:
  - Description of decompression sickness symptoms, including depth and time of onset.
  - Description and results of treatments.
- Diver's condition upon surfacing. Diver Signature:____

5.14 DECOMPRESSION PROCEDURE ASSESSMENT

Each employer shall:

- Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of the decompression table used, and individual susceptibility.
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness.
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken.

5.15 MINIMUM REST HOUR POLICY

Except in an emergency, diving operations personnel may work no more than 18 continuous hours when that work includes loading equipment; traveling to the job site by air, land or sea; setting up the dive station; standing by to commence diving operations; participating in diving operations; or any combination of same. After 18 continuous hours of performance, such persons must be provided a minimum of eight consecutive hours away from the dive station and engaged in no alternate work activity.

Excluded from the above are any hours during the initial 18-hour period where diving operations personnel may have been afforded an opportunity for an uninterrupted period of sleep in excess of four hours. That opportunity may be considered to have been afforded during such times as during transport to the job site by land, sea or air.

When duty at the dive station does not include activities under paragraphs 1 and 2 above, diving operations personnel will not be permitted to work more than 16 hours in any 24-hour period or 60 hours in any 96-hour period, except in an emergency. Furthermore, such persons must be given at least eight consecutive hours off duty between work periods.

An emergency exists when a there is direct threat to the continued health and wellbeing of an individual or individuals or a significant loss of property may take place as the direct result of an unplanned event.

5.15.1 COVERAGE

This policy is intended to apply to all members of the operating dive team, including diving supervisors, divers, life-support technicians and tenders. Excluded from this policy are persons falling into the contractors' management category, such as those performing duties of a project manager, project superintendent, diving superintendent or other individuals whose activities are not required to take place at the actual dive station during a regularly scheduled shift/watch.

5.16 HAZARDS TO UNDERWATER OPERATIONS

1. Notice shall be given of the planned underwater operations, including the daily start and finish times, to those in the vicinity whose activities may interfere with or pose a hazard to personnel engaged in the operation. These activities include underwater demolition, movement of surface vessels, lifting of material directly over the underwater operations, etc.
2. Diving operations shall not take place wherever hazardous activities or conditions in the vicinity pose a safety hazard to the divers or impair the support personnel from safely carrying out their work tasks.
3. In no case shall the diver be required to dive against his or her will.

5.17 DIFFERENTIAL PRESSURE (Delta P)

A significant number of fatalities in the diving industry involve a differential pressure (Delta P) situation. Delta P is a particularly insidious hazard for several reasons:

- Delta P is invisible to a diver and strikes suddenly, without warning.
- Once entrapped by Delta P, there is almost no way to escape.
- If the velocity profile of a hazard is such that at the periphery, the diver may approach without any perceptible increase in the water flow velocity. By the time the diver can feel the water velocity, it is already at a dangerous level.
- Even small forces may be compounded by factors such as the immobilization of limbs or the geometry of the structure surrounding the Delta P hazard.
- The application of as little as 77 pounds of force (35 kilograms/343 newtons) on the torso can impair respiration and disrupt blood flow. A diver's chest, back, or abdomen trapped against a 9-inch by 9-inch opening with a Delta P of only 1 psi (less than 2.5 feet water head) would experience 81 pounds of force.
- Currents of 1 knot (0.5m/s/1.64 fps) or more are very difficult for a diver to overcome, and can sweep a diver, or diver's umbilical, into a Delta P hazard. A 6-inch diameter opening with a Delta P of 10 feet of water can create current velocities exceeding 1 knot 16 inches or more from the opening, depending on geometry of the surrounding structure; 10-inch opening with the same Delta P can create hazardous currents over 2 feet from the opening.

5.17.1 TYPES OF DELTA P

1. When water levels between adjoining areas vary and are attempting to equalize.
2. When water is adjacent to a gaseous void at lower pressure than the water pressure.
3. When water is mechanically drawn through intakes or pumps.
4. When water is mechanically drawn towards propellers or other types of thrusters on ships.
5. Positive pressure being released from HP subsea wells or pipelines.

5.17.2 EXAMPLES OF DELTA P

- Clogged intake screen (type 1 from above).
- Outlet screen/trash rack on dams (type 1 from above).
- Hole in a water storage tank (type 1 from above).

- Open sluice gates (type 1 from above).
- Opening in a barrier between two areas (type 1 from above).
- Transfer pipes (type 1 from above).
- Water tower drain (type 1 from above).
- Diver installing a section of pipe with flange protectors over the ends without a vent (type 2 from above).
- An existing hole in an underwater pipeline (type 2 from above).
- Cutting into an underwater pipeline or other void with Delta P (type 2 from above).
- Pump house intake (type 3 from above).
- Air lifts or dredges (type 3 from above).
- Draw from thrusters on a ship (type 4 from above).

5.17.3 RECOMMENDATIONS

- Attend a pre-job meeting to understand where the hazards may be.
- Know the layout of the facility you are working in. (Review plans of facility or as-builts, if available.)
- Understand where the potential for Delta P may exist.
- Ensure high-quality, well-informed leadership, backed up by the provision of adequate information, instruction and training, for the dive teams and other relevant personnel.
- Make sure the diver and supervisor know how the piping and valve systems work together.
- Make your concerns regarding potential Delta P hazards clear to personnel of the company you are working for.
- Check and ask about any pumps, suctions, gates or valves.
- Physically verify that all gates or valves around the divers' work area are properly positioned and locked/tagged out as applicable.
- Perform any lockout/tagout procedures necessary to perform the job as safely as possible.
- Calculate the water forces in the potential Delta P areas.
- Check for flow using a flow meter if applicable.
- Brief the diver as to the location of any possible suction. Use of a simple illustration can be very beneficial.
- Be cautious when diving on a structure where damage is suspected.
- Where possible, establish an exclusion zone of such a size as to incorporate a suitable safety margin around a hazard.
- Keep the divers' umbilical taut to prevent the umbilical from getting caught in a Delta P situation.
- Limit the amount of umbilical given to the diver.
- Keep in communication with topside and make sure topside and any other divers in the water know exactly where you are at all times.
- Verify that all the divers' equipment is properly hooked up, and ensure that there are no loose articles that could get drawn in.
- On dynamic positioning (DP) vessels, the diver's umbilical should be at least 16 feet shorter than the distance to the closest hazard, such as propellers and thrusters. The standby diver's umbilical must be 10 feet shorter than the closest hazard.
- The standby divers' umbilical must be long enough to be able to reach the primary diver at all times.
- Install screens or guards over openings when possible.
- If cutting into a low pressure area, cut slats spaced apart instead of holes in order to allow water to keep flowing even if the diver is in front of part of that opening.
- Special attention should be given to air lifts and dredges in all depths, especially those greater than 33 feet.
- A remote pre-dive survey may need to be conducted prior to divers entering the water. This may be done using an ROV, drop camera, flow meter, etc. (see remote pre-dive survey methods below).
- Consider the condition of the structure. Failing parts of the structure can allow a Delta P hazard.

Control measures should be implemented as possible in the following order of importance:

1. Eliminate the hazard:
    - Dive on the downstream side of the hazard.
    - Equalize water levels or fill any voids
    - Substitute divers by using remotely operated vehicles (ROV).

2. Use engineering controls to eliminate the hazard (engineering controls should distance the diver from or prevent the formation of a Delta P hazard):
   - Limit the length of the diver's umbilical or lifeline.
   - Construct guards/screens or close valves to minimize entrapment potential.
   - Separate the diver from the hazard by using more than one valve (redundancy) when possible.
3. Use of safe systems at work:
   - Use lockout/tagout procedures to isolate valves, pumps intakes and propulsion devices.
   - Evaluate the effectiveness of the control measures prior to the diver entering the water.
   - Divers and crew should be given training to recognize pressure hazards and risks. The pre-dive safety meeting should encompass the risks of Delta P hazards.
4. Personal protective equipment (PPE):
   - Use of surface-supplied air breathing apparatus incorporating an umbilical with appropriate strength member.
   - Full face mask or helmet that incorporates topside communications.

5.17.4 REMOTE PRE-DIVE SURVEY METHODS

The use of some kind of water movement detection device is recommended when a potential Delta P situation exists. Even if the indicator on a valve or gate indicates that it is in the closed position, the indicators may not be functioning properly. For example, in the case of a bent control stem, the effective length of the stem will shorten, resulting in the indicator showing that the valve is in the closed position even though the valve or gate may not be completely closed.

Historically, a weighted mop head or similar device (telltale) was often lowered in front of a potential Delta P hazard. If it was drawn towards the area, or sucked in, that would indicate a Delta P hazard. This method is still used today and can be an effective means of determining the presence of a Delta P hazard. However, technology has advanced with the use of digital readout flow meters, which can be lowered through the water column and will electronically display the flow rate (typically in ft/s). This can be converted to knots if desired (see formulas below).

5.17.5 FORMULAS

The following formulas can and should be used to calculate the potential forces and flows that the diver may encounter while diving near a potential Delta P hazard. These formulas can also be used to express the potential dangers of a Delta P hazard to the client.

Force due to differential pressure calculation (U.S. standard)

F=D x density x Area

Where: F = Pounds of force

D = Difference in water level (ft)

density = 62.4 pounds per cubic foot of fresh water

density = 64.1 pounds per cubic foot of sea water

A = πr^2 for a circle (r is radius in feet)

A = Length x height (in feet) for a rectangle or square

Example: A hole that is 1-foot x 2 feet is located 10 feet below water on a sinking ship. How much force would be on an object placed over the hole?

F=(10')(64.1)(2ft²) = 1,282 lbs.

Force due to differential pressure calculation (metric)

F=D x density x Area

Where: F = Kilograms of force (kgf)

D = Difference in water level (m)

density = 1025 kg $\cdot m^3$ for sea water

density = 1000 kg $\cdot m^3$ for fresh water

$A = \pi r^2$ for a circle (r is radius in meters)

A = Length x height (in meters) for a rectangle or square

Calculation of water flow through an opening (U.S. standard)

Q=3600 x (A) x (√ D)

Where: Q = Flow rate (gpm)

A = Area of opening (ft^2)

D = Depth of water above the opening (ft)

Calculation of water flow through an opening (metric)

Q=4.43 x (A) x (√ D)

Where: Q = Flow rate (m^3/s)

A = Area of opening (m^2)

D = Depth of water above the opening (m)

Convert feet per second to knots = (fps) x 0.5925 = knots

5.17.6 MISCELLANEOUS FACTS

- If the velocity profile of a hazard is such that at the periphery, the diver may approach without any perceptible increase in water flow velocity. By the time the diver can feel the water velocity, it is already at a dangerous level.
- Even small forces may be compounded by factors such as the immobilization of limbs.
- The application of as little as 77 pounds (35 kilograms) on the torso can impair respiration and disrupt blood flow.**5.17.7**

5.17.7 REFERENCES

Association of Diving Contractors International, Inc. “The Hazards of Working in Delta-P Work Environments,” 2010 Video.

For order information, go to www. .adc-int.org/products.php

Fisher, A.S.; Gilber, M.J.; Anthony T.G. “Differential Pressure Hazards in Diving,” Health and Safety Executive RR761, (2009): pp 107.

Tucker, Wayne C. “Diver’s Handbook of Underwater Calculations.” San Pedro: Best Publishing Company, 1980. Print.

5.18 TEMPORARY IMPAIRMENT OR CONDITION

Divers shall not dive or be otherwise exposed to hyperbaric conditions for the duration of any known temporary impairment or condition if such is likely to adversely affect health or interfere materially with the person’s ability to safely perform a specific diving task or safely be exposed to hyperbaric conditions. These include, but are not limited, to colds, alcoholic intoxication or its aftereffects, influence of drugs, pregnancy, respiratory or middle ear diseases, skin or external ear infections, excessive fatigue, or emotional distress. The diver should be consulted before such determination is made. In no case shall the diver be required to dive or be exposed to hyperbaric conditions against his or her will, except for treatment procedures.

5.19 ENTERING AND LEAVING THE WATER

There shall be a safe means for entering or leaving the water from the diving platform, such as a ladder, stage or other appropriate device. If a ladder is used, this device shall extend a minimum of 3 feet below the water surface. Additionally, the means of entering and leaving the water shall be adequate to facilitate rescue of personnel. In any instance where the air gap from the location of the dive station and waterline is greater than 15 feet (5 meters), it is highly recommended that a stage or other appropriate device be the preferred means of entering or exiting the water.

5.20 REQUIRED DECOMPRESSION CHAMBER AVAILABILITY

1. For any dive in excess of 100 fsw, dives deeper than 60 fsw (18.29 msw) when liveboating or where dives require decompression, a dual-lock decompression chamber having a minimum capability of 6 ATA (equivalent to 165 fsw/50.3 msw) shall be available and ready for use at the dive site.
2. Prior to mobilization on jobs not normally requiring a decompression chamber, a job hazard analysis shall be performed to determine whether a decompression chamber will be required at the dive location. Those considerations may include, but not be limited to:

- Dive site location with respect to a known and identified location of a decompression chamber that will be available under emergency circumstances.
- Multi-day and/or repetitive diving operations.
- Potential for diver fouling or entrapment.

Other potential hazards or factors that may cause the diver to incur decompression obligations.

- Liveboating operations.
- Remote locations.

5.21 INSPECTION OF LIFE-SUPPORT SYSTEMS, EQUIPMENT AND TOOLS

1. Before diving or other underwater operations commence, personnel shall confirm that all operational systems, equipment and tools to be used are in working order, appropriate for the tasks and are in compliance with the information presented in **Section 6: Life-Support Equipment: Requirements, Maintenance and Testing.**
   - To ensure the highest standard of safety, checklists shall be used to confirm that the systems, equipment and tools are in safe working order.
2. Operational systems, equipment and tools used in underwater operations shall be inspected daily and monitored throughout the operations by designated persons.
3. Each person engaged as a diver in the diving operation shall inspect his or her personal diving equipment and confirm its operational readiness prior to each use. The diving supervisor or his or her designated alternate shall be likewise required to check the equipment of each diver before the diver enters the water.

5.22 THERMAL EXPOSURES TO DIVING PERSONNEL

5.22.1 PROCEDURES FOR DIVING IN COLD WATER AND COLD WEATHER

(Cold water is defined as water that is less than 40°F/4°C.)

5.22.1.1 Diver

1. To help prevent hypothermia, the diver should wear appropriate thermal protection based upon the water temperature and expected bottom time.
2. In cold water (below 40°F/4°C), a dry suit or hot water suit should be worn to keep the diver properly protected.
3. Make sure the suit fits properly and that all the seals are in good condition.
4. Because severe chilling can result in impaired judgment, the tasks to be performed under water must be clearly identified, and the diver's condition should be continually monitored.
5. Keep hydrated at all times.
6. Exercise on a regular basis.
7. Do not exercise in cold water to try and stay warm. Exercise will cause the body temperature to fall more rapidly.
8. Bring the diver up if the diver is showing minor or severe symptoms of hypothermia. Minor symptoms include uncontrolled shivering, slurred speech, imbalance and/or poor judgment. Severe symptoms include loss of shivering, impaired mental status, irregular heartbeat and/or very shallow pulse or respiration (this is a medical emergency).
9. Upon exiting cold water:
   - If the diver is wearing a wet suit or hot water suit, immediately flush the suit with warm water. Doing so will have a comforting, heat-replacing effect.
   - Get the diver to a dry and relatively warm area as soon as possible.
   - The diver should remove any wet dress, dry off and don warm, protective clothing as soon as possible.
   - Hot, non-alcoholic beverages should be available to the diver.

5.22.1.2 Tender And Topside

1. Topside personnel should wear warm, proper protective clothing.
2. Plan extra time to perform tasks under cold conditions.

5.22.1.3 Equipment And Maintenance

1. The moisture in an air compressor and air lines must be dealt with to prevent freezing in the air system, which can cause catastrophic damage or failures.
2. The dive crew can also make use of high-pressure cylinders, which generally will contain less moisture than air produced by a low-pressure compressor.
3. Topside must continually empty the excess water out of the volume tank to help reduce the amount of moisture in the system.
4. Do not allow the diver's umbilical to rest for long periods of time on cold surfaces (barge decks, etc.). Fittings on the umbilical can transfer the temperature from the cold surface and cause the moisture in the diver's umbilical to freeze.
5. In water temperatures of 37° F (3° C) or less, first stage regulator on bailouts should be equipped with a proper cold water setup (environmental kit).
6. Extra precautions must be taken to make sure that the bailout cylinders are completely dry inside, that moisture-free air is used and that the regulator is thoroughly dried prior to use.
7. If using a hot water machine, careful attention must be exercised to monitor the output temperature of the hot water machine. In extreme cold-water environments, the hot water machine is classified as life-support equipment. Failure in the system can cause catastrophic results for the diver.
8. Failure of the hot water machine during decompression must be considered during the operation and dive plan.
9. Gasoline and diesel engines must be cold-weather modified to prevent engine freeze-up.
   - Use proper lubricants in the diver's air compressor.
   - Use appropriate cold-temperature lubricants in pre-packed bearings.
10. Bring extra batteries for equipment. Cold temperatures can shorten the life of a typical battery.
11. A hypothermia management kit should be considered.
12. Extreme caution must be exercised when refueling in dry, cold weather. Static electricity should be "drained off" by grounding the equipment or fuel container (away from vapor openings) with the hand. Static electricity can form in the layers of clothing worn by personnel and can cause a spontaneous discharge of electricity, which can ignite fuels.
13. When using a funnel, use funnels with copper screen to help filter out ice particles and foreign debris.

Precautions should be taken to protect divers and topside personnel from adverse thermal exposure and maintain proper thermal balance while engaged in operations.

5.22.2 PROCEDURES FOR DIVING IN HOT WATER

(Hot water is defined as water that is greater than 87° F/30.5°C.)

5.22.2.1 Diver

1. In many cases, hot water is the product of an industrial process and is often contaminated. As such, proper contamination protection equipment should be utilized by both the diver and topside personnel. While protecting personnel from possible contaminants in the water, such protective equipment can exacerbate the heat issues to the diver and topside personnel, so extreme caution must be taken when contamination protection measures are necessary.
2. To help prevent hyperthermia, the diver should wear appropriate thermal protection based upon the water temperature and expected bottom time. In hot water environments, a tube suit that circulates cool water through an undergarment beneath a diver's dry suit may be used. These were originally developed for foundry workers but have been modified for use by divers in hot water environments. Some ADCI member companies have found them to be effective in water temperatures up to 100°F depending upon the exposure time of the diver. Beyond that, some member companies have performed short dives in temperatures up to 120°F, although this is an extreme environment (i.e. a normal hot tub is generally around 100°F to 104°F). For this environment, some companies use special suits called shroud suits, which consist of an outer garment that goes over the diver's dry suit. A large supply of cold water is pumped into the shroud suit and exits in a controlled manner, keeping a cooler temperature envelope around the diver. Because this is such an extreme environment with many safety hazards, it is advised that divers be used as a last resort.
3. Care should be taken to ensure that water flow to and from the diver does not become obstructed due to line kinks or other impediments.
4. Heat absorption can occur rapidly through the diver's pate and so this area must be kept cool. Additionally, the diver's breathing gas will be heated due to the umbilical being in the water and all excess umbilical shall be kept out of the water. Additionally, in extreme cases, other methods may be needed to ensure that the diver's breathing gas is delivered as cool as possible.
5. Make certain the suit fits properly and all seals are in good condition.

6. Because overheating can result in impaired judgment, the tasks to be performed underwater must be clearly identified, and the diver's condition should be continually monitored.
7. Keep hydrated at all times.
8. Ensure that the diver is in good physical condition.
9. Bring the diver up if the diver is showing minor or severe symptoms of hyperthermia. Since a diver might have been in water that may not be considered hot, support personnel must not rely solely on classical signs and symptoms of heat stress for land exposure but be aware of commonly encountered signs and symptoms of hyperthermia in diving. Minor symptoms include profuse sweating, high breathing rate, inability to think clearly, fatigue, headaches or lightheadedness, muscle cramps, nausea and vomiting. Severe symptoms include the cessation of sweating, sudden rapid increase in pulse rate, the change in mental status, disorientation or confusion, exhaustion and potential seizures, loss of consciousness or shock (this is a medical emergency).
10. Upon exiting hot water:
    - If the diver is wearing a chiller suit or a cold water suit, immediately flush the suit with cool water and remove after the diver is sufficiently cooled. If a dry suit is worn and cannot be immediately removed due to contamination, cool the exterior of the dry suit with cool water.
    - Cool, non-alcoholic beverages should be available to the diver.

5.22.2.2 Tender and Topside

1. Overheating is a risk when wearing protective clothing while operating in contaminated environments. Constant monitoring of topside personnel for heat related issues is necessary in such situations.
2. Ensure that cool, non-alcoholic drinks are available, as well as cool, damp rags for cooling purposes.
3. Ensure that access to climate controlled environments is readily available, if necessary.
4. Continue to monitor topside personnel conditions as you would a diver.
5. Plan extra time to perform tasks under hot conditions.

5.22.2.3 Equipment and Maintenance

1. In humid environments, volume tanks and filters will build up moisture and will need to be continually drained.
2. The dive crew can make use of high-pressure cylinders, which generally will contain less moisture than air produced by a low-pressure compressor.
3. Keep the amount of the umbilical in the water to a minimum. Doing so will reduce the amount of hot water contacting the air and coolant hoses, resulting in lower temperature air and coolant for the diver.
4. If using a cold water machine, careful attention must be exercised to monitor the output temperature of the cold water machine. In extreme hot-water environments, the cold water machine is classified as life-support equipment. Failure in the system can cause catastrophic results for the diver.
5. Failure of the cold water machine during decompression must be considered during the operation and dive plan.
6. A hyperthermia management kit should be considered.

Precautions should be taken to protect divers and topside personnel from adverse thermal exposure and maintain proper thermal balance while engaged in operations.

5.23 DIVING OPERATIONS WARNING DISPLAY

For areas that support marine traffic, an appropriate warning display shall be exhibited near the work site so that it has all-around visibility. This may include, but is not limited to, shapes, lights, flags or placards. <u>These signals should be given only when actual diving operations are being conducted.</u> When diving from surfaces other than vessels in areas capable of supporting marine traffic, a regid replica of the international code flag "A" at least one meter (3'-3.5') in height shall be displayed at the dive location in a manner which allows all around visibilty, and shall be illuminated during night operations. It is also recommended that the "Dive Down" flag (red flag with a white diagonal stripe commonly used by recreational SCUBA divers be used in conjuction with the "Alpha" flag).

5.24 DIVER-WORN OR CARRIED EMERGENCY GAS SUPPLY

A calculated 4 minute minimum of EGS is required for the deepest depth to be attained.

1. A diver-worn or carried emergency gas supply must be provided for all diving operations, except where heavy gear (defined as diving equipment of the nature of the U.S. Navy MKV, or equivalent) is involved.
2. A diver-worn or carried emergency gas supply shall provide a physiologically appropriate mixture and a minimum four-minute capacity for the depths involved.
3. Diver-worn or carried emergency gas supply must provide a positive indication to the diver that his or her reserve has been actuated. Such an indication can be the requirement for the diver to open a valve, a visual signal or other appropriate method, such as a pre-dive bailout drill.

Note: Consideration of the reserve breathing gas cylinder duration should be a part of pre-dive planning.

4. The diver-worn or carried emergency gas supply shall be of sufficient duration for use until the diver can reach the surface (including any required in-water decompression) from the maximum depth of the dive; can reach another source of breathing media; or can be reached by the standby diver equipped with another source of breathing media. When a stage is used, where additional gas supplies are available, the diver-worn emergency gas supply does not need to be of sufficient amount and duration to take the diver through any required decompression.

The following information is provided to aid in selecting a reserve breathing cylinder size appropriate for the intended dive operation.

Gas consumption can be determined by the following calculation:

EMERGENCY GAS SUPPLY DURATION FORMULA
DA = VA/CD
DA = Duration in Minutes
VA = Available Volume
CD = Consumption Rate at Depth
Consumption rate at depth = Volume minute X depth in bars or atmospheres
Gauge pressure minus (depth in pressure + regulator delivery pressur) = usable gas pressure
***Refer to Bailout Calculations for Cylinders in Section 11**

NOTE: The available volume depends on the type (rated volume and rated pressure) and number of cylinders used, the measured gauge pressure and the recommended minimum cylinder pressure.

5. In all cases, the activation of the diver's reserve shall cause the dive to be aborted, unless primary gas can be immediately restored. The reason for activation of the diver's reserve must be ascertained and corrected prior to continued use of the involved equipment.

5.25 VOICE COMMUNICATIONS ON STATION

There shall be a properly functioning two-way audio-communication system between the diver and the normal station of the diving supervisor at the dive location.

During the conduct of underwater operations, topside communications must be established, and continuously maintained for the duration of the dive, between the supervisor, winch operator, person in charge, and other key personnel as determined necessary during the conduct of the job hazard analysis. Use of headphones should be considered when background noise has the capability of hampering communications to all key personnel as determined necessary during the conduct of the JHA.

5.26 DIVE PLATFORM POSITIONING

Vessels from which diving and other underwater operations are conducted shall afford a safe working platform. Safe operations from dynamically positioned vessels are covered in Section 8 of these standards.

5.27 PERSONAL PROTECTIVE EQUIPMENT

The appropriate ANSI (or standard used within a particular nation) approved personal protective equipment shall be worn when required. These items may include, but are not limited to:

- Protective head gear.
- Protective footwear.
- Protective eyewear.

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- A personal flotation device to appropriate regulatory standard.
- Hearing protection.
- Safety harness with approved double-locking elastic lanyard.
- Respiratory equipment.

5.28 SAFETY PROCEDURE GUIDELINES

The following are minimum guidelines that may require modification for each diving or underwater operations mode to meet individual company needs.

5.28.1 SAFE PRACTICES/OPERATIONS MANUAL

1. Each employer shall develop and maintain a safe practices/operations manual as required by applicable government regulations and the ADCI and shall make this manual available at the dive location to each dive team member. This manual must provide for the safety and health of the divers. Associate Member Schools are required to have their own version of a Safe Practices & Operations Manual, specific to the safety of both the students and instructors. The manual shall be available at the dive location or at each dive station at the school. The safe practices/operations manual shall meet or exceed the requirements of the ADCI International Consensus Standards for Commercial Diving and Underwater Operations.
2. The ADCI International Consensus Standards for Commercial Diving and Underwater Operations may be used as a set of minimum guidelines to assist companies in developing their own specific safe practices/operations manual. Each employer is responsible for completing, modifying and/or complementing any of the procedures, checklists and standards in accordance with applicable governmental regulations and as dictated by specific policies and practices of the employer.
3. The safe practices/operations manual shall, at a minimum, contain the following information:
    a. A copy of applicable government regulations for the conduct of commercial diving or other underwater operations.
    b. For each diving mode engaged in:
        I. Safety procedures and checklists for commercial diving operations.
        II. Assignments and responsibilities of dive team members.
        III. Equipment procedures and checklists.
        IV. Emergency procedures for fire, equipment failure, adverse environmental conditions, medical injury and illness.
4. The ADCI strongly recommends that each safe practices/operations manual contain a definitive statement regarding the use of drugs or alcohol. Such language should include references to applicable governmental regulations regarding drug and alcohol use in the work place. Additionally, such a statement should reference the employer's ADCI-required drug and alcohol program (reference Section 5.3: Drug and Alcohol Screening).

5.28.2 EMERGENCY AID

- Nearest decompression chamber (off-site).
- Nearest hospital/medical treatment facility.
- Air or ground emergency transportation.
- On-call physician.
- U.S. Coast Guard, other national Rescue Coordination Centers, or other responding authority.
- Emergency rescue source other than U.S. Coast Guard.
- Two-way communications available on site and where practical, tested to emergency response link.

5.28.3 FIRST AID

- First aid kit.
- First aid manual.
- Bag-type manual resuscitator.
- Full floatation backboard or Stokes litter, complete with head restraint and restraint straps.

5.28.4 PLANNING AND ASSESSMENT

- Written dive plan outling the steps and sequence of operations. Note: Commercial diver training programs should also have written dive plans, as a training aid, outlining the steps and sequences of the operation.
- Job hazard analysis.

- Site assessment.
- Evaluate environmental pollution containment and response readiness where applicable.
- Diving model/equipment system(s).
- Means of water entry and exit.
- Breathing gas supplies, including reserves (set up and tested).
- Thermal protection (all dive team members).
- Dive team assignments/briefing and fitness to dive.
- ROV team assignments/briefing and readiness to conduct operations.
- Inert gas status of dive team members (repetitive dive designations).
- Decompression and/or treatment procedures (including altitude).
- Communications procedures and methods for all personnel involved in the operation.
- Emergency procedures.
- Dive station setup.
- Any necessary modifications to the safe practices/operations manual.
- Report on the nature and planned times of the intended operation and the involvement of the vessel or facility's equipment and personnel to the person in charge.

5.28.5 HAZARDS TO DIVING OPERATIONS

- Surface vessel, vehicular traffic or aircraft operations.
- Overhead crane/gantry operations.
- Pedestrian traffic.
- Vessel and dive equipment weather limitations.

5.28.6 UNDERWATER HAZARDOUS CONDITIONS

- Umbilical fouling and/or entrapment.
- Differential pressures.
- Lockout/tagout.
- Contaminated or toxic liquid.
- Limited access/confined space/penetration.
- Use of explosives or seismic activities.
- Underwater sonar.
- Cathodic protection.
- Marine life.
- High currents/severe tidal conditions.
- Foreign waterborne materials, such as logs, ice flow, etc.

5.28.7 RECORD KEEPING

- Project description/accomplishment records completion.
- Diving and treatment records, accident reports.

5.29 LIFE-SUPPORT EQUIPMENT PROCEDURES CHECKLIST

The following are minimum guidelines that may require modification for each diving mode to meet individual company needs.

5.29.1 EQUIPMENT PREPARATION

1. Assemble, lay out and inspect all diving equipment and spares intended for the job including all accessory equipment and tools.
2. Check all helmets and masks and ensure that they are certified and properly functioning.

5.29.2 GENERAL EQUIPMENT

1. Check that all accessory equipment — tools, lights, special systems, spares, etc. — are on site and in working order.

5.29.3 PREPARING THE BREATHING GAS SUPPLIES

The ADCI does not recommend the use of 100 percent O_2 as an in-water breathing media. However, should O_2 (in excess of 50 percent) be used for in-water breathing media, the equipment should be O_2 clean and designed for use with pure oxygen.

1. Check that primary and suitable back-up breathing gas supplies are available and that breathing gasses comply with regulations for purity; are available in sufficient volumes; are properly mixed to accommodate the diving mode and profile; and that supply pressures are adequate for the intended operations and helmets/masks to be utilized.
   i. Ensure that the available breathing gas supply pressure is adequate for the intended depth and duration of the dive and that the supply pressure will accommodate the over bottom pressure requirements for the helmet or dive mask to be utilized as established by the manufacturers' instructions.
   ii. The over bottom supply pressure requirement for the intended helmet or mask to be utilized on the dive can be determined by reference to the manufacturer's specifications.
   iii. Minimum flow requirements for helmets/masks should be based on manufacturer's recommendations.

Example: Air flow requirements can be calculated by:

$$\textbf{FLOW} = \frac{D + 33}{33}(\textbf{ACFM})(n)$$

ACFM = Flow required based on manufacturer's recommendations

n = Number of divers

D = Depth in feet

- Standby diver must be included in the equation. Thus, if the dive will be performed by one individual, (n) will be 2.
- D equals the depth of the intended dive.
- ACFM equals the minimum air flow requirement; however, it may be higher as determined by the manufacturer's specifications for the intended helmet/mask.

2. Ensure that the breathing gas supplies are adequate to include decompression, recompression and necessary equipment throughout all phases of the planned operation.
3. Verify that all breathing gas supply systems have a suitable volume tank and filtration system installed in the air supply line between the supply source and diver's hose connection. A filtration system must be installed between the volume tank and dive manifold.

4. Verify that all supply hoses running to and from the compressor have proper leads, do not pass near high-heat areas such as steam lines, are free of kinks and bends and are not exposed on deck in such a way that they could be rolled over, damaged or severed by machinery or other means.
5. Verify that all high-pressure supply and interface hoses have safety lines and strain relief properly attached.
6. Compressors:
   - Determine that sufficient fuel, coolant, lubricants and anti-freeze are available to service all components throughout the operation. All compressors should be fully fueled, lubricated and serviced.
   - Verify that oil in the compressor is of an approved type. Ensure that compressor oil does not overflow the fill mark during servicing, as this is a source of potential contamination of the air supply. Any oil spillage must be cleaned up immediately.
   - Check that the compressor's exhaust is vented away from the work area, and specifically that the air compressor intake is not in the path of exhaust gasses. Check that the compressor inlet is located in an area free of potential contamination.
   - Check that compressors are not covered during operation.
   - Check all filters, cleaners and oil separators for cleanliness.
   - Bleed off all condensed moisture from filters and from the bottom of volume tanks.
   - Check all manifold drain plugs.
   - Check that all valves are properly aligned.
   - Check that all belt-guards are properly in place on drive units.
   - Check all pressure-release valves, check valves and automatic unloaders

5.29.4 ACTIVATING THE BREATHING GAS SUPPLIES

1. Compressors
   - Ensure that all warm-up procedures are followed correctly.
   - Check all petcocks, filler valves, filler caps, overflow points, bleed valves and drain plugs for leakage or malfunction of any kind.
   - Leak check all valves and connections.
   - Verify that there is a properly functioning pressure gauge on the air receiver and the compressor is meeting its delivery requirements.
2. Cylinders
   - Check all cylinders for proper pressure.
   - Verify availability and suitability of reserve cylinders.
   - Check all manifolding and valving for operation.
   - Activate and check delivery.

5.29.5 BREATHING GAS HOSES

1. Ensure all hoses have a clear lead and are protected from excessive heating or physical damage.
2. Briefly blow through hoses prior to connection.
3. Check breathing gas hoses and fittings for leaks and flow.
4. Ensure that breathing gas hoses (umbilicals) are properly marked to determine the distance the umbilical is paid out from the dive control station.
5. Ensure that breathing gas hoses (umbilicals) are suitable for the gasses to be used and have been maintained in proper conditions of cleanliness.

5.29.6 TESTING OF EQUIPMENT WITH BREATHING GAS SUPPLY ACTIVATED

1. Check all exhaust and non-return valves.
2. Hook up all breathing gas hoses to helmets, masks and chamber; make connection between back-up supply and primary supply manifold.
3. Ensure breathing gas mixture is suitable for depth and diving mode used.
4. Verify flow to helmets and masks.

5.29.7 DECOMPRESSION CHAMBER CHECKOUT (PRE-DIVE ONLY)

1. Check that the chamber is completely free and clear of all combustible materials.
2. Check primary and back-up air supply to chamber and all pressure gauges.
3. Check that the chamber is clean and free from contaminants. Check all chamber BIBS supplies. Verify that sufficient appropriate breathing media is available and that overboard dump systems (if fitted) are functional.
4. Verify the medical kit is available and in close proximity to the chamber.
5. Check all doors and seals.
6. Check that chambers meet code requirements with respect to periodic tests required by ASME/PVHO or equivalent.
7. Check that all valves are in the correct position.
8. Hook up and test all communications.

5.29.8 FINAL PREPARATIONS

1. Verify that all necessary records, logs and timesheets are on the diving station.
2. Check that appropriate decompression and treatment tables are readily at hand.

5.30 HAND-HELD POWER TOOLS

The following are minimum requirements for hand-held power tools. Prior to use of any hand-held power tools, a job safety analysis shall be performed.

5.30.1 ELECTRICAL HAZARDS

1. All hand-held electrical tools, including hand-held electrical equipment, shall be de-energized at the surface before being placed into or retrieved from the water.

2. All underwater AC (alternating current) electrical equipment cabled from topside shall be powered via a ground fault circuit interrupter (GFCI) between the topside power source and the tool.
3. GFCIs are used to assist in protecting divers against electrocution when using AC power underwater. GFCIs used shall meet all applicable regulatory requirements.
4. Have plug and receptacles compatible with cabling and dedicated ground cable.

5.30.2 SWITCHES AND CONTROLS

All hand-held power tools (e.g., hydraulic and pneumatic tools, water blaster guns) shall have a constant pressure switch or control (except for underwater welding and burning equipment).

- Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

5.31 WELDING AND BURNING

The following are minimum requirements for underwater welding and burning.

CAUTION: Underwater welding and burning should be performed only by qualified personnel with prior training in these operations and should only be performed while utilizing surface supplied diving equipment with communication to the diver.

As a minimum, the following shall be taken into consideration:

- Diver dress to ensure protection from shock.
- Proper equipment and setup (DC power, polarity, etc.).
  - Addressing the potential for existing explosive gasses and the creation of explosive gasses through the burning and welding process; also ensuring proper venting.
  - Ensuring that any members or compartments that can contain combustible gasses are either flooded or pressurized with an inert gas (nitrogen, carbon dioxide, argon, etc.) prior to cutting into them.

Underwater welding and burning creates hydrogen/oxygen mixtures that are HIGHLY explosive. Ensure that all closed compartments, structures or pipelines subjected to the heat of underwater burning or welding are flooded or purged with water and vented. Ensure that gasses cannot be trapped by providing a vent location at the highest point. If unsure whether a compartment or pipe is fully flooded, vent holes shall be cold cut initially. Cold cutting: A technique that does not generate sufficient heat that could cause the ignition of flammable gasses or hydrocarbons.

5.31.1 GENERAL REQUIREMENTS

- The diver shall wear adequate protective clothing (generally a rubber wetsuit or dry suit in good condition), including insulated gloves, while engaged in underwater welding or burning operations. Additionally, a diving helmet should be worn to keep the diver's head dry, to prevent the possibility of shock.
- While only partially immersed in the water, the diver is at risk of severe electrical shock when burning or welding. From the standpoint of electrical shock danger, the splash zone is the most hazardous location for divers while burning or welding. When working in the splash zone, divers must always wear a full wet or dry suit and insulating rubber gloves, in good condition, to insulate their bodies and hands.
- The diver shall use an appropriate welding shade to protect his or her vision when working in water with visibility.
- The diver shall be careful not to get between the ground and the work.
- The ADCI does not recommend burning or welding while using the scuba mode.

5.31.2 EQUIPMENT AND SETUP REQUIREMENTS

Use only a DC power source for underwater burning or welding. There is extreme danger with the use of AC current in the water.

The welding power source should be checked out by knowledgeable personnel before use.

Select your machine by the amperage required at the torch head to burn the steel with the rod to be used. A high-end machine will burn on the low end; a low-end machine will not burn on the high end. On extended or critical burning jobs, a backup welding machine should be considered.

- All underwater burning or welding operations shall be conducted utilizing straight polarity.
- This can be remembered by the acronym P.I.G. (positive is ground). This will help prevent electrolysis to the torch or electrode holder.

Welding machine polarity could have been internally changed and differ from the external markings on the machine (e.g., indicated positive on the machine could actually be negative and vice versa).

To confirm straight polarity, insert the ground and the rod tip approximately 2 inches apart into a bucket of salt water. Energize the rod by closing the safety disconnect switch. A stream of bubbles should travel from the rod tip toward the ground clamp. If not, reverse the polarity and test again.

- The ground shall be connected from the welding machine directly to the work. (In-water ground is not recommended.)
- A positive current safety disconnect switch (e.g., knife switch) shall be a part of the electrical circuit and shall be located at the dive control station in such a manner that it cannot be accidentally knocked or vibrated closed. It shall be capable of being immediately operated by the person in communication with the diver. The switch shall be rated for the maximum amperage utilized and shall remain open except during actual welding or burning. Due to the potential for arcing, the disconnect switch shall not be placed in a location that has the potential for oxygen or combustible gas buildup.
- Welding cables, electrode holders, underwater torches, and connections shall be properly insulated and capable of carrying the maximum amperage required by the work. Poorly insulated cables lying on a steel deck could allow for a current shunt around the safety disconnect switch. Electrode holders and torches shall be designed for underwater work.
- Ensure that all equipment is in good condition and that all manufacturers' recommendations are followed for the particular equipment being utilized. The underwater torch should have a good collet and washer, and it should be ensured that there is no oxygen leakage. All components of the system that may come into contact with oxygen shall be kept free of any grease or oil.
- In torches utilizing spark arrestors, ensure that the spark arrestor is in place.

5.31.3 SAFETY RECOMMENDATIONS

Prior to the command to "MAKE IT HOT," the diver should squeeze the trigger to vent any possible build-up of hydrogen gas.

- The diver should say "MAKE IT HOT" top side and then should say "MAKING IT HOT" and close the knife switch. When the diver completes a rod or burn, he or she should say "MAKE IT COLD" top side, then open the switch and say "IT'S COLD."
- Always keep tight control of the knife switch; never allow it to be closed when the diver is not burning, since this could cause injury to the diver or damage to the work site. Never mount the switch in a way that it could fall closed.
- Special consideration, planning and hazard identification should be considered for any habitat operations, including, but not limited to, habitat living parameters, atmospheric contaminant monitoring and ingress/egress of the habitat.
- Gasses from the burning/welding operation will collect in enclosed spaces as well as within shaped structural members such as under H-beams. ALWAYS ensure that adequate flooding/purging/venting has been accomplished prior to burning/welding. When in doubt, use cold cutting techniques to create vents.
- Trapped combustible gasses, such as methane from decaying organic material, may exist in submerged compartments in a barge or ship hull. Trapped gasses may also be present within a pipeline.
- When burning, if possible, start at the highest point and work downward to allow for gas venting. When burning large sections where entrapment from falling steel is a potential hazard, ensure that the section being cut is well-secured from topside, and cut the most difficult section first. The diver's body and umbilical should be outside of any potential danger zone when finishing the cut. Extreme care should be exercised when burning anything with tension upon it (cable, etc.), as it may spring back with tremendous force.

The diver must be aware of his or her location, as well as his or her umbilical, at all times when burning, in order to avoid the potential for entrapment or injury from falling steel or molten slag.

- Ensure that the disconnect switch (knife/contactor switch) is open when changing rods or laying down the electrode holder or torch.
- Ensure the disconnect switch (knife/contactor switch) is open prior to raising or lowering the torch/electrode holder or ground.

5.32 EXPLOSIVES

The following are minimum requirements for employing explosives. Prior to the use of explosives, a Job Safety Analysis shall be performed.

5.32.1 GENERAL

Employers must transport, store and use explosives in compliance with 29 CFR 1910.109, 29 CFR 1926.912 and the requirements of this section. Other state and local regulations may apply.

5.32.2 TRANSPORT AND STORAGE

Single-component explosives shall be transported and stored in magazine boxes. Blasting caps will not be stored with explosives.

5.32.3 CIRCUIT TESTS

Electrical continuity of explosive circuits shall not be tested with divers in the water.

5.32.4 AREA CLEARANCE

Divers shall be out of the water before explosives are detonated.

5.32.5 DETONATION DEVICES

All detonation devices shall be maintained under the custody of the diving supervisor when divers are in the water or when personnel on the surface are in the vicinity of explosives.

5.32.6 UNEXPLODED ORDINANCE

Unexploded ordinance, (or UXOs/UXBs, sometimes acronymized as UO) are explosive weapons (bombs, bullets, shells, grenades, land mines, naval mines, etc.) that did not explode when they were employed and still pose a risk of detonation, potentially many decades after they were used or discarded. If they are encountered, they should not be disturbed by untrained personnel, and appropriate authorities should be notified. The location of the unexploded ordinance should be noted.

5.33 UNDERWATER LIFT BAG OPERATIONS GUIDELINES

5.33.1 PURPOSE

- The purpose of this section is to identify potential hazards and recommend safety precautions when working with underwater lift bags.
- This recommended procedure is applicable for all sectors of the commercial diving community, both inland and offshore.

5.33.2 PRECAUTIONS

- When performing tasks underwater, divers are often required to move or lift objects using the assistance of underwater lift bags.
- Using underwater lift bags can pose a threat of uncontrolled ascent to the diver or object.
- Extra precautions should be taken through the performance of pre-dive hazard assessments.

No standard can cover all potentialities that might be encountered. JHAs, common sense and extra attention by the entire dive team are considered essential components for approaching operations of this nature. JHAs should be updated as work progresses to reflect the current conditions.

Note: Underwater lift bags are not like other forms of lifting devices. The lifting action is produced by the displacement of water when the bags are filled with air. A diver must be aware of the position of his or her umbilical at all times to avoid fouling. Hose management is essential to prevent entanglement with the underwater air lift bag rigging or the object to be lifted. The use of enclosed lift bags or lift bags with multiple attachment points requires additional planning, and the user should refer to the manufacturer's suggested guidelines for proper use and operation.

5.33.3 DEFINITIONS

Anchor point: (Also referred to as dead man anchor.) A point where the anchor line is attached to the underwater lift bag to restrain the load. Anchor points must have a mass in excess of the maximum lift capacity of the underwater lift bag.

Dump line: Line attached to the dump valve inside of the lift bag. It should be distinguishable from any other line. The dump line controls deflation of the lift bag by the diver. (Some lift bags are also outfitted with an extra length line, which can allow the diver to operate the dump valve from a safe distance.)

Dump line anchor: A weight attached to the dump line with enough mass to activate the dump valve during unplanned ascent.

Dump valve: Valve located inside of the lift bag for deflation of the lift bag, which is controlled by the diver through the use of the dump line.

Inversion line/upset line: Line attached to an appropriate anchor point, and to the top of the lift bag, to ensure that the bag inverts and deflates the air in the event of any failure of the lift bag's rigging.

Main lifting lines: This is the standard rigging that is attached to the lift bag, generally in either a two- or four-strap configuration. These lines are normally shackled to the object to be lifted.

5.33.4 RESPONSIBILITY

The dive supervisor is responsible for the welfare and safety of the dive team. However, the diver is responsible for ensuring that he or she is familiar with the principles of underwater lift bag operations that he or she is performing tasks utilizing underwater lift bags in a safe and responsible manner.

5.33.5 POTENTIAL HAZARDS ASSOCIATED WITH UNDERWATER LIFT BAG OPERATIONS

1. Over-inflation of the lift bag.
2. Accidental deflation of the lift bag.
3. Failure of the rigging or lift bag straps.
4. Failure of the lift bag fabric.
5. Utilization of a lift bag not rated for the load.
6. Obstructions in the path of the lift (water-column or surface).
7. Possible disruption of DP system during deflation of lift bags.
8. Possible entrance of deflated air into the diving bell.
9. Unplanned free ascent.
10. Diver fouling on lift bag or rigging during unplanned ascent.

5.33.6 RECOMMENDED WAYS TO MITIGATE POTENTIAL HAZARDS ASSOCIATED WITH UNDERWATER LIFT BAG OPERATIONS

1. Situational awareness on the part of the diver and topside personnel.
2. Proper education and training (Boyles' Law/Archimedes' Principle/hydrostatic pressure/absolute pressure; see ADCI Physics and formulas in Section 11).
3. Ensure that an anchor/restraining line is present, when applicable, with sufficient strength to remain attached to the load and dead man anchor.
4. Ensure that dump lines are distinguishable from all other lines.
5. Ensure that diver's personal equipment and all other tools are not in a position to get fouled with the dump line.
6. Proper maintenance, inspection and testing of lift bag and its rigging. It is recommended that a log for the inspection and maintenance of each underwater lift bag accompany the lift bag whereever it is operationally deployed.
7. Attachment of an inversion line to the top of the lift bag (the inversion line should be secured to an anchor point).
8. Proper education and training, combined with visible markings to indicate the ratings of the lift bag and the units of measurement used to express that rating (lbs./kg). It is important to utilize lift bags that have a lift capacity that is as close as possible to the weight of the object to prevent the potential for additional tilt on ascent.
9. A complete assessment and survey of the area must be performed prior to initiating lift (inflation of the lift bag).
10. On DSV/DPV: The volume of air escaping from the lift bag during the deflation phase may affect the vessel's DP system; prior notification to the bridge should be made before initiating deflation.
11. It is important that lift bags are not deflated in the area directly underneath the diving bell, as this could pose a hazard to personnel inside of the bell.
12. Ensure anchor points, when applicable, are heavier than the greatest potential lift of the lift bag(s).

5.33.7 OPERATIONAL CONSIDERATIONS WHEN USING UNDERWATER LIFT BAGS

1. Weather and environmental conditions

   Factors to consider include:

   a. Current.

   b. Seabed obstructions.

   c. Seabed conditions.
2. Details of the object to be lifted and its position in the water column

   a. The composition (what the object is made of and its approximate center of gravity).

   b. Assessment of the object's exact position and its stability.

   c. Determination the object's lifting points.

3. Perform all necessary calculations to determine the object's weight, taking into consideration the object's submerged weight, stability and its approximate center of gravity.
4. When making your calculations, it is important to assess the best position and number of lift bags required to avoid damage to the object (bending or buckling). Determination of the inflation sequence, when using multiple lift bags, is important to establish a safe and damage-free lift.

NOTE: Extreme caution must be used when inflating underwater lift bags. Do not use excess buoyancy to "break out" or "free" a load from the seabed. Remember: In shallower water, air entering the bag will experience a greater percentage of change in volume as it rises than at deeper depths. Underwater lift bags inflate more rapidly at more shallow depths.

5.34 UNDERWATER EXCAVATION OPERATIONS GUIDELINES

5.34.1 PURPOSE

1. The purpose of this document is to identify potential hazards and recommend safety precautions when conducting underwater operations below the mud line (deep ditch).
2. This recommended procedure is applicable for all sectors of the commercial diving community, both inland and offshore.

5.34.2 FACTORS TO CONSIDER

1. When performing a variety of tasks, divers are often required to excavate areas or enter excavated areas.
2. Hand-jetting and airlifting material from the natural bottom can pose a threat of burial.
3. Extra precautions should be taken through the performance of pre-dive safety assessments.
4. Variations in bottom conditions can cause changes in stability, which might warrant a more conservative approach to operations than the outlined recommendations of this document.

   No standard can cover all potentialities that might be encountered. JHAs, common sense and extra attention to detail by the entire dive team are to be considered essential components for approaching operations of this nature. JHAs should be updated as work progresses to reflect the current conditions. 4.3

5.34.3 DEFINITIONS

Ditch: An excavation area/trench/channel created to gain access to the working area.

Deep ditch: Any excavation or channel that is 6 feet or deeper from natural bottom (top of subsurface ditch) to the bottom of the subsurface ditch.

Natural bottom: Depth of the seabed prior to any excavation.

5.34.4 RESPONSIBILITY

The dive supervisor is responsible for the welfare and safety of the dive team. The diver is responsible for ensuring that he or she is performing the assigned tasks in a safe and responsible manner.

5.34.5 POTENTIAL HAZARDS ASSOCIATED WITH DEEP-DITCH OPERATIONS

1. Ditch wall collapses and traps the diver and/or his or her umbilical.
2. Unintentional creation of a tunnel by the diver while hand-jetting.
3. Malfunction of jet nozzle or other component of hand-jetting tool.
4. Injury to diver or his or her equipment due to jet hose or water directed from the hand-jet.
5. Injury to topside personnel due to component malfunction of hand-jetting equipment.
6. Injury to diver or damage to his or her equipment due to airlift suction.

5.34.6 RECOMMENDED WAYS TO MITIGATE POTENTIAL HAZARDS ASSOCIATED WITH DEEP-DITCH OPERATIONS

1. Situational awareness on the part of the diver and topside personnel:

The diver should always inspect the condition of the ditch wall prior to beginning or resuming work.

a. Hose management/regular communication.

b. Diver should routinely ensure that an adequate slope to depth ratio be established and maintained. At a minimum, it is recommended that for every 1 foot/meter excavated downward, 3 feet/meter need to be excavated in an outward direction (3:1 ratio).

2. Periodic and regular physical checks need to be made by the diver on his or her exact location. The diver should periodically remove himself or herself from the ditch and return to natural bottom to assess any potential hazards to him or herself, his or her umbilical, or hand-jet equipment.

There are no guarantees that equipment malfunctions will not occur during the course of operations. Routine pre-dive and post-dive checks of all equipment and systems are the best ways to guard against malfunction.

3. The diver should always ensure that he or she is capable of handling the force of pressure being emitted from the jet nozzle. Proper balance, footing and positioning of the diver is the best way to ensure that back or frontal spray from the jet nozzle does not injure the diver or damage his or her equipment.

Sending gas to the diver's pneumo and partially activating the diver's "free flow" are other recommended practices while conducting deep-ditch operations.

5.34.7 MINIMUM PERSONNEL REQUIREMENTS FOR DEEP-DITCH OPERATIONS

On all deep-ditch operations, a minimum of five crew members are required, consisting of:

- One diving supervisor.
- One diver.
- One standby diver.
- Two diver/tenders.

(The stand-by diver's equipment and thermal protection shall be dressed/outfitted to at least equal that of the diver.)

5.34.8 MINIMUM EQUIPMENT REQUIREMENTS FOR DEEP-DITCH OPERATIONS

Redundant jetting equipment and a greater length of jet hose shall be present at the dive site. In addition, the redundant jetting equipment shall be primed and running at an idle pressure at all times that the primary system is in use.

NOTE: Deep-Ditch Operations are considered construction work. A helmet that totally surrounds the diver's head is the only acceptable form of head gear for personnel working in this type of setting.

5.34.9 PERSONNEL QUALIFICATIONS

All members of the dive team should be trained and experienced for the tasks to be performed. In the case of deep-ditch operations, underwater personnel should be properly screened to ensure that they understand the scope of work to be performed, the potential hazards involved, and the procedures for rescuing a trapped or injured diver.

5.34.10 HAND JETTING ON PIPELINES – PIPE MOVEMENT

NOTE: Hand jetting on a live pipeline requires several factors to be considered, such as the contents of the pipeline, external and environmental factors, as well as the age, condition and diameter of the pipeline.

The following guidelines are based on CFR 49 Transportation of Hazardous Liquids by Pipeline Subpart F – Operation and Maintenance. (See below)

195.424 Pipe Movement

(a) *No operator may move any line pipe unless the pressure in the line section involved is reduced to not more than 50 percent of the maximum operating pressure.* **Hand jetting to expose a live pipeline does not require a reduction in pressure.**

(b) No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are joined by welding unless:

(1) Movement when the pipeline does not contain highly volatile liquids is impractical;

(2) The procedures of the operator under §195.402 contain precautions to protect the public against the hazard in moving pipelines containing highly volatile liquids, including the use of warnings, where necessary, to evacuate the area close to the pipeline; and

(3) The pressure in that line section is reduced to the lower of the following:

(i) Fifty percent or less of the maximum operating pressure; or

(ii) The lowest practical level that will maintain the highly volatile liquid in a liquid state with continuous flow, but not less than 50 p.s.i. (345 kPa) gage above the vapor pressure of the commodity.

(c) No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are not joined by welding unless –

(1) The operator complies with paragraphs (b) (1) and (2) of this section; and

(2) That line section is isolated to prevent the flow of highly volatile liquid.

Both operator and contractor should perform a thorough risk assessment analysis, ensuring that all of the above requirements are met and that there are no other external conditions which could compromise adherence of this Code of Federal Regulation. It is not recommended that live pipelines be moved in an upward direction (lifted).

5.35 HIGH-PRESSURE WATER BLASTING

5.35.1 INTRODUCTION

High-pressure water jets are employed in a variety of ways to accomplish cleaning and cutting tasks underwater. These units typically operate at pressures of 1,000 to 40,000 psig and higher.

Water blasters are dangerous and can cause serious injuries. Recommended practices and procedures do not replace the proper training necessary to operate high-pressure water blasting systems. Injuries caused by water blasters are highly susceptible to infection and should be given immediate treatment. Anyone who suffers an injection should immediately stop working, report to their supervisor and seek medical advice on treatment.

5.35.2 GENERAL

- Personnel assigned to water blasting operations, particularly diving personnel, should be trained by qualified personnel and properly demonstrate their knowledge and ability to perform a task prior to being required to do so.
- Serious harm and injury may result from the misuse of water-blasting equipment and from the use of improperly selected fittings, hoses or attachments. All components of the system should be checked against the manufacturer's instructions to ensure that they are compatible and of the correct thread size and pressure rating for the intended service.
- All dive team members (divers, tenders and supervisors) should be familiar with the equipment intended for use and with the hazards associated with their operation.
- Prior to operation, all equipment should be inspected for damage and deterioration, with particular attention paid to high-pressure hoses, fittings and gun trigger function.
- Prior to use in diving operations, the water-blasting equipment should be fully assembled and functionally tested, including emergency shutdown or dump valve operation.

5.35.3 PLANNING AHEAD FOR WATER BLASTER SAFETY

- Be a good observer. Look out for yourself and others. Review what to look for and act on what you see. Use your Stop Work Authority.
- JHA: Unsafe work conditions and unsafe behavior are the main reasons for injuries and accidents. Identify and minimize risk, and assign responsibilities to produce a safe working environment.
- Stop Work Authority: Every worker has the responsibility to stop an unsafe act or task. Shut down the operation and reassess the potential problem. Revise your JHA and resume safe operations.
- Report all incidents: Properly report all incidents, document the event, and obtain medical care if needed. Reporting incidents, no matter how minor, is the key to injury prevention.

5.35.4 POTENTIAL HAZARDS

- The safety point for water blasters is the rupture disc. Do not use coins to replace the disc. There are reasons that cause discs to rupture (wrong tip or blockage).
- Using the wrong tips in the underwater gun will rupture the disc or lower discharge pressure.
- Diver inadvertently directs the front pressure stream onto himself or herself, his or her umbilical, or equipment.
- The baffle tube comes loose from the control valve block and exposes the retro nozzle assembly. Unaware of the situation, the diver continues blasting and inadvertently directs the stream from the exposed retro nozzle onto him or her.

- A hose or fitting failure allows leaking pressure stream to contact and injure topside personnel or diver.
- Topside personnel inadvertently direct the front or retro pressure stream onto themselves or others when preparing, testing or using the system.
- Airborne debris created when using the water blaster topside causes persons in the area to have particles carried by mist into their eyes.
- Topside personnel strain their backs while handing hose.
- Water supply to the pump is used up, shut off or blocked, and the pump overheats and damages occur. (The water cools and lubricates the pump machinery and, if the pump is operated dry, it will quickly heat up and seize.)
- Tools or items of equipment fall or are dropped and cause injury to personnel or damage to the pump.

5.35.5 PRIOR TO COMMENCEMENT OF UNDERWATER WATER BLASTING OPERATIONS

A survey of the underwater site should be undertaken to identify potential hazards. A job hazard analysis should be done or reviewed by the dive team.

The job hazard analysis should include, but not be limited to, the following provisions:

- Tending of the diver's umbilical and the high-pressure water hose during water blasting operations.
- System to be pressurized only on request from the diver.
- Ability to quicklyshut down pressure to the gun.
- System pressure is shut down prior to the diver leaving the worksite.
- A thorough risk assessment analysis must be conducted if more than one diver is performing high pressure water blasting operations at the same time. Safe distance and other considerations must be provided to each diver and their applicable equipment.
- Due to the high noise levels generated, commands and signals should be agreed to and reviewed between the diver and topside.
- Ear protection for the diver is necessary. Limit diver exposure time due to the noise hazard.
- Trigger mechanism shall be of a dead-man type and shall not be tied back or wedged in the flow or "open" position under any circumstances.
- Careful check of the retro jet nozzle guard, as this could present a hazard to the diver and his or her hose if it is not properly guarded and diffused.
- Nozzle selection should be appropriate for the work intended (the smaller angle of rifle barrel nozzle being the most dangerous due to its cutting ability).
- The ADCI recommends against the miss-matching of high-pressure hoses, water blast guns and any high-pressure connections between different company units.

5.36 PENETRATION DIVING

PENETRATION DIVES SHALL BE RIGOROUSLY RISK ASSESSED.

5.36.1 DEFINITIONS

Penetration dive: A dive that requires a diver to access an area that is both a physically confining space and one in which there is no direct access to the surface or bell for recovery of the diver from the water by the tender.

Physically confining space: Any underwater space that would restrict the diver's ability to rotate himself or herself head to toe, 180 degrees, in any plane.

Direct access to the surface: A dive location where the diver can be easily pulled to the surface by a surface tender, or to a bell by an inside bell tender. This does not necessarily mean that there is not an obstruction on the surface directly above the diver during the dive, but that there is nothing to restrict the diver from being pulled back to the point of entry at the water surface or bell by a topside tender or bell tender.

Diver working around corners: A situation where the umbilical may become fouled or where line pull signals may become dissipated due to the dive site configuration creating an impossibility of a straight line pull between a surface tender and the diver.

Confined space: A confined space is an enclosed space and is descriptive of topside conditions only. In certain instances, in order to access the dive site, the dive crew may have to transit or work from a confined space. Generally, a confined space:

- Is large enough and arranged so an employee could fully enter the space and work.
- Has limited or restricted entry or exit. Examples are tanks, vessels, silos, storage bins, hoppers, vaults, excavations and pits.
- Is not primarily designed for human occupancy.
- Is not flooded.

All topside operations performed from/in confined spaces shall conform to appropriate regulatory requirements.

5.36.2 PERFORMING PENETRATION DIVING

When performing penetration diving, if the entrance to the penetration is underwater and not readily accessible from the surface, then the diver shall be tended at the entrance of the penetration by an in-water tender at all times. The purpose of the in-water tender is to tend the penetrating diver's umbilical and to assist should the diver require assistance in the event of a fouled umbilical or entrapment.

In these conditions, the dive team must include an additional tender/diver, as well as a third umbilical for the topside standby diver.

When any diver is working around corners where the umbilical is likely to become fouled or line-pull signals may be dissipated, other in-water diver/tenders may be sent down to tend the lines of the first diver at the obstructions and to pass along any line-pull signals.

5.36.3 MINIMUM PERSONNEL REQUIREMENTS FOR PENETRATION DIVING OPERATIONS

- One diving supervisor.
- One diver.
- One in-water tender (standby diver).
- Two topside tenders.

(One of the topside tenders can act as the topside Standby Diver)

5.36.4 EXAMPLES OF PENETRATION DIVING

- The most common example of a penetration dive is that of a diver entering a pipe and traveling along its interior. This would generally meet both criteria listed above for penetration diving (physically confining space and no direct access to the surface).
- Generally, working under a vessel or barge would not be considered a penetration dive, as the diver can usually be easily pulled to the surface at the location of the topside tender.

There is a clear and distinct difference between working beneath a vessel and working in a pipeline. In the former case, the diver may be directly retrieved by the surface tender without danger of entrapment or entanglement as the umbilical is generally maintained in a horizontal direct line to the diver. In case of a diver entering an underwater pipeline, the umbilical will often turn a corner at the entrance to the pipeline, or even within the pipeline, and therefore it must be tended at such points by another diver acting as in-water tender. When performing long penetrations, additional in-water tenders may be needed, and calculations should be performed to ensure adequate volume and pressure of gas is delivered to the diver.

5.37 POTABLE WATER DIVING OPERATIONS

5.37.1 GENERAL

The intent of these guidelines is to address some of the more obvious requirements necessary for the conduct of safe commercial diving operations in potable water tanks and reservoirs.

All equipment and manning levels should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

5.37.2 OPERATING PROCEDURES

5.37.2.1 Non-isolated Storage Facility Operations

While the water facility operator may choose to isolate the facility from the system during underwater maintenance activities, it is recognized that isolation of the storage facility in order to undertake routine underwater maintenance may be inconvenient, or even impossible, as a result of system operating or design limitation.

Any diving operation conducted with the water storage facility in a non-isolated status may present potential hazards to the diver. This is due to the differential pressure created by the head of water versus the decreased pressure at the valve outlet location.

Under such conditions, a thorough JHA evaluation of the situation must be considered during planning and assessment and proper steps taken to ensure that the diver and equipment will not be subjected to the differential pressure. (See Section 5:17: Differential Pressure.)

Steps must be taken to ensure that the diver is aware of the fact that a particular valve will be open and that a differential pressure hazard exists. Care must be taken to furnish the diver with a detailed location of open valves and instruct the diver to remain clear of any such openings. The water facility operator MUST take part in discussions relative to diver safety in a non-isolated facility and be prepared to take appropriate action as agreed.

5.37.3 ISOLATED STORAGE FACILITY OPERATIONS

In the event that the water facility operator elects to isolate the water storage facility for the conduct of underwater maintenance activities, the facility shall be removed from service and isolated from the system prior to the commencement of any diving activity. All system primary and secondary inlet and outlet valves must be verified as locked and tagged "closed" by the designated person in charge (diving supervisor) of the diving operation.

In the event that storage facility valves must be inspected during diving operations, system valves farther upstream or downstream must be closed.

All valves critical to isolation of the water storage facility must be tagged in either the open or closed position as agreed during planning and assessment. Security of the valve(s) position must be assured, and that no valve can be opened without the expressed permission of both the water facility's designated person in charge and the designated person in charge of the diving operation (diving supervisor).

Divers shall not enter the riser pipe in an elevated tank unless the tank has been isolated, locked, and tagged in accordance with Lockout/Tagout procedures.

5.37.4 EQUIPMENT AND PERSONNEL REQUIREMENTS

NOTE: It is strongly recommended that equipment used in these operations be solely dedicated to potable water operations only.

5.37.4.1 Equipment

All diving and other equipment used for underwater inspection of potable-water storage facilities shall, wherever possible, be dedicated for that purpose only. If not feasible, all equipment intended for use in a potable-water storage facility shall be certified as having been thoroughly disinfected prior to arrival at the job site, and the dressed diver shall again be disinfected at the potable-water site.

Equipment to be used in potable-water storage facilities should, at a minimum, be disinfected by first removing all visible debris, dirt or other substances and then totally immersed in 200 PPM chlorine solution for a minimum of two minutes prior to use in potable water. Total immersion means that all outside surfaces of the equipment that will have contact with the potable water must be in continuous contact with the 200 PPM chlorine solution. The dressed divers shall be sprayed with a 200 ppm chlorine solution immediately before entering the water. Further information on disinfection procedures is available from the ANSI/AWWA Disinfection Standard.

Any equipment previously used in a contaminated water diving environment should not be used inside a potable water facility.

Scuba shall not be used in potable water facility operations.

- **Diver clothing.** Each diver shall wear a vulcanized rubber or other smooth surface material dry suit in good condition, free from tears, scrapes, damaged areas or other imperfections that may impair the integrity of the suit or serve as a site for bacteriological contamination. Further, the diver's dress, including the diving helmet and suit, shall provide complete encapsulation and isolation of the diver's body from the potable water.
- **Diving helmet.** The diver shall wear a diving helmet (a hard helmet that totally surrounds the diver's head in a dry environment) that is equipped with live voice communications and a neck dam that can be sealed to the suit, and can be fitted to accept a bailout system with shut-off valve. Further, the helmet shall, just as all of the diver's equipment and clothing, be considered a potential source of bacteriological contamination. The use of a diver band mask (any configuration of mask and breathing regulator that does not totally surround the diver's head with a dry helmet) shall be specifically prohibited except in the case of an emergency.

5.37.5 SAFETY

No standard can cover all situations that might be encountered. JHAs, common sense and extra attention by the entire dive team are considered essential components for approaching operations of this nature. JHAs should be updated as work progresses to reflect the current conditions.

5.37.6 GENERAL REQUIREMENTS

- For all diving operations intended to take place in an elevated structure, a means of rescue of personnel from the top of the structure shall be provided. A safe and effective means of lowering injured personnel from the top of such tanks will be provided.
- A means for rescue of diving personnel from an enclosed space or elevated height must be furnished as applicable, when required.

When diving operations are being conducted on elevated tanks, increased manning levels shall be considered.

5.38 CONTAMINATED WATER DIVING OPERATIONS

All equipment and manning levels should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning shall be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

The information presented in this section has been generated as guidance material only that must be considered when planning the conduct of contaminated water diving operations.

A primary consideration during contaminated water diving operations is to minimize the length of time during which members of the dive team are exposed to contaminants. Dives should be scheduled to require no in-water decompression so as to limit the diver's exposure to waterborne hazards.

5.38.1 TRAINING

a. All personnel who are likely to participate in contaminated water diving operations should receive training consistent with regulatory requirements for the area where operations are to be conducted, such as 29 CFR 1910.120 (U.S. OSHA) – Hazardous Waste Operations and Emergency Response (HAZWOPER).

b. Specific training must be furnished in:

- Dry suits.
- Personal protective equipment for topside and diving personnel.
- Decontamination procedures, including preparation of the disinfectant or other solution intended for use.
- Decontamination of personnel and equipment used during operations.

5.38.2 SITE EVALUATION

When operations will take place where the water is suspected or known to be contaminated, a site assessment must be conducted. This assessment should include:

- Any suspected contaminants and potential hazards.
- Testing of the dive environment: It is not always possible to tell whether an environment is contaminated either by sight or smell. Any diving environment should be approached with caution, and when contamination is suspected, the water should be tested prior to commencing operations.
- Wind: In situations where there may be toxic fumes, the dive station, compressor and topside personnel must be situated up-wind from any source of contamination to the air.
- Current: Both on the surface and underwater, the diver should approach any known point-source of contaminant from the up-current side whenever possible. This will allow the current to carry contaminants away from the diver.
- Perimeter: Whenever possible, a perimeter should be established around the dive station and dive site to keep unprotected persons away from any possible contamination.
- Established zones: Zone management should be employed when applicable to keep unprotected personnel and equipment outside of the hot zone.

5.38.3 TOPSIDE PERSONNEL PROTECTIVE EQUIPMENT: EPA SELECTION GUIDELINES

To aid in the selection of complete protective ensembles, including chemical protective clothing and respirators, the United States Environmental Protection Agency's (EPA) Office of Emergency and Remedial Response has designated four levels of chemical hazards, ranging from extremely dangerous or unknown (Level A) to situations where only basic work-wear (Level D) is the required protection. The OSHA standard recommends the use of these guidelines, which can assist employers in complying with the protective equipment requirements of the standard.

The following is a brief review of the EPA guidelines. These are explained in greater detail in Appendix B of the OSHA standard and Table 1 (in this section).

- **Level A** calls for a vapor-tight suit (total-encapsulating) that is non-permeable to the chemicals to which a worker will be exposed. Also necessary is an approved, positive-pressure, self-contained breathing apparatus (SCBA) or a NIOSH-approved, positive-pressure air-line respirator with escape SCBA having no less than a five-minute air cylinder. Outer and inner chemical-resistant gloves and chemical-resistant boots with a steel toe and shank should also be used.
- **Level B** necessitates the same level of respiratory protection and complete skin coverage as Level A. However, protective clothing does not have to be vapor tight.
- **Level C** calls for a full-face piece, or half-mask air-purifying respirator; splash garments used with outer and inner chemical resistant gloves; and chemical resistant boots with a steel toe and shank.
- **Level D** calls for basic work-wear such as long sleeve coveralls, hard-soled shoes and face shields or goggles.

a. Before any diving operation is conducted in contaminated water, a risk assessment is vital. Personal protective equipment (PPE) must be selected based on its known ability to protect workers from the specific hazards present or suspected. This applies to the diver and the topside personnel. There are four different categories of topside PPE, from the least protective (Level D) to total encapsulation (Level A). Requirements for these levels are set forth in Table 1 in this section.

b. <u>The key variables that must be considered when selecting PPE are:</u>
   - Identification of the hazard(s).
   - Route of potential hazard to employees, e.g., inhalation, skin absorption, ingestion and eye or skin contact.
   - The performance of PPE materials, seams, visors and all other vital components
   - Matching PPE durability of materials such as seam, tear, burst and abrasion strength to dive site-specific conditions.
   - Matching site environmental conditions to PPE effect on employees (e.g., heat stress, hypothermia, dehydration, duration of task, etc.).
   - Equipment selection (PPE). Site-specific variables must be considered and protection geared to the worst case situation if those variables are not positively identified. The more that is known about the site, the easier it will be to customize suitable PPE to ensure protection of the dive team topside members.

<table>
<tr><th colspan="5">TABLE 1
GUIDELINES FOR SELECTION OF PERSONAL PROTECTIVE EQUIPMENT</th></tr>
<tr><th>EPA Level</th><th>Respiratory Protection</th><th>Protective Clothing</th><th>Hand and Foot Protection</th><th>Additional Protection</th></tr>
<tr><td>A</td><td rowspan="2">An approved positive-pressure, full face-piece, self-contained breathing apparatus (SCBA)

or

An approved, positive-pressure, supplied-air respirator with escape SCBA (minimum 5-minute duration)</td><td>Totally encapsulating chemical protective suit specifically designated to resist permeating by chemicals that are encountered</td><td rowspan="3">Gloves: Outer and inner chemical-resistant gloves

Boots: Chemical-resistant, with steel toe and shank</td><td>• Coveralls
• Long underwear
• Hard hat
• Two-way radio communications system</td></tr>
<tr><td>B</td><td rowspan="2">Hooded chemical-resistant clothing made of materials resistant to the chemicals encountered (overalls and long-sleeved jacket; coveralls; one-or two-piece chemical splash suit; disposable chemical-resistant overalls).</td><td>Above, plus:
Face shield

Boot covers (disposable, chemical-resistant)</td></tr>
<tr><td>C</td><td>An approved full face-piece or half-mask air-purifying respirators</td><td>Above, plus: all items that precede it Escape tank</td></tr>
<tr><td>D</td><td></td><td>Coveralls.</td><td>Boots: Chemical-resistant, with steel toe and shank</td><td>Above, plus: all items that precede it Safety glasses or splash goggles

Gloves</td></tr>
</table>

5.38.4 DIVER-WORN OR CARRIED EQUIPMENT AND ACCESSORIES

a. Selection of the diver-worn equipment must be based on the level of contamination protection required. The following equipment configurations are only recommendations. Responsibility for selection of equipment and diving technique must be made by the persons engaged in the diving activity as identified in the dive plan and/or job safety analysis.

b. Equipment that supports the diver must also be compatible with the contaminants that may be encountered.

c. There are three levels of protection for diver-worn equipment and accessories, from the most protective (Level One) to the least protective (Level Three). Requirements for these levels are set forth in Table 2 in this section.

d. All diver-worn equipment should be tested for integrity and function prior to the diving operation.

TABLE 2

DIVER-WORN OR CARRIED EQUIPMENT AND ACCESSORIES

LEVEL ONE (Most Protective)	LEVEL TWO	LEVEL THREE (Least Protective)
• For diving in waters containing biological contamination, petroleum fuel, lubricating oils and industrial chemicals known to cause long-term health risks or death • Helmeted surface-supplied diver with mated non-porous dry suit with attached boots, gloves, and a return line exhaust or double exhaust valve system **NOTE:** The use of Level One protection should take into consideration the chemical compatibility of the equipment being used and the resultant permeation of waterborne contamination into the equipment. (Consult manufacturer's data). Diving in waters containing strong chemicals or nuclear contamination where even minor exposure could cause a serious threat will require special consideration and planning, equipment precaution, and training	• Biological or chemical contamination that will cause short-term health effect but will not cause lasting injury, disability or death • Surface-supplied umbilical with dry suit with attached and sealed hood, gloves and boots • Full-face mask that overlays the dry suit hood face seal	• Recommended for diving in waters that are considered to pose a minimal health risk • Scuba/surface-supplied umbilical with half-mask or full mask, chafing overalls, and hand and foot protection

Any actual or suspected breach of a Level One diving system is cause for the immediate termination of diving operations.

5.38.5 DECONTAMINATION PROCEDURES

In certain highly contaminated diving situations, the following procedures may be applied but are not necessarily applicable for every job:

a. The area surrounding the diving control station may be divided into three zones for proper isolation of contamination. The zone immediately surrounding the point of water entry/exit is deemed "high contamination." The zone where divers and gear progress after initial decontamination is termed "low contamination." The final zone into which the divers progress after they have been decontaminated and all diving gear removed is "clean."

b. An effective color-coding system may be employed to communicate clearly the demarcation point of the decontamination area. One system might be to use red to identify all "high" areas, yellow for "low" areas and green for "clean" areas. If at all feasible, the "clean" zone should be positioned up-wind of the contaminated zones.

c. **Initial freshwater rinse:** Spray off bulk of contaminants using high-pressure, clear freshwater rinse. If effluent does not require capture, begin hosing diver as he or she initially exits water to limit quantity of contaminants transferred to the dive station.

- Take precautions to direct water flow away from potential points of leakage of diver's rig, such as exhaust valves, seal junctions, etc. A high-pressure jet of water directed at such potential breach points may inject contaminants inside of the protective gear and into contact with the diver. Care should be taken to ensure the removal of the bulk of contaminants at this stage in order to afford the greatest efficacy of subsequent decontamination steps.

d. **Oversuit:** If a reasonable expectation exists for encountering bulky, adherent contaminants in the course of a dive, the use of a disposable oversuit is strongly encouraged. Disposable, hazardous material protective suits may be secured to a diver after he or she has been outfitted with the entire diving rig.

- No effort to make the oversuit water-tight should be attempted. Such action could complicate the dive by creating air pockets that could affect buoyancy of the diver. As the diver arrives on the dive station, the oversuit should be cut away to allow for decontamination of the diver and equipment. At this time, removal of dive gear such as harnesses, weight belts, emergency gas supply (bailout) tanks, etc., should be performed with these items themselves being properly decontaminated.

e. **Scrub down:** After the diver has been initially rinsed and his or her equipment removed, he or she may be scrubbed with a stiff-bristle synthetic brush and a cleaning solution as applicable. Long-handled brushes may facilitate the cleaning process. Hand-held brushes may be employed for detailed cleaning of the dive helmet and the neck-dam interface.

- Once the diver has been thoroughly scrubbed with cleaning solution applied from head to toe, he or she should be rinsed with fresh water. Care should be taken to ensure the diver has been cleaned of all visible contamination, most notably in the area adjacent to the neck-dam, helmet and dry suit.
- The composition of the cleaning solution should be appropriate for the contaminant to be removed.

f. **Undress diver:** Once the diver has been adequately decontaminated and moved into the "low contamination" zone, the dive gear should be removed. First, disconnect the locking mechanism from the helmet to dry suit and remove the helmet. Then, remove the dry suit and gloves and finally, the undergarments.

- If there are no indications that the diving rig has been breached during the dive, the diver may proceed to the "clean" zone and, if applicable, take a post-dive shower.
- If there are positive indications of dermal exposure to contaminants, additional decontamination measures may be required.

g. **Clean equipment:** After removal from the diver, all equipment should undergo secondary decontamination.

h. **Capture effluent:** In some circumstances it will be necessary to capture all fluids used to rinse, wash and re-rinse the diver and equipment and dispose of them in a manner appropriate for hazardous materials. If necessary, the above procedures will need to be altered to ensure that all decontamination procedures take place within a water-impermeable capturing area.

5.38.6 HAZARD EVALUATION AND IDENTIFICATION[1]

a. When the threat of a chemical hazard is suspected, consider conducting a historical review of the site. Items such as spill history, known chemicals present, volume of chemicals, active discharges, air quality, present and past nature of operations, and presence of extremely hazardous substances should be examined. Facility safety officers, plant supervisors or technicians may provide useful information.

b. When planning contaminated water diving operations, water temperature needs to be taken into account when determining the proper equipment to be used.

c. Check with local, state or federal water quality agencies for current advisories on biotoxins, waterborne pathogens, microbial contamination, fish or shellfish advisories, beach closures or storm events, any of which may indicate pollutants to be present.

d. When hazardous contaminants are suspected, consider water or sediment sampling and analysis. The selected laboratory can provide proper containers and procedures for sample collection, handling and shipping.

e. If the pollutants have been identified, rapid on-site test kits for selected chemicals in sediment or water are, in some cases, available.

If severe contamination is known to be present at the planned site of diving operations, consideration should be given to using an ROV if possible.

f. Hand-held detectors for monitoring a class of airborne chemicals, such as volatile organics, can be utilized for:

- Initial entry into the staging area during mobilization if the air quality is unknown.
- Continuous monitoring with alarms during diving operations to rapidly notify the participants if air quality changes.
- Scanning the diver upon water exit and after decontamination to determine if contaminants are present.

g. Lists of very dangerous chemicals that may readily penetrate diving equipment or cause substantial harm after a brief exposure can be obtained from the suit manufacturer. If a diver or topside crew member suspects exposure, blood, urine or other biological samples may be gathered for medical review.

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5.39 HYDROGEN SULFIDE (H_2S) RECOMMENDED GUIDELINES

5.39.1 PURPOSE

This purpose of this procedure is to provide guidelines for identifying, training, and monitoring the health and safety of personnel that could potentially be exposed to Hydrogen Sulfide (H_2S) vapors or gasses.

NOTE: These are minimal guidelines. Contractors and operators should seek current directives and procedures from appropriate sources.

5.39.2 SCOPE

Thes procedure outlines the equipment required for working on projects with potential H_2S contamination, recommended evacuation procedures, alarms for H_2S detection, as well as training and medical guidelines.

5.39.3 RESPONSIBILITY

Contractors are responsible for ensuring that all components are in place for compliance of these guidelines. They are also responsible for ensuring that the proper training, qualification, certification, and medical requirements have been met by personnel. HSE departments should make available to company personnel any pertinent information on the job site to ensure compliance. It is also the responsibility of the contractor to establish an "H_2S Evacuation / Contingency Plan" that can be tailored to specific projects when necessary. It is recommended that a formal Management of Change (MoC) be performed should any changes be required to the above mentioned evacuation / contingency plan.

5.39.4 PROCEDURE

5.39.4.1 Definition

Hydrogen Sulfide (H_2S) is a colorless, very toxic, flammable gas that has the characteristic odor of rotten eggs at concentrations up to 100 parts per million. Depending on environmental conditions H_2S' characteristic odor might not be detected, despite the gas being present. H_2S is also referred to as "sour gas" or "sewer gas". It is not restricted to any one area or sector of the commercial diving industry. H_2S is invisible and is capable of breaking down such materials as steel and rubber.

- At 200ppm – Symptoms: burning of eyes and throat, and severe headaches
- At 600ppm – lethal without immediate medical treatment
- At 1000ppm – lethal with little chance of survival

5.39.4.2 H_2S Operational Guidelines

All projects with the potential for H_2S contamination should have a H_2S contingency plan that is tailored to the area and scope of work to be performed. Personnel should be familiar with the plan and trained and qualified to implement it.

It is recommended that the following guidelines be followed for personnel, equipment, and the implementation of contingency plans where H_2S may present a hazard to operations:

- Personnel should be trained and familiar with OSHA 29 CFR 1910.134 outlining respiratory protection. Self Contained Breathing Apparatus (SCBA) should be used.
- Emergency muster points should be established for personnel with the proper respiratory equipment available.
- Scheduled drills should be conducted during the course of the project. It is also recommended that scheduled drills be conducted periodically for all project personnel.
- All equipment (alarms, breathing apparatus, compressors, HP bottles, and emergency escape packs, etc.) should be available at the project location. This equipment should be inspected prior to mobilization and documentation of its inspection should be available at the project location for review.
- All H_2S alarms should be treated as an actual release.
- After any release all areas of the job site should be thoroughly checked and all holds ventilated. Re-entry to the job site requires verification of no presence of H_2S.

5.39.4.3 Diving Operations

If the H_2S alarm is activated:

- All diving operations are to be aborted.
- All topside personnel should be outfitted in SCBA equipment or BIBS.
- All divers should be switched to emergency breathing gas and begin ascent to the surface. Divers in saturation should be returned to the saturation diving complex.
- The "H_2S Evacuation / Contingency Plan" should be put into effect immediately.
- Communication and coordination between the Dive Supervisor and Vessel Captain/Barge Superintendent will determine vessel or barge movement. For land based operations the Dive Supervisor will interface with designated personnel as outlined in the job specific contingency plan. The job specific contingency plan should be completed by the Contractor.

H_2S Project Specific Contingency plan should contain:

- Project location
- Client representative information
- Vessel(s) information
- Contact names and numbers for the client and all project managers
- Mobilization dates of the project
- Sub-contractor information (if applicable)
- Dock support information
- Equipment and training information
- Emergency plan and contacts

5.40 UNDERWATER SHIP HUSBANDRY (UWSH) FOR CARGO SHIPS/ FREIGHTERS

5.40.1 PURPOSE

The purpose of this section is to provide guidelines for defining the different tasks associated with the safety considerations, recommended operational guidelines, and training for the conduct of underwater ship husbandry operations for ocean-going cargo ships/freighters (general cargo vessels, container ships, tankers, dry bulk carriers, multi-purpose vessels, reefer ships), mega-ships, MODUs, and cruise ships.

NOTE: These are minimal guidelines. Prior to the commencement of any diving operation, a risk assessment (RA) and job hazard analysis (JHA) shall be completed and all members of the dive team, including the vessel master and chief engineer shall be present at a pre-dive safety meeting. Increased manning levels and additional equipment may be required depending on the scope of the operation.

5.40.2 RESPONSIBILITY

The diving contractor is responsible for ensuring that all components are in place for compliance to these guidelines. They are also responsible for ensuring that personnel have met the proper training, qualification, certification, and medical requirements. It is also the responsibility of the diving contractor to obtain local permits and establish a dive plan that can be tailored to specific ship husbandry operations when necessary. It is recommended that a formal Management of Change (MoC) be performed should any revisions to the dive plan be required.

5.40.3 GENERAL

Ship husbandry entails all aspects of maintenance, cleaning, repair, and general upkeep of the hull, appendages and underwater equipment of a ship (thrusters, rudders, propellers, sea chests, hull plating intakes and discharges), including the repair of pin holes, replacement of anodes, and the welding of cofferdams to isolate cracks.

5.40.3.1 Underwater ship husbandry includes the following operations:

- Underwater hull cleaning to remove fouling organisms. Such cleaning may be of the entire hull or specific parts, such as propellors, rudders, shafts, thrusters' tunnels, bilge keels, cathodic protection, stabilizer fins and sea chest grating. Pre/post hull inspections should be completed prior to and/or after all underwater work. Hull cleaning may be done by divers using hand-held tools or self-propelled mechanical brushing equipment, water jets or scrapers.

- Non-destructive testing or hull-gaging inspection, including fouling surveys, inspection of known or suspected damage to hulls, appendages, underwater equipment or coatings, and inspection of previous repairs. Several methods may be used, including visual inspection, video recording, magnetic particle testing and ultrasonic thickness testing.

- Underwater coating is done to repair paintwork/ and epoxies after inspections or repairs, or where small areas of coating have been damaged or have polished through. Suitable underwater paints or underwater epoxies can be applied by the diver using brush/roller or by hand in the case of epoxies.

- Underwater fiberglass wraps can be used for hull repairs or propeller shaft protective coating repair. Repair of fiberglass shaft coating is generally done in a dry habitat mounted over the shaft, allowing access through the open bottom for the divers.The shaft is first cleaned before wrapping with a new layer of sheathing.

- Cathodic Protection replacement, to include sacrificial and/or Impressed Current Cathodic Protection (ICCP) systems.

- Underwater welding is either done in a submerged dry or hyperbaric habitat, or in water. The AWS D3.6M:2010 Underwater Welding Code defines important variables associated with underwater welding (e.g. metal transfer characteristics, solidification behavior, weld appearance, mechanical properties, etc.) and to describe welding and inspection procedures so that work of a known quality level can conveniently be specified. The AWS D3.6 Underwater Welding Standard is currently the only standard available for qualifying wet or hyperbaric underwater welding. Prior to any wet or hyperbaric welding, diving contracts should qualify welder/divers to existing procedures or qualify their own procedures to the class weld that fits their applications.

- Coating damage to the rudder, hull sonar domes and appendages can be repaired by divers. This entails removal of damaged rubber, preparation of the surface and application of rubber patch using a suitable adhesive.

- NDE Inspection of the vessel below the water line, to include general visual survey to specific areas that require hull-gaging/ thickness readings or weld seams requiring shear wave inspections.

- Removing obstructions from thrusters, propellers or rudders of the vessel.

NOTE: Several of these operations will release some quantity of harmful material into the water, particularly hull cleaning operations, which will release antifouling toxins. Underwater ship husbandry may cause an adverse environmental effect as significant amounts of copper and zinc are released by underwater hull scrubbing. Alien biofouling organisms may also be released during this process. Environmental regulations regarding the release of these materials vary by location and must be considered as part of the project plan.

5.40.3.2 Safety in Ship Husbandry

- It is critical that divers understand how ships are constructed and understand the terminology used to describe the various areas and parts of vessels.
- An assessment should be made on the suitability of the vessel from which the ship husbandry diving is taking place. Vessel size, available working deck space, adequate space for equipment and supplies, as well as adequate space to address any diver related emergencies should be considered. Reaction from working next to a large ship in swell and heave, as well as mooring arrangements must also be considered.
- A thorough JHA and RA shall be conducted prior to dive operations.
- All divers' must be established as fit-to-dive before beginning operations.
- A means for the safe recovery of an injured/unconscious diver must be present at the dive site.
- All machinery identified in the JHA/RA that poses a risk to the diver should be adequately controlled using appropriate lockout-tagout (LOTO) and hierarchy of control.
- Diver umbilical management must be outlined to consider all identified hazards.
- There should be adequate umbilical management procedures to restrain divers from accessing live water intakes.
- LOTO warning signs must be posted at the bridge and control room console.
- Ensure LOTO criteria is applied to any diver deployment vessel if utilized.
- All anchor stoppers/chain locks must be engaged.
- Periodic announcements should be made from the vessel's bridge that divers are in the water, and to not take suction from or discharge into the sea, operate propulsion or steering equipment or pay out on moorings or anchors.
- Diver umbilical management must be outlined to take into account all identified hazards.
- Divers should be restricted from transiting further than the keel of the vessel from the side of entry i.e., the side the diver is being tended from.
- Divers' excursion distance should be relative to the diver-worn emergency gas supply and duration at working depth.
- The bridging of the diving contractor's emergency response plan with that of the vessel's emergency response plan should be performed.
- No work may take place above the diver's worksite (no scaffolding, lifting operations, repairs, etc.).
- Assessments should be performed when working on a quayside for other land-based risks such as intakes for seawater, outlets from drains, etc.
- Consideration of differential pressure situations shall be considered where the hull of the vessel is ruptured.
- The Alpha Flag and all other dive-operations warning signs must be displayed as required.
- Periodic updates on weather conditions should be conducted.

- The ship's draft, depth below the hull, and time of tide must be checked. Ensure a safe depth is under the vessel to prevent a diver from being trapped or crushed under the hull during low tides or if the river level drops. Passing ship traffic can turn a "safe" area into a crush hazard area. This can also include the loading and offloading of supplies and materials (or bunkering) while the diver is in the water.
- Make certain the local Coast Guard (or Maritime Authority) and Harbor Master have been notified of any diving operations. Keep a close eye out for vessel traffic and have a method (VHF radio, etc.) to communicate with traffic if necessary. Ensure that known local vessel traffic (yard tugs, etc.) are aware of the operation and have been instructed to maintain a safe distance.
- Consider the proximity of adjacent vessels and whether they require any isolations (dive vessel, etc.).
- Consider whether non-vessel related hazards require isolation – intakes / discharges from the quay and differential hazards (e.g. lock gates / drydock) and other vessels that may be laying alongside or directly forward or aft of the vessel being dived on.
- Consider a dropped-object sweep around the perimeter of the vessel.
- A survey should be performed for fouled propeller or steering gear.
- The use of a downline for saws, scrubbers, and other heavy equipment used for debris removal is recommended.

NOTE: When working off vessels with cracks or suspected leaks, internal pumps need to be stopped to prevent differential pressure injuries to the divers working on the hull of the vessel. All investigations should only take place when the vessel is in port or in calm weather – waves can cause differential pressure on larger cracks.

Lockout-Tagout (LOTO) is a safety procedure which is used in the commercial diving and maritime industry to ensure that potentially hazardous machines (thrusters, intakes, rudders, propellers, ICCS systems) are properly shut off and not able to be started up again prior to the completion of maintenance or repair work. It requires that hazardous energy sources be "isolated and rendered inoperative" before work is started on the equipment in question. The isolated power sources are then locked, and a tag is placed on the lock identifying the designated personnel who placed it. The diving supervisor then holds the key(s) for the lock, ensuring that only the designated personnel can remove the lock(s) and reenergize the machinery. Some vessels may be too large or complex for complete isolation. In this case LOTO is performed on segments of the vessel. In this scenario the diver must be physically restrained using a golden gate or similar system to ensure that he does not exit the safe zone. A safety buffer zone of 16.5 feet (5 meters) should be in place to ensure compliance.

NOTE: The ADCI mandates that Lockout-Tagout methods be employed when ship husbandry operations are performed.

- Before diving operations begins on a ship's hull, the diving supervisor should first meet with the master (or mate) and chief engineer and lock out all machinery with intakes, including the main engines. Signed paperwork and possession of keys (by the diving supervisor) for the locks are the only confirmation that lockout procedures have been followed. Depending upon the vessel type, other items that may need to be locked out include (but may not be limited to):
    - Thrusters
    - Steering Pumps
    - Sea Chests
    - Z Drives
    - Pod propulsion systems
    - Impressed current cathodic protection systems
    - HiPAP transducer poles and sonar.
- The main engines and all thrusters must be locked out. If needed, the engineer should be requested to restrain the main shaft from turning if there is a strong current. Additionally, there should be an emphasis on physical restraints on the thrusters to prevent movement caused by strong currents. For steam propulsion plants, turbine gear interlock rotation of the propeller must not exceed 0.2 rpm. Careful planning and special attention must be given during any operation while the propeller is in constant rotation. On large vessels you can isolate the forward half of the vessel and post "GO" – "NO GO" limits and leave the aft available for steering (diving far forward of the midship). Flowing water will cause the propellers to rotate slowly, perhaps entangling the diver. Passing ship traffic can cause a propeller to spin. On smaller vessels, a pipe wrench on the shaft works well. Vessel shafts can also be secured from turning with a chain fall.
    - Lockout-Tagout Compliance MUST have the following five components:
        - Lockout-Tagout Procedures (Documentation)
        - Lockout-Tagout training (for authorized employees and affected employees)
        - Lockout-tagout Policy (Program)
        - Lockout-Tagout Devices and Locks
        - Lockout-Tagout Auditing – Every 12 months, every procedure must be reviewed as well as a review of authorized employees.

- It is important to make certain that no auxiliary equipment on board the vessel is set on automatic start if that equipment has intakes outside of the hull.

5.40.4 DIVE PLAN

The dive plan should be clear and concise. It should adequately cover:

- All pre-job planning and environmental conditions, with the input and approval of the vessel master, chief engineer, and harbor master, as appropriate.
- Any maps, drawings, manuals, or other documents relevant to the dive operation.
- Assignments of responsibility for all personnel during the dive operation.
- Documentation of all required equipment, tools, and materials.
- Diving techniques and tables/schedules to be used.
- Emergency procedures and contacts (First Aid Kit and Emergency O2 Administration Kit
- Detailed outline of the diving operation, to include the dive application utilized.
- Decompression chamber proximity requirement and location.
- Details of the permit-to-work system and the interface between the dive team and the vessel crew, including the means of effecting and controlling isolations of the vessel's systems and machinery that may compromise the safety of the divers and support personnel. Secure isolation of the vessel's machinery needs to be maintained until diving operations have ceased and all divers are confirmed to be clear of the water by the supervisor and termination of the permit-to-work.
- Post-dive operations procedures.
- Safety precautions (access / egress [launch and recovery] of divers to the worksite, including recovery method of an unconscious diver).
- Supervision and coordination with all crane and ROV operations. Restriction on over-side working and lifting operations in the vicinity of diving operations.
- Risk assessment conducted.
- Remoteness of worksite and access to emergency services may require a higher degree of medical competence and equipment to be immediately available at the dive site.
- Recovering an injured/unconscious diver from working depth to a safe place for treatment, and consequential treatment, including possible recompression requires a site-specific plan.
- Plans for conducting emergency drills to test the effectiveness of the emergency plan.
- Readiness verification of life-support and emergency equipment.
- SIMOPS, e.g. surface craft movements, managing general public, neighboring operations.
- Regulation of marine traffic by harbor master/port authority. Cooperation between the dive team and harbor master for the possibility of limiting vessel traffic in the area and when diving in a drydock.
- Any subcontractors or technical authorities providing support or consultation.
- Site Specific Emergency Response Plans must be at the dive location.

5.40.5 MINIMUM PERSONNEL REQUIREMENTS

Because of the wide range of tasks and varying conditions performed as "Ship Husbandry" the minimum manning levels allowed by the ADCI for the mode of diving being performed is an absolute minimum. Dive Team size is subject to formal risk assessment. There must be sufficient number of competent and, where appropriate, qualified personnel to operate all the diving plant and to provide support functions to the dive team. This may require additional support personnel and other management or associated technical support personnel, for example project engineers or maintenance technicians.

The diving supervisor shall be competent for the task and be in possession of a letter of appointment from the diving contractor. A thorough Dive Plan, RA, and JHA needs to be prepared for each project to determine if crew augmentation beyond the minimum allowed levels is needed. Some of the factors that may require additional crew members include the use of tools, heavy current, offshore conditions, size of vessel, remoteness of location, and scope of work. As an example, a relatively simple inspection of a propeller on a small tug, securely fastened to a dock, can typically be performed with a smaller crew than a significant hull cleaning job in an offshore (less protected) environment on a large vessel. Effectively managing an emergency should also factor into determining the size of the dive team.

Should two divers be in the water at the same time, there must still be a surface standby diver available for immediate deployment. A manifold/dive panel to accommodate 3 divers, plus extra breathing media and treatment gas will be required. Calculations for the specific amounts of breathing media and gas will need to be a part of the pre-job planning.

a. Diving Supervisor

A qualified person shall be designated as the diving supervisor for each diving operation. The diving supervisor oversees the planning and execution of the diving operation, including the responsibility for the safety and health of the dive team.

The diving contractor shall appoint the diving supervisor in writing, and this document must be available at the dive site for review. The diving supervisor should only transfer control of the dive operation to another supervisor appointed in writing by the diving contractor. This transfer of control should be formally documented in the dive log.

In underwater ship husbandry, the supervisor must work closely with the vessel master, officer of the watch, chief engineer, and harbor master. Whereas the supervisor is the only person who can order the start of diving operations, the vessel master or harbor master can tell the supervisor to terminate a dive for safety or operational reasons.

The diving supervisor needs to ensure that all parties are notified that diving operations are about to commence. All necessary permits/permission needs to be in place before commencement of dive operations.

During the dive operation, the diving supervisor needs to have direct verbal communication with the primary and standby diver at all times during the dive operation. Direct communication is also required between the vessel master, chief engineer, or other members of the bridge crew as necessary. This may also include crane operators and ROV pilots.

The diving supervisor shall possess the proper ADCI supervisor certification card (or recognized equivalent) and be knowledgeable and familiar with all techniques, procedures, emergency procedures and operational parameters for the diving mode under his or her direct supervision.

b. Diver / Standby Diver

- Must have formal training, experience and industry recognized certification in the following areas:
- Surface-Supplied Air (SSA) diving procedures and techniques.
- Industry recognized certification for the task assigned (diver, supervisor).
- Emergency procedures.
- Diving accident treatment procedures.
- Proper operation and use of all equipment related to SSA diving, including decompression chambers.
- Use of SSA diving equipment
- Familiarity with the type of work engaged in.
- Recognize and report any medical problems or symptoms experienced before, during, and after the dive.
- The standby diver must be in a state of immediate readiness during dive operations. This means donning all necessary equipment for immediate deployment, except for helmets or masks and weight belts.
- Standby divers must be equipped to the same degree/level as the primary diver. The umbilical length of the standby diver must be longer than that of the primary diver(s)' umbilical or be able to reach further because of dive station set-up.

c. Tender/Diver

Must have the same qualifications as an SSA diver, with the requisite level of experience required.

During the conduct of the job hazard analysis, the diving supervisor must consider whether the use of any surface-tended equipment by the diver will require an additional individual to tend associated cables or hoses, as in the case of hull penetrations, such as ballast tanks, sea chests, tunnel thruster, etc. This includes hand jetting, water blasting, cutting and welding, the use of any pneumatic or hydraulically operated tool, or the use of underwater video or sonar equipment requiring a power or data cable not affixed to the diver's umbilical.
(Personnel on the dive team may carry out more than one duty, so long as it doesn't compromise the safety of the dive team. For example, a diver may assist the supervisor by operating a deck decompression chamber or standing in to help tend another diver.)

5.40.6 OPERATIONAL GUIDELINES

1. The maximum depth of each dive shall be determined prior to the start of operations.

2. The breathing mixture supplied to the diver must be composed of a mixture of gasses that is appropriate for the depth of the dive. All mixed breathing gasses must be analyzed before they go on-line for O2 content and for proper mixture necessary to support the maximum depth of the planned dive.

3. A separate dive team member shall continuously tend each diver while the diver is in the water.

4. Diver-worn (or carried) emergency gas supply (EGS) shall be utilized and calculations for the gas supply should be performed based on distance, depth, ingress, and egress of the diver.

5. If no decompression chamber is on site, the nearest manned operational chamber (capable of providing treatment for dive-related illnesses) should be known, and an evacuation plan should be in place. A thorough risk assessment should be conducted to determine if a chamber is needed at the dive site. **Dives with planned decompression and deeper than 100 fsw [30 msw]) are required to have at least one double-lock decompression chamber and adequate air source to recompress the chamber to 165 fsw. An adequate supply of gasses for the planned dive profile and a potential treatment.**

6. Both the diver's umbilical and the hull-cleaning umbilical must be actively tended to ensure the hull cleaning machine does not cut or entangle the diver's umbilical. Risk assessments must be completed for this type of operation. The diver's umbilical and hull-cleaning machine umbilical are not to be mated and must always remain separate from each other.

7. Hull cleaning machines that recover all debris and have large bore recovery pipes pose a greater challenge for umbilical management. A separate machine operator is to be provided at the power pack control or the dive supervisor must have immediate ability to independently stop the hull cleaning machine's rotating brushes.

8. All machines should have a dead-man handle to allow the diver to immediately stop the rotation of the brushes. The standby diver must be able to respond with the ability to remove the hull cleaning rotating brushes should the diver's umbilical become entangled. **Note: Some machines cannot be moved unless the brushes are moving.**

5.40.7 MINIMUM EQUIPMENT REQUIREMENTS

- One air source to independently support two divers (working diver and standby diver).

- Topside secondary air source.

- Adequate supply of gasses for the planned dive profile.

- Two hose groups consisting of:
  - Air hose.
  - Strength member/strain relief. (The strength member may be the entire hose assembly, if so designed.)
  - Communications cable.
  - Pneumofathometer hose.

- One set of air decompression and treatment tables.

- One control station consisting of:
  - Communication systems.
  - Depth gauges and gas distribution system with the capability to supply and control two divers at the maximum work depth. The rack box/manifold must be equipped with a non-return valve (NRV).
- Two time-keeping devices.
- One basic first aid kit with ADCI required contents. Local regulatory authorities may require additional equipment and training.
- Emergency O2 administration kit, with sufficient O2 supply for transit to the nearest hyperbaric facility, capable of treating diving-related illnesses.
- Emergency rescue equipment for the recovery of an unconscious/injured diver.
- Two sets of divers' personal diving equipment consisting of:
  - Helmet or mask.
  - Diver-worn EGS.
  - Weight belt if needed.
  - Protective clothing.
  - Tools as required.
  - Safety harness.
  - Knife(s).
- Spare parts, tools, and manuals as required, for the preventive maintenance of equipment.
- Logbooks, dive sheets, safe practices manual, first aid handbook and written JHA applicable to job.

All equipment and personnel must, as a minimum, meet all requirements as contained in the latest edition of the *International Consensus Standards for Commercial Diving and Underwater Operations.*

Further information on diving personnel responsibilities, qualifications and certifications can be found in Section 3.0 of the *International Consensus Standards for Commercial Diving and Underwater Operations.*

Further information on diving modes: definitions, requirements and guidelines can be found in Section 4.0 of the *International Consensus Standards for Commercial Diving and Underwater Operations.*

Further information on underwater operations; procedures, checklists and guidelines can be found in Section 5.0 of the *International Consensus Standards for Commercial Diving and Underwater Operations.*

SECTION 6.0

LIFE-SUPPORT EQUIPMENT: REQUIREMENTS, MAINTENANCE AND TESTING

Association of Diving Contractors International, Inc.

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6.0 LIFE-SUPPORT EQUIPMENT: REQUIREMENTS, MAINTENANCE AND TESTING

6.1 GENERAL

Equipment such as helmets, masks, bailout systems, regulators, etc., that provide direct life support shall be of a type familiar to the diver and subject to a planned maintenance system.

Due to the life-support nature of diving, personnel involved in the operation, maintenance and repair of diving systems and equipment shall have appropriate training and experience in the maintenance and use of type of equipment used.

The diving supervisor shall ensure that all diving systems and equipment have been examined and tested prior to diving to determine their condition and suitability for service. No diving operation shall be permitted to commence until all systems and equipment have been thoroughly tested for proper functionality.

All relief valves related to life support systems shall be inspected and tested annually as to cracking pressure (must not exceed + 10% of MAWP.)

All fittings related to the life support system:

1. Shall be of corrosion-resistant material.
2. Have a minimum pressure rating of 200 psi or greater in accordance with the actual maximum allowable working pressure (MAWP) of the system of which they are installed.
3. Shall be of the proper thread design to mate to the adjacent fittings in the system.

For Mobile/Portable Commercial Diving Spreads (applicable to offshore AND inland?) – This was requested by HQ USCG

At the dive location (vessel or land based) there must be a list of all life-support, and rigging equipment, with all applicable certifications documenting fitness for use. Maintenance and test records and documentation outlining design limitations and manufacturers' restrictions on use should be easily accessible at the company level and provided as needed. This may also include technical manuals, spares inventory for the equipment on site, documentation of planned maintenance, repair and maintenance records, equipment logbooks, and checklists.

Additionally, maintenance should be based on the amount of time the equipment has been in operation, manufacturer's recommendations, or the equipment's documented history and pedigree.

Maintenance schedules must be outlined and documented, with only qualified personnel performing the inspection, maintenance, and testing of equipment and systems. This documentation should be accessible at the company facility and provided as needed.

Fixed surface and saturation systems, at a minimum, will have to adhere to the above requirements.

6.2 MAINTENANCE RECORDS

Suitable equipment logs shall be established and maintained in a correct and current condition.

Life-support equipment shall have a unique identity assigned by the manufacturer or contractor, be easily visible, permanently affixed and traceable to the equipment/maintenance log.

Entries made in the equipment log shall describe the nature of the work performed, including the dates of modification, repair or test; the name of the individual performing the work or test; and the particular piece of equipment involved.

A preventive maintenance program is required for all life-support equipment.

6.3 DIVER'S DRESS

6.3.1 GENERAL

Diver's dress shall be suitable for the job intended and consider such factors as biological, radiological, chemical and thermal conditions.

6.3.2 DRY SUITS

Diving personnel should be familiar with dry suit use requirements or should receive training prior to dry suit operations.

Dry suits shall:

1. Have a means of preventing over–inflation, which could result in an uncontrolled ascent.

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2. Be constructed of material suitable to the environment in which it is to be used.
3. Protect the diver from the environment, e.g., temperature or hazardous material.

6.3.3 HOT WATER SUITS

Hot water suits shall:

1. Flow sufficient water to maintain the diver(s) in thermal balance at the desired temperature.
2. Be capable of withstanding an operating temperature of 110º F (44º C).
3. Have a means to allow the diver to bypass incoming water prior to it entering the suit.

6.3.4 HARNESSES

A working diver shall be equipped with a full body diving harness that:

a. Is designed to:
   I. Provide a method to securely attach the umbilical to the diver.
   II. Lift an unconscious or injured diver and his or her equipment from the water in an emergency.
   III. Be utilized for underwater use.
b. Has an overall breaking strength of no less than 2,000 pounds.
c. Is equipped with a positive buckling device (i.e., designed to prevent strap pull-through and accidental release by the diver). It shall not be possible to release the harness by a single action.
d. Is equipped with at least one attachment point for the umbilical that is rated to at least the same breaking strength as the lifeline or strength member in the umbilical bundle. If the harness has multiple attachment points of different strengths, those suitable for umbilical attachments are to be clearly identified.
e. Is equipped with adjustable, permanently attached leg straps.
f. Is fitted with at least one lifting (recovery) ring, accessible when the diver is fully dressed, suitable for recovery of the diver from the water in an emergency using a hoisting device or other suitable means.
g. Is designed to maintain the diver in a heads-up position during recovery (using the lift ring/rings) from the water in an emergency.
h. Allows for easy disconnect of the main umbilical and weights, without removal of the main bail-out harness. This may be achieved by use of a separate/independent outer harness or jacket for the bailout system and diver's weights, or similar systems.
i. Is to be visually inspected prior to use for any signs of deterioration or damage. Any harness whose material condition is in doubt shall not be used until a determination is made by the diving supervisor.
j. Is to be regularly maintained in accordance with the manufacturer's recommendations.
k. Is certified by the manufacturer as detailed below.

- <u>**Certification and Testing of Diving Harnesses**</u>

A new diving harness shall be certified by the manufacturer or supplier to confirm that:

a. Each securing point intended for attaching an umbilical or lifting a diver out of the water in an emergency shall withstand a tensile of at least 2,000 pounds for five minutes without sustaining damage that would render it inoperable or unsafe to use.
b. Each complete full-body harness, including adjustment systems, buckles, etc., shall withstand a tensile load of at least 2,000 pounds for five minutes, applied in the direction of lift, without sustaining damage that would render it inoperable or unsafe to use.
c. Each harness is clearly marked in a durable manner with the following minimum information:
   - Manufacturer's name.
   - Unique identifier.
   - Breaking strength.

6.3.5 WEIGHT BELTS

Weight belts shall:

a. Be of sufficient weight to maintain the diver at working depth.
b. Not be used as an attachment for the diving umbilical.
c. Be equipped with an appropriate release device.
d. Be attached to the diver in a manner to avoid accidental disengagement.

6.3.6 DIVER-WORN OR CARRIED EMERGENCY GAS SUPPLY

Diver-worn or carried emergency gas supply (bailout) shall have a minimum calculated four-minute supply at the anticipated depth. (See bailout calculations in Section 11: Reference Materials).

EGS systems shall:

1. Have a cylinder(s) meeting the requirements in Section 6.11.2
2. Have a depth-compensating regulator on the cylinder capable of delivering the proper pressure and flow to the diver's helmet or mask in accordance with the helmet or mask manufacturer's recommendations.
3. Have a means of attachment to the hat or mask, which prevents accidental disengagement.
4. The diver-carried EGS or mask/helmet shall have a positive means of isolating it from the primary gas supply.
5. When diving a gas mixture other than air, sample/test to verify contents.
6. Bottles must be clearly marked with content, date, pressure and the name of the individual performing this verification.

6.4 HELMETS AND MASKS

6.4.1 GENERAL

Helmets and masks and their associated diver-carried regulators are components of a critical life-support system that, if not functioning properly, can expose the diver to significant hazards. As such, all helmets and masks and their associated diver-carried regulators shall be maintained and inspected in strict compliance with the manufacturer's recommendations. Suitable logs shall be maintained to reflect compliance.

Helmets and masks used for surface supplied diving operations shall:

1. Be appropriate for the task intended.
2. Be fitted with a two-way audio communications system.
3. Be equipped with a non-return valve in the main gas supply that closes readily and positively.
4. Have non-return valves with springs not exceeding 3 psi cracking pressure.
5. Be made of corrosion-resistant materials.
6. Be maintained in accordance with manufacturer's specifications and have all modifications that affect safety or performance documented in the equipment log.

6.4.2 HEAVYWEIGHT DIVING HELMETS

Helmets designated as a heavyweight diving outfit (heavy gear) shall:

1. Meet the requirements of paragraph 6.4.1.
2. Have a helmet group consisting of a helmet, breastplate and associated valves and connections.
3. Be equipped with a quick-dump valve to prevent over-inflation.

6.4.3 LIGHTWEIGHT DIVING HELMETS

Lightweight diving helmets shall:

1. Meet the requirements of paragraph 6.4.1.
2. Be fitted to accept diver-worn EGS.
3. Be fitted to allow for positive and ready removal from the diver in all uses.

6.4.4 CLOSED-CIRCUIT AND GAS-RECLAIM-SYSTEM HELMETS

Closed-circuit and gas-reclaim helmets shall:

1. Meet general requirements of Section 6.4.4
2. Be fitted to function on open circuit.

6.4.5 BIBS (BUILT-IN BREATHING SYSTEMS)

Individual breathing equipment utilized in PVHO built-in breathing systems (BIBS) shall:

1. Be held in place by adjustable straps, hood or other suitable means that frees the diver's hands.
2. Be capable of providing 2.0 ACFM (56.6 alpm) at maximum depth. (Some regional and regulatory requirements may differ.)
3. Be equipped to allow user to adjust for ease of breathing or constant free flow.
4. Be equipped with an exhaust valve.
5. Be equipped to prevent over-pressurization or rapid negative pressure from endangering the user.
6. Be maintained in accordance with manufacturer's specifications.

6.5 HOSES

6.5.1 GENERAL (i.e. all hoses associated with the breathing gas system)

Flexible breathing gas hoses used with diving systems or equipment shall:

1. Have a minimum burst pressure equal to four times the maximum allowable working pressure (MAWP). Be suitable/rated by manufacturer for work intended.
2. Have a MAWP and flow rating not less than the system in which it is installed or used and be suitable for the service intended.
3. Have connectors with pressure capability equal to or greater than the designed working pressure of the system on which they are installed.
4. Have fittings of corrosion-resistant material that cannot be accidentally disengaged.
5. Be kink-resistant or arranged to prevent kinking.
6. Have a suitable temperature rating when used for hot water service.
7. Be visually examined and pressure tested after each pressure boundary repair.
8. Be of suitable design to prevent collapse when used for operation with higher external pressure than internal pressure.
9. Have a maximum allowable working pressure equal to or greater than supply pressure plus 150 psi. (10.546 kg/sq).
10. Have all hose end fittings plugged, capped, or bagged (i.e. umbilical to helmet connection/bailout to helmet quick coupling connection). The use of tape by itself for this purpose is not permitted.

6.5.2 HOSES UTILIZED FOR BREATHING GAS (LP) (i.e. deck whips and all other LP hoses associated with the breathing gas system)

Breathing gas hose assemblies shall:

1. Meet requirements of paragraph 6.5.1.
2. Be suitable for breathing gas service.
3. Each hose assembly will be subjected to an annual pressure test to one-and one half times the design working pressure of the system. The test pressure should be maintained (when corrected for temperature) for 10 minutes.

6.5.3 UMBILICALS

Diver umbilical and dive hose assemblies shall:

1. Meet the requirements of paragraph 6.5.1 and 6.5.2.
2. Be marked from the diver/bell end in 10-foot intervals up to 100 feet and marked in 50-foot intervals thereafter.
3. Be subjected to an annual pressure test to one-and-one-half times the design working pressure of the system. The test pressure should be maintained without loss of pressure (when corrected for temperature) for 10 minutes.

Note: To ensure uniformity throughout the commercial diving industry, ADCI Standard 006 recommends the following color coding be used by all participants.

10 feet (3.05 meters)	1 white band
20 feet (6.10 meters)	2 bands
30 feet (9.15 meters)	3 white bands
40 feet (12.2 meters)	4 white bands
50 feet (15.25 meters)	1 yellow band
60 feet (18.29 meters)	1 yellow band/1 white band
70 feet (21.34 meters)	1 yellow band/2 white bands
80 feet (24.39 meters)	1 yellow band/3 white bands
90 feet (27.44 meters)	1 yellow band/4 white bands
100 feet (30.49 meters)	1 red band
150 feet (45.73 meters)	1 red band/1 yellow band
200 feet (60.98 meters)	2 red bands
250 feet (76.22 meters)	2 red band/1 yellow band
300 feet (91.46 meters)	3 red bands

Beyond 300 feet (91.46 meters), continue to place yellow bands after 50 feet (15.25 meters) and red bands after 100 feet (30.49 meters).

4. Be marked with a unique identity and be subjected to a planned maintenance program.
5. Consist of a breathing gas hose, communications cable, a means of determining the diver's depth, and a strength member (the strength member may be the entire hose assembly, if so designed).
6. Have a minimum break strength of the hose assembly, including terminating hardware (e.g., "D" ring or attaching points), of 1,000 pounds.
7. Pneumo hose shall be annually pressure-tested for leakage.

The umbilical assembly used for the standby diver must be of sufficient length to reach the primary diver at his or her furthest possible excursion from the dive station.

6.5.4 OXYGEN HOSES

1. Oxygen hoses shall meet the requirements of Section 6.5.2 and be suitable for use intended.
2. LP hose assemblies (less than 500 psi) used in systems containing greater than 50 percent oxygen are to be cleaned for oxygen service.
3. Hoses used for oxygen (over 50 percent) service shall be identified by a consistent color code or tagged "FOR OXYGEN USE ONLY."
4. Lubricants used to assemble fittings on hoses for oxygen service shall be compatible with oxygen.

6.5.5 BREATHING GAS HOSES (HP) (High pressure hoses associated with the breathing gas system)

Breathing gas hose assemblies shall:

1. Have a minimum burst pressure equal to four times the maximum allowable working pressure (MAWP) and be suitable/rated by the manufacturer for work intended.
2. Have connectors with pressure capability equal to or greater than the designed working pressure of the system on which they are installed.
3. Have fittings of corrosion-resistant material that cannot be accidently disengaged.
4. Be kink-resistant or arranged to prevent kinking.
5. Be visually examined and pressure tested after each boundary repair.
6. Be suitable for breathing gas service.
7. Each hose assembly will be subjected to an annual pressure test to the maximum allowable working pressure (MAWP) of the system. The test pressure should be maintained (when corrected for temperature) for 10 minutes.

6.6 COMPRESSOR SYSTEMS

6.6.1 COMPRESSORS AND GAS PUMPS

Compressors, boosters, gas transfer pumps and filters used to provide breathing air/gas for diving shall be designed and manufactured to:

1. Have suitable personnel protection around rotating machinery that meets applicable jurisdictional requirements.
2. Have the necessary instrumentation to facilitate operations.
3. Be of the proper type, pressure and flow rate, and be suitable for service intended.
4. Have its air intake arranged to be clear of exhaust fumes and other contaminants.
5. Have flexible pressure hoses in accordance with paragraph 6.5.1.
6. Have electrical controls, wiring and drive units meeting the jurisdictional requirements, when so equipped.

6.6.2 FILTRATION

Filters, when installed to prevent contamination, must meet or exceed the flow rate and pressure rating of the compressor or piping system in which they are installed and be able to deliver breathing gas in compliance with Compressed Gas Association (or equivalent) purity standards for extended operation.

6.6.3 TESTING

Compressors used for breathing gas shall be functionally tested per the following schedule, and shall conform to design specifications.

1. Prior to being put into service.
2. Periodically in accordance with manufacturer's recommendations and planned maintenance schedule.
3. During annual inspection.
4. After any repairs that may affect the compressor's performance.

6.6.4 AIR PURITY REQUIREMENTS

1. All compressors, transfer pumps or booster pumps used for breathing air service will be subjected to an air quality test every six months. Compressors with a discharge pressure of 500 psi or less shall meet the standards of the current ANSI CGA required for Grade D air, or equivalent. Compressors with a discharge pressure that exceeds 500 psi shall meet the requirements of the current ANSI CGA for Grade E air, or equivalent.
2. Air purity tests shall be taken at the discharge point that would normally supply the breathing gas system, the diver's hose or cylinder fill point.
3. Documentation of the latest test(s) shall be kept on file and available upon request.
4. Compressors used for breathing gas transfer other than atmospheric air shall be checked every six months to ensure they do not induce contaminants into the gas being processed.

6.7 MANIFOLDS

Manifolds:

1. Shall be plumbed for the proper pressure and flow to supply gas to the job as required.
2. All components shall be suitable for all gases being used, be of corrosion-resistant material, and have a pressure rating of 200 psi or greater in accordance with the actual maximum allowable working pressure (MAWP) of the system on which they are installed.
3. Shall be appropriately cleaned for the gas being used.
4. Shall not use fast-opening valves with oxygen service greater than 50% mix.
5. Shall be equipped with inlet pressure gauges on each supply line and manifold supply pressure gauge.
6. If equipped with regulator, each regulator installed in the manifold shall be equipped with an inlet pressure gauge and outlet pressure gauge. Also, shall be equipped with a pressure-relief valve set no higher than +10% of the MAWP of the system and shall have a fast-acting shutoff valve (unless the breathing media has an oxygen mixture greater than 50%).
7. Shall have pneumo gauges rated at 1/2 of 1% accuracy or greater as needed for the job intended.
8. Shall have a back-up gas source available and connected to the manifold with an easy changeover capability.
9. Shall have fast-acting valves at all locations leaving the divers' breathing area (unless the breathing media has an oxygen mixture greater than 50%).

6.8 PRESSURE-REDUCING REGULATORS

Pressure-reducing regulators:

1. Shall be the appropriate pressure and flow required to do the job at the depth intended.
2. Shall be corrosion-resistant material.
3. Shall have an appropriate relief valve, with fast-acting shutoff valve (unless the breathing media has an oxygen mixture greater than 50%), downstream to protect the lower part of the system, set no higher than +10% of the MAWP of the system.
4. Shall be equipped with inlet pressure gauges and outlet pressure gauges.

6.9 LAUNCH AND RECOVERY SYSTEMS (LARS)

6.9.1 GENERAL

Launch and recovery systems intended for the launch and recovery of a diver or divers between the surface dive location and the work location by either bell or stage shall:

1. Be designed, manufactured installed and tested in accordance with applicable design codes, standards and regulations.
2. Air purity tests shall be taken at the discharge point that would normally supply the breathing gas system.
3. Be fitted with two independent braking systems capable of holding 1.25 times the safe working load of the winch.
4. Be designed so that the load can be stopped, and held in position, if the power supply fails, is disengaged, is switched off, or if operating control is released.
5. Have controls located or equipped such as to afford the operator both a view and control of the lifting operation, or appropriate signalman.
6. After any installation, alteration, repair or failure, be thoroughly examined and be functionally and load tested to 1.25 times the safe working load of the handling system.
7. Have wire ropes and fittings that are:
   - Installed, terminated and maintained in accordance with design criteria and/or manufacturer's recommendations.
   - Visually inspected every six months for damage, deterioration or deformation.
   - Periodically examined and tested to recognized applicable codes and standards.
   - Have wire ropes and fittings that are rated eight times the load.
8. Have a spooling arrangement fitted if fleeting angle exceeds 2 degrees.

6.10 DIVER ENTRY AND EGRESS SYSTEMS

6.10.1 DIVING LADDER AND STAGE

Diving ladders and stages shall:

1. Be capable of supporting the weight of two divers plus their gear.
2. Be made of corrosion-resistant material or be maintained free of corrosion.
3. Be suitable for the purpose intended.
4. Ladders must extend a minimum of 3 feet below surface where installed.
5. Stages must be equipped with a safety chain and internal handholds for dive safety during launch and recovery.

6.10.2 OPEN-BOTTOM BELLS

Open-bottom bells shall:

1. Have an upper section that provides an envelope capable of maintaining a bubble of breathing mixture for a diver when the diver is standing on the lower section with his or her body through the open bottom and his or her head in the bubble.
2. Have lifting eyes rated for lifting 500 pounds for each occupant, plus the weight of the bell.
3. Be protected against and maintained free from injurious corrosion.
4. Able to accommodate two divers with gear in an uncramped position.
5. Be fitted with internal handholds for divers.
6. Have provisions for mounting of breathing gas cylinder(s) and regulator for emergency breathing at all depths of intended operation.

6.11 GAUGES

Gauges utilized with diving equipment or systems shall:

1. Be suitable for purpose intended.
2. Be cleaned for oxygen when installed in oxygen systems using mixtures greater than 50%.
3. When used to indicate a diver's depth:
   - Be of appropriate range and graduation.
   - Be graduated in units consistent with the decompression tables to be utilized.
   - Be calibrated to a known standard every six months.
   - Be recalibrated using a gauge of equal or greater accuracy in accordance with ASME B4.100-2005. Guage must be treated ata a minimum of 5 points up and down the scale with variance no greater than the accuracy of the scale.
   - Be marked with a label, tag or sticker indicating date of last calibration, due date, and technician's initials, which will not interfere with full-scale visibility.
   - Have calibrations documented in the equipment log.
   - A pressure-limiting device may be fitted to avoid gauges being over-pressurized.
4. If master reference gauge is used for calibration, gauge accuracy needs to be at least .25%.

6.12 TIMEKEEPING DEVICES

Devices utilized to monitor a diver's exposure time under pressure shall be suitable for purpose and easily readable.

6.13 COMPRESSED GAS EQUIPMENT

6.13.1 VOLUME TANKS/AIR RECEIVERS

Volume tanks used in diving systems shall:

1. Be designed, fabricated, inspected, tested and certified in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section VIII, Div. I, "Unfired Pressure Vessels," and/or other statutory or classification society requirements.
2. Be equipped with a pressure gauge.
3. Be equipped with a check valve on the inlet side.
4. Be pressure-rated to the maximum system pressure on which it is installed.
5. Be equipped with a relief valve as required by code of manufacturer and tested at least annually.
6. Be equipped with condensate drain valve, located at its lowest point.
7. Be equipped with slow-opening valves when used with design pressures exceeding 500 psi.
9. Be cleaned for oxygen service and have slow-opening valves when used in systems containing greater than 50 percent oxygen.
10. Be inspected internally and externally at least annually for damage or corrosion.
11. Be pneumatically tested to MAWP annually, utilizing the breathing mixture normally used.
12. Be hydro tested to 1.3 MAWP (ASME 2007 UG 99) every fifth year or after any repair, modification or alteration to the pressure boundary and marked with the test date.
13. Have a unique identity with results of all tests being recorded in the equipment log.

6.13.2 GAS STORAGE CYLINDERS AND TUBES

High-pressure gas cylinders or tubes shall:

1. Be manufactured to recognized code or standard.
2. Be equipped with an overpressure relief device.
3. Be visually examined externally at least annually for damage and corrosion.
4. If rack-mounted into banks of cylinders or tubes, have valves and regulators protected from damage caused by impact or from falling objects. HP cylinders that are stamped with a star adjacent to their hydro date are only subject to hydrostatic testing every 10 years.
5. Be hydrostatically tested every fifth year to the requirements of the code of the manufacturer by an authorized test facility and stamped with the date of test.

6. Be inspected internally at least annually for damage or corrosion if used underwater by a qualified technician.
7. Be labeled as to contents. Fire-hazard warning signs should be erected in the vicinity of stored oxygen.
8. Be stored in a well-ventilated area, protected from overheating and secured from falling.
9. A record shall be kept in a designated place of the contents and pressure of each cylinder, quad or bank. These records should be updated daily when the system is in use.

6.13.3 SCUBA AND EGS (BAILOUT) BOTTLES

High pressure bottles used for scuba and EGS (bailout) shall:

1. Be manufactured to recognized codes or standards.
2. Be equipped with an overpressure relief device.
3. Be inspected internally and externally at least annually for damage or corrosion by a qualified technician.
4. Be hydrostatically tested every fifth year to the requirements of the code of the manufacturer by an authorized test facility and stamped with the date of test.
5. Have a unique identity with results of all tests being recorded in the equipment log

It is recommended that a maximum rate of 600 psig per minute be adhered to for the safe filling of EGS (bailout) bottles and that personnel refrain from over-pressurization or fast filling. Proper PPE should be worn by all personnel when charging cylinders.

Proper labeling of contents (bottom mix) should be visible on the bottle. It is further recommended that complete discharge of the bottom mix be conducted after the dive if the bottle is charged with a mixture other than air.

6.14 PRESSURE VESSELS FOR HUMAN OCCUPANCY (PVHO)

6.14.1 GENERAL

Pressure vessels for human occupancy (PVHOs), associated with diving operations cover a wide range of applications, including, but not limited to, deck decompression chambers, diving bells, saturation living chambers, transfer locks and hyperbaric emergency evacuation systems.

PVHOs and associated systems are specialized equipment that are operated within the harsh environment of the diving industry and present potential risks to personnel supporting diving operations. PVHOs typically have unique attributes such as acrylic viewports and quick-opening pressure closures that have requirements for maintenance and safe operation.

The ADCI, in its technical and advisory capacity to the diving industry, has adopted a set of recommended standards for PVHOs specifically to minimize the risks involved with their safe operation. These standards were conceived as recommendations to be incorporated into industry practice. The standards cover PVHO design, fabrication, inspection, maintenance and repair. A PVHO is governed by industry standards, classification societies and national and applicable regulatory authorities (see "References" at the end of Section 6).

6.14.2 PVHO DESIGN AND CONSTRUCTION REQUIREMENTS

All PVHOs shall meet the following minimum requirements:

1. PVHOs and their associated systems shall be built in accordance with the most current version of ASME PVHO-1 and/or in conformance with the requirements of a classing society competent in PVHO diving systems.
2. Have a pressure relief device as per the most current version of ASME PVHO-1 or the code/standard of construction. Normally this is no more than 10 percent above MAWP (maximum allowable working pressure) of the PVHO.
3. Any doors, hatches or quick-acting closures associated with a TUP (transfer under pressure) system shall be equipped with an interlock system to prevent accidental opening under pressure. This would include medical locks, equipment locks and bell TUPquick closures.
4. Have a control panel with a dedicated pressure gauge indicating depth for each pressurized compartment. The gauges shall:
   - Be maintained with a calibration of each depth gauge within six months.
   - Be arranged so as to allow comparison with another gauge while in operation.

6.14.2.1 Surface Diving Decompression Chambers

When selecting a surface diving decompression chamber, careful consideration must be given to its MAWP capabilities relative to the planned deepest depth of the diving operation (See 7.).

Surface diving decompression chambers shall:

1. Be dual-lock and multiplace (except emergency rescue chambers or chambers designed to mate with another P.V.H.O., if regulatory codes allow).
2. Have sufficient internal dimensions to accommodate a person lying in a horizontal position with another person attending (except designated diving bells, transfer locks and emergency rescue chambers).
3. Permit ingress and egress of personnel and equipment while the occupants remain pressurized.
4. Have a means of operating all installed man-way locking devices, except disabled shipping dogs, from both sides of a closed hatch.
5. Have illumination of the interior sufficient to allow operation of any controls and allow for visual observation, diagnosis and/or medical treatment.
6. Have viewports that allow the interior to be observed from the exterior.
7. Have a minimum pressure capability of 6 ATA (165 fsw [50 msw]; **and a minimum pressure capability of the maximum depth of the dive plus 1 ATA.**
8. Be capable of a minimum pressurization rate of 60 fsw (18.3 msw) within 1 minute. The inner lock may be blown down in advance to achieve this pressurization rate. There must be adequate air capacity on site to achieve deeper treatment depths.
9. Be capable of a decompression rate of 30 fsw (9.2 msw) per minute to 33 fsw [10.06 msw].
10. Have a means to maintain an atmosphere below a level of 25 percent oxygen by volume.
11. Have a means of maintaining an atmosphere not to exceed 1 percent surface equivalent carbon dioxide by volume.
12. Have mufflers/silencers on blowdown and exhaust outlets.
13. Have suction guards on exhaust line openings inside each compartment.
14. Have piping arranged to ensure adequate circulation.
15. Have all installed flexible hoses meet the requirements of Section 6.5: Hoses.
16. Have all penetrations clearly marked as to service.
17. Have piping in accordance with ANSI B31.1 and/or the most current version of ASME PVHO-1 or the classification society to which it was built.
18. Have the relief valve pressure settings tested annually and the test recorded in equipment log.
19. Pressure test the chamber and associated piping annually to MAWP, as stamped on the chamber name plate, and record in the equipment log.
20. Have an installed breathing system with a minimum of one mask per occupant per lock, plus one spare mask assembly per lock.
21. Have the capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work.
22. Have a non-return valve or quick disconnect with built-in check valve on through-hull penetrators supplying any built-in breathing system [BIBS].
23. Have a primary and secondary two-way voice communication system between the occupants and the operator.
24. Be equipped with a readily available means for extinguishing fire.
25. When fitted, have electrical systems designed and installed fit for purpose for the environment in which they will operate.
26. Chamber and BIBS exhaust should not vent into an enclosed space.
27. The chamber and its general area and controls should be adequately illuminated for operations at night. An enclosed space can mean a small shack, tented area, container, or inside of a vessel.
28. If external lights are used to illuminate the chamber internally, they shall not be placed in a manner to subject viewports to heat buildup and damage.
29. If the chamber is located away from the dive control station, there must be a means of communications between the two locations.
30. All chambers shall have an emergency breathing media immediately available to the BIBS in addition to the treatment gas.

6.14.2.2 Saturation Chambers

Saturation PVHO chambers, regardless of use; living chambers; TUP chambers; or any man-rated components of a saturation complex designed and intended for a human to be housed in shall have all the requirements of decompression chambers plus the following:

1. Have sufficient internal dimensions to accommodate the PVHO-rated occupancy of each person standing and lying on their assigned bunk in a horizontal position and personal storage.
2. The ability to analyze the ambient environment, including temperature, humidity, oxygen and CO_2, on a continuous basis.
3. Oxygen and CO_2 analysis gas sampling shall be from dedicated equipment with visual and audio alarms to ensure a predetermined high or low level is brought to the attention of the sat control life-support technicians
4. Chambers shall have the ability to analyze the gas samples in the chambers from a low and high point in the chamber. (This ensures gas stratification is identified and monitored.)
5. Chambers shall have an environmental control system capable of maintaining a physiologically suitable temperature and humidity during normal operations.
6. Metabolic oxygen make-up shall be controlled in a manner that will maintain a constant desired level.
7. Medical or equipment locks shall be located in strategic locations to ensure the PVHO occupants have the ability to receive supplies, food, drink and miscellaneous needs during normal operation as well as during emergency operations.
8. In chambers designated as sanitary and shower areas, the toilet receptacle shall have a raised vented seat to ensure a seal cannot be created by the occupant sitting on the toilet seat.
9. The toilet assembly shall have a safety interconnect device that will not allow the flushing of the toilet while the occupant is seated.

6.14.2.3 Diving Bells, Submersible Decompression Chambers, Closed Bells[3]

Submersible decompression chambers/diving bells shall:

1. Meet the PVHO design and construction requirements where applicable.
2. Have sufficient internal dimension to accommodate the intended number of divers and their equipment.
3. Have protection against mechanical damage to valve penetrators, sealing surfaces, onboard gas, etc.
4. Have view ports to allow occupants to observe their external surroundings, also sufficient to allow observation of the interior from the exterior.
5. Have protection against mechanical damage on all view ports.
6. Have all piping penetrations equipped with a shutoff valve on both sides of the pressure boundary.
7. Have all penetrations, valves, gauges and piping clearly marked as to service and operation. A diagram or photographic records of the bell valves (internal and external) should be available at the dive control station.
8. Have identified points for connection of emergency services.
9. Have all installed flexible hoses meet the requirements of paragraph 6.5: Hoses.
10. Be equipped with sufficient primary and emergency electrical power for 24 hours.
11. Have a means by which occupants may read internal depth pressure and external depth pressure at all times.
12. Have an installed oxygen analyzer readable by the occupants.
13. Have an internal method of analyzing CO_2. (Chemical tubes are acceptable.)
14. Have a means of removing CO_2.
15. Have a primary two-way communication system between the diving supervisor and all divers supported from the bell, including the bell occupants.
16. Have a secondary communication system connected to the dive control center. This may be a sound-powered telephone with growler signal devices.
17. Be equipped with a "through-the-water" emergency communication system.
18. Be equipped with an acoustical beacon (must have sufficient power to last a minimum of 24 hours).
19. Have internal electrical systems that are designed for the environment in which they will operate to minimize the risk of fire, electrical shock or galvanic action of the PVHO.

20. Have electrical penetrators designed and installed fit for purpose for the environment in which they will operate that are tested to a minimum of two times the design working pressure of the bell and capable of withstanding applied pressure in either direction.
21. Have a capability of recovering an injured diver from the water (block and tackle/boom vang).
22. Have identified, installed and tested a secondary lift point capable of supporting the submerged weight of the bell.
23. Have a means of maintaining a physiologically suitable temperature during normal operations.
24. Have a means of controlling hot water flow to a diver locked out of the bell.
25. Have gas piping designed and arranged so that a venting or flushing of the bell will not adversely affect the breathing gas supply of any divers supported from the bell.
26. Be equipped with one individual breathing device for each occupant capable of providing breathing gas from both a surface-supplied source and the onboard emergency gas (plus one spare mask assembly).
27. Have sufficient onboard gas to allow a diver to remain outside the bell for 30 minutes at the maximum depth rating of the bell, at a breathing rate of 1.5 cfm.
28. Have a gauge indicating the pressure in the onboard emergency gas cylinders, readable by the bell occupants.
29. Have metabolic oxygen onboard to support the number of occupants for a period of 24 hours at a consumption rate of at least 0.5 liters per minute, per occupant. Note: Mixed gas in sufficient quantity may be substituted.
30. Have an oxygen supply so arranged that oxygen flow into the bell is limited to a controlled rate or volume relative to the bell internal pressure.
31. Have a first aid kit in a clearly marked and suitable container.
32. Have a basic tool kit.
33. Have a water-resistant copy of emergency procedures.
34. Have umbilical that meets the requirements of Section 6.5: Hoses, and provides breathing gas; pressurization and exhaust; communications and power; hot water; and other required services. The bell standby diver's umbilical must be capable of quick release action by the bellman once he is out of the bell in an emergency. If the bell standby diver's umbilical is stored outside of the bell, it must be adequately stowed to avoid damage during launch and recovery of the bell. The end of the bell standby diver's umbilical must be arranged to allow the standby diver to attach his or her mask or helmet and test it before the main diver exits the bell.
35. When fitted, have ballast release mechanisms that are designed to prevent accidental release.
36. Be designed so that the diver can freely exit and re-enter the bell if it is resting on the seabed. This normally requires a standoff frame and/or clump weight.
37. If diving below 500 fsw (152 msw), there must be a means of heating the divers' inspired gas.
38. Have a copy of the emergency tap code available to the bell occupants and dive control station personnel. (Emergency tap codes should be posted on the outside of the bell.)
39. Have a copy of the emergency tap code attached outside the bell near a viewport.
40. There shall be a means and written procedure to evacuate divers under pressure during an emergency.
41. No dive shall be made that exceeds the depth rating of the saturation system.
42. Maximum system working pressure shall not exceed the lowest-rated maximum working pressure of any component.

6.14.3 EMERGENCY EVACUATION SYSTEMS (EES)[3]

An EES is a dedicated PVHO that is designed for transport/evacuation of divers in saturation in an emergency situation. Any planned saturation diving operation shall require an EES.

There are two types of emergency evacuation systems:

1. A PVHO adapted and designated for use in an evacuation. **(Not to include the primary bell.)**
2. A dedicated rescue system where a pressure chamber is fitted into or forms a part of a purpose built lifeboat.

Emergency evacuation systems shall:

1. Meet the requirements of sections 6.12.2.1 and 6.12.2.2: Saturation Chambers, as applicable.
2. Be outfitted to accommodate the maximum number of divers who may be under pressure.
3. Be fitted with a locating device.
4. Have oxygen or mixed gas on board to support the number of occupants for a period of 72 hours at a metabolic oxygen consumption rate of .017 cfm/0.48 liters per minute, per occupant.

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5. Have a primary and secondary means to remove carbon dioxide from the atmosphere (e.g., battery and lung powered), as well as a means to monitor CO_2 and O_2 levels (PPO_2 meters are recommended).
6. Have onboard batteries to meet the demand of the electrical load for 72 hours.
7. Have a suitable first aid kit clearly marked, in a suitable container, and accessible.
8. There must be a detailed written procedure for evacuation of the EES contained in emergency procedures.
9. The EES shall be connected to the saturation system and a reserve supply of gas shall be available to press the EES to the deepest storage depth of the system during all diving or decompression operations. This procedure should be detailed in the emergency procedures for evacuation (see number 8).
10. The EES shall be capable to transfer supply and equipment under pressure.
11. Contain appropriate warning signs. (Refer to IMO warning sign document in the IMO Code of Safety for Diving Systems a.536 (13))
12. Have the means to be recovered, towed and lifted.
13. Shall be tested for positive buoyancy to verify design, after any structural modifications or annually.

The HRC shall have a compatible life-support control system (LSCS)[3] available within 24 hours maximum of the HRC location and shall be stored in a different location than the saturation system. HRC LSCS shall, at a minimum:

- Have two-way communication.
- Have gas control panels.
- Have gas suitable for a maintaining depth.
- Have emergency gas for BIBS.
- Be able to monitor oxygen and CO_2
- Have a written copy of procedures in place to maintain the environment.

6.15 MAINTENANCE OF PRESSURE VESSELS FOR HUMAN OCCUPANCY ADDENDUM

6.15.1 INTRODUCTION

The ADCI, in its technical and advisory capacity to the diving industry, has adopted a set of guidelines for the repair and maintenance of PVHO equipment that it recommends be incorporated into industry practice.

The diving business is, by its nature, an industry that operates within a harsh environment. Consequently, the design, construction and maintenance of diving equipment and the associated operational procedures are governed by industry and national standards, as well as national and international regulations (Appendix A). PVHO tankage and its associated hardware and associated systems are specialized equipment, rules for which were conceived specifically to minimize the risk involved.

6.15.2 GENERAL PRECAUTIONS FOR ACRYLIC VIEWPORTS

These are general precautions for the cleaning, operational inspection, installation and maintenance of acrylic viewports used in pressure vessels for human occupancy. **For additional information, it is recommended that ASME PVHO-2 be referenced. This document covers design, inspection and maintenance for acrylic viewports.**

6.15.3 CLEANING

When cleaning is required, viewports should be carefully cleaned, and surfaces must not be scratched. An acceptable cleaning agent is mild soap and water.

Do not use solvents of any type (alcohol, acetone, etc.) for any purpose on the window, gaskets or O-rings.

CAUTION: Only hand-cleaning is allowed. The use of power-driven tools is not permitted.

After cleaning, inspect the window for blemishes such as cracks, chips, dings, scratches, crazing, blisters or discoloration. (Crazing is the development of a network of fine spiderweb-type cracks on the surface of the window; it can be caused by either stress or exposure to solvents.)

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6.15.4 IN-SERVICE INSPECTION

Operational inspections should be conducted prior to each chamber pressurization. Visually inspect the accessible exterior, interior and bearing surfaces for the presence of blemishes in the form of crazing, cracks, scratches, blisters and discoloration. A common flashlight will assist in locating blemishes such as chips, cracks, or crazing and in determining the condition of bearing surfaces.

Blemishes on the low-pressure face can serve as initiators of cracks and subsequent failure in flat disk and conical frustum viewports. For diving bells and submersible diver lock-out compartment viewports, both faces should be considered low-pressure faces.

The depth of the blemish can be measured with a depth micrometer with a pointed rod (Brown and Sharpe, or equivalent or an optical comparator). Consideration should be given to the concentration of scratches, cracks or crazing occurring in the center of the viewing area, as this may be an indication of stress.

6.15.5 INSTALLATION

Viewports should be properly cleaned and carefully installed to ensure proper fit and safe operation. All viewport surfaces should be free of defects.

All metal contact surfaces must be smooth and clean. Surface should be free of all defects and foreign matter. An oxygen compatible lubricant, which is compatible with acrylic, should be used. Retaining bolts should also be cleaned, inspected and lubricated.

O-ring and gasket sealing surfaces must be completely free of any foreign material, such as cleaning agents and solvents, rust, sand, grit, paint chips, etc.

All paint that will come in contact with the viewport should be fully cured.

6.15.6 MARKINGS

Viewport identification markings must be preserved on each viewport during cleaning and handling. Corresponding viewport documentation should be maintained with the PVHO documentation package.

NOTE: Further information can be found in ANSI ASME/PVHO-1, Section 2.

6.16 DAMAGE BY ACCIDENT

Major structural damage may be caused by an accident or mishandling. This may include things like:

6.16.1 PRESSURE HULL DAMAGE

- Dents.
- Gouges.
- Damaged penetrator (stripped threads).
- Mating flange.
- Lift lug or tie-down eye (bent, broken or hole elongation).
- Support base (frame deformation).

6.16.2 DOORS

- Damaged sealing surface.
- Bent/broken hinge.
- Damaged dogging mechanism.

6.16.3 VIEWPORT DAMAGE

- Crazing.
- Cracked/chipped.
- Weld spatter.
- Paint thinner damage.
- Overheated/blistered (permanent deformation).

6.17 DAMAGE BY CORROSION

6.17.1 GENERAL

More important than damage done by an accident, and often unseen until more extensive, is the damage done by corrosion. Most damage by corrosion can be avoided with a diligent preventative maintenance program, however, even with the best preventative maintenance programs, damage can still occur.

6.17.2 TYPICAL CORROSION DAMAGE MAY INCLUDE

- Pit corrosion (shell and heads).
- Crevice corrosion.
- Penetrators.
- Viewport sealing surfaces.
- Door faces.
- Sealing surfaces.
- O-ring grooves.
- Support legs/saddles.

6.17.3 CORROSION ALLOWANCE

Pressure vessels are typically built with a corrosion allowance in the calculated required metal thickness. This information is usually found on the pressure vessel certificate. Examination of corrosion-affected areas should be done in a manner necessary to determine if the corrosion has gone beyond the calculated allowable amount and may require remedial action.

6.18 REPAIR OF A PVHO

The owner should be aware of the requirements of the regulatory authority and of interested third parties, as their requirements will have a direct bearing on the repair specification.

PVHO repair must be approached properly, regardless of how well the work is done or the quality of the material used. Without a conscious effort to comply with existing rules and regulations, it is possible to have an expensive repair that does not meet the requirements and is unacceptable.

It is important that a defined method is used when approaching the repair of a PVHO.

Recommended steps for approaching any repair are as follows:

- Appraisal.
- Plan.
- Execution.
- Documentation.

6.19 APPRAISAL

1. The initial step is to appraise the damage. This means more than a casual look at the vessel and agreeing that it has been damaged. All damage should be investigated to determine the cause and what measures can be taken to prevent a reoccurrence.

2. Measure or otherwise quantify the damage so you can answer questions about the extent of the visible damage. Be aware that there may be areas of hidden damage. Make a sketch or map of the damaged area; photos may be helpful. Make a written report, describing the nature and extent of the damage. Be accurate, and include as much detail as possible. Be honest in your appraisal; remember that the goal is to save the PVHO vessel and to put it safely back into service.

3. Damage to the pressure boundary of the vessel will require that any repairs be done in accordance with the code of manufacture. Likewise, damage to the attached piping shall be repaired to the code to which it was built. Only components meeting the applicable code requirements should be used for repairs or replacements.

4. Gather all of the existing documentation on the vessel. This information will be needed by engineering, code repair shop, authorized code inspector, insurance adjuster, classing society surveyor, etc.

5. Depending on the type and extent of damage, it may be necessary to perform in a nondestructive examination (NDE) to determine the extent of damage. It may be necessary to grit-blast the vessel to bare metal to determine the exact scope of work.

6. Prepare a written report and budget for the repairs.

   NOTE: If the decision as to the disposition of the repair is yours to make, don't skip this step. It will become your tool to control the repair project.

6.20 PLAN

1. Make a technical plan for the repair. The plan should clearly establish the scope of work for the fabricator, as well as the scope of responsibility. This plan, if correctly drawn up, can function as the specification for the work and as part of a purchase order.
2. The plan should clearly state the codes, standards, rules, regulations and quality of workmanship that will govern the work. Don't forget the paperwork requirements. Be very specific about the paperwork and paper deliverables for which the fabricator or repair shop is responsible.
3. Prepare the drawings and/or calculations as necessary to affect the planned repair. An engineer, either in-house or outside, may need to be engaged to verify all details have been addressed.

   You should then obtain agreement from the regulator (jurisdiction) or classing society that:

   - The proposed repairs and techniques are within the code.
   - The proposed materials meet the code requirements.
   - The repair plan will be approved.

   Most repairs will require an initial survey to look at the vessel and assess your repair plan.

6.21 EXECUTION

1. Having obtained the concurrence of the required parties, and armed with your repair plan, budget, drawings and specifications, you are now ready to talk with a qualified fabricator or repair shop.
2. The least problematic choice is the original vessel fabricator. This is not always possible, but the likelihood is that the original fabricator will have the records that will make the repair and documentation go more smoothly.

   Unfortunately, many of the fabricators that have built PVHOs in the last 15 years are either out of business or may not have retained the records on your vessel. The ASME requires records to be retained for only five years. It is a good idea to require, as part of your purchase agreement with any fabricator or repair facility, that you receive a copy of all paperwork. If the vessel was registered with the National Board of Pressure Vessel Inspectors, you can get copies of the certificate by contacting the National Board.
3. The next best choice would be a fabricator that is currently building and certifying PVHO vessels. The fabricator should be authorized to apply the ASME "U" stamp and/or the "R" stamp from the National Board. The scope and criteria to differentiate between minor and major repairs is provided in the National Board Code ANSI- NB23. Alternatively, for PVHOs constructed to other codes, the repair shop should be certified to do repairs to the code to which the PVHO vessel was built.

6.22 TESTING

1. Prior to, during and after repairs, various types of testing may be employed. Test results should be retained as part of the equipment record.
2. All non-destructive examinations should be done in accordance with ASME Section-V: Non Destructive Examination, by personnel competent in the type of test employed.

3 Pressure tests should be done in accordance with a written procedure and appropriate safety precautions.

6.23 DOCUMENTATION

1. All repairs and alterations are to be recorded in the equipment log. This should be accompanied by references to certificates and identification markings. Pressure testing should likewise be documented and recorded in the log. Any alteration or modification should be reflected in all drawing revisions.
2. All certificates, drawings, calculations and reports should be retained for the service life of the equipment.

A professional approach to the repair of PVHOs will yield professional results, thereby preserving a valuable asset and ensuring the safety of the occupants and operators.

It is impossible to guarantee that accidents will not happen. However, the probability can be significantly reduced by a good PREVENTATIVE MAINTENANCE PROGRAM and consistent safe practices.

6.24 REFERENCES

- ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and 2
- ASME Section V : Non Destructive Examination
- ANSI — ASME/PVHO-1 and 2
- ANSI B31.1: Code for Pressure Piping, Power Piping
- Association of Diving Contractors International Consensus Standards for Commercial Diving Operations
- 29 CFR Part 1910: OSHA Rules for Commercial Diving
- 46 CFR Part 197: USCG Rules for Commercial Diving Operations
- IMO (International Maritime Organization) Code of Safety for Diving Systems, a.536 (13)
- IACS (International Association of Classing Societies)
  - ABS (American Bureau of Shipping)
  - DNV (Det Norske Veritas)
  - Lloyds Registry
  - National Board of Boiler & Pressure Vessel Inspectors ANSI-NB23

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SECTION 7.0

EMERGENCY PROCEDURES, ASSESSMENTS AND REPORTING OF ACCIDENTS

Association of Diving Contractors International, Inc.

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7.0 EMERGENCY PROCEDURES, ASSESSMENTS AND REPORTING OF ACCIDENTS

7.1 BASIC EMERGENCY PROCEDURES GUIDELINES

The following emergency procedures that may affect the health and safety of personnel are offered as minimum guidelines to assist companies in developing their own specific detailed emergency procedures. The steps that are listed may not be in order of preference. Each emergency will dictate its own priorities. In general, every emergency will cause the dive to be aborted until the cause has been fully remedied.

The pneumofathometer should always contain the same mixture as the diver breathing media. Emergency procedure drills should be performed on a periodic basis to ensure familiarity by the crews.

7.1.1 LOSS OF BREATHING MEDIA

1. Re-establish breathing media supply by:
   - Diver going on diver-worn or carried EGS (bailout);
   - Activating topside secondary breathing media supply; or
   - If applicable, put breathing media to diver's pneumo hose and confirm that the diver has bubbles, before insertion of the pneumo hose into the diver's neck dam.
2. Alert standby diver.
3. Diver goes to bell/stage/surface, as applicable.
4. If required, send standby diver to diver's assistance.
5. Terminate dive.

7.1.2 LOSS OF COMMUNICATIONS

1. Attempt to reestablish electronic communications.
2. If communication cannot be reestablished, attempt to communicate through line-pull signals.
3. If applicable, put breathing media to diver's pneumo.
4. Alert standby diver.
5. Diver proceeds to downline/bell stage or surface as applicable (if bell, attempt to use bell communications).
6. Bring diver to first stop once line-pull signals are established.
7. If required (unable to establish any form of communications with diver), send standby diver to diver's assistance prior to bringing diver to his or her first stop.
8. Terminate dive.

7.1.3 FOULED OR ENTRAPPED DIVER

1. Avoid panic and ensure diver does not ditch equipment.
2. Diver informs topside.
2. Alert standby diver.
4. Diver determines extent of entrapment.
5. Diver attempts to free himself or herself.
6. If required, send standby diver to diver's assistance.
7. When diver is free, if unable or unwilling to continue the dive, or if standby diver was required to go to diver's assistance, terminate dive.

7.1.4 INJURED DIVER IN WATER

1. Diver informs topside, and dive is aborted.
2. Alert standby diver.
3. Diver determines nature and extent of injury.
4. If required, send standby diver down to assist diver, administer first aid and evaluate injury. Standby diver should remain with injured diver.
5. Monitor diver's breathing. If diver stops breathing, overpressure his or her regulator, if possible.

6. If applicable, standby diver assists injured diver to surface, following proper decompression procedures, except when severity of injury indicates a greater risk than omitting decompression.
7. Institute planned diver recovery procedure.
8. Request required medical assistance and emergency evacuation, if required.

7.1.5 SEVERANCE OF DIVER'S UMBILICAL - GAS HOSE ONLY

1. Activate breathing media to diver's pneumo hose.
2. Diver activates bailout bottle.
3. Alert standby diver.
4. If required, diver inserts pneumo hose inside of helmet/mask after confirmation of bubbles to the pneumo hose.
5. Diver returns to bell/stage/surface.
6. If applicable, diver activates and uses emergency breathing media on bell/stage.
7. Terminate dive and follow proper decompression procedure.
8. If required, send standby diver down with additional bailout bottle or hose.

7.1.6 SEVERANCE OF COMPLETE UMBILICAL

1. Diver activates bailout bottle and returns to bell/stage/surface. If applicable, diver activates and uses emergency gas on bell/stage.
2. Alert standby diver.
3. Deploy standby diver if the diver has not immediately surfaced.
4. If applicable, deploy marker buoy at diver's last known location.
5. If applicable and available, standby diver provides new hose/bailout bottle. Otherwise, send standby diver down the downline or bell stage cable.
6. Terminate dive and follow proper decompression procedure.

7.1.7 FIRE

Topside fire:

1. Employ standard fire emergency procedures.
2. If required, suspend diving activities and evacuate diving station.

Fire inside PVHO:

1. Each chamber must have a means of extinguishing a fire in the interior.
2. Notify topside there is a fire in the chamber; evacuate to another chamber or lock if available or possible.
3. Divers inside the chamber should put on the BIBS with emergency gas.
4. Secure electrical power to non-essential systems.
5. Extinguish fire.
6. Vent the chamber.
7. Establish condition of the chamber occupants.

7.1.8 EQUIPMENT FAILURE - DIVER IN THE WATER

1. Evaluate effect on diver.
2. Inform diver of problem and action planned.
3. Alert standby diver.
4. Alert deck crew.
5. Diver informs topside of his or her readiness.
6. Activate plan and terminate dive.

7.1.9 ADVERSE ENVIRONMENTAL CONDITIONS

As a minimum, a JHA or specific procedure should be developed to address the following, as applicable:

- Adverse environmental conditions, including but not limited to:
  - Weather.
  - Sea state.
  - Currents.
  - Lightning.
  - Winds.
  - Methane/swamp gas.
  - Dangerous marine life.

7.1.10 OXYGEN TOXICITY IN WATER

1. Supervisor notes signs, or diver reports symptoms to topside.
2. Reduce oxygen partial pressure (switch to air), or lower PPO2 of mixed gasses.
3. Deploy standby diver.
4. Continue decompression on appropriate table unless a 50/50 nitrox mix is available for in-water decompression use.

7.1.11 OXYGEN TOXICITY DURING TREATMENT

1. Diver reports to topside.
2. Instruct diver to remove oxygen mask for 15 minutes. After all symptoms disappear, start oxygen again. Do not count time not on oxygen. Recommence decompression where oxygen stopped.
3. Tender shall be locked in.
4. If oxygen toxicity symptoms occur for the second time, repeat step 2.
5. If oxygen toxicity symptoms occur for the third time, discontinue oxygen and immediately request medical advice and assistance from designated point of contact.

7.1.12 EMERGENCY EVACUATION

1. Notify diver and all surrounding personnel of emergency and terminate dive.
2. Decompress diver according to proper decompression procedures. If not possible, follow omitted decompression procedures.
3. Evacuate all unnecessary personnel to safe platform.
4. Inform management of conditions as soon as possible.
5. Additional emergency procedures should be developed as needed, possibly including, but not limited to:
   - Loss of power supplies.
   - Loss of SDC (bell).
   - Loss of ROV.
   - Adverse environmental conditions.

7.2 ACCIDENT REPORTING

Association of Diving Contractors International Requirements:

ADCI requires ALL General Member Companies and Associate Member Schools to report industry-related fatalities/catastrophic injuries.

Procedures:

ADCI member companies can submit the reports on either their own company documents or the ADCI accident report form (See Section 7.2.1: Accident Report Form).

FOR U.S.-BASED COMPANIES:

Federal Regulatory Requirements

46 CFR – Department of Transportation – Coast Guard

Subchapter V-Marine Occupational Safety and Health Standards, Part § 197.484, requires the person in charge to notify the officer in charge, marine inspection, as soon as possible after a diving casualty occurs, if the casualty involves any of the following:

- Loss of life.
- Diving-related injury to any person causing incapacitation for more than 72 hours.
- Diving-related injury to any person requiring hospitalization for more than 24 hours.

Part §197.486 defines the form of the written report of casualty and requires:

- That the report be furnished on Form CG-2692 when the diving installation is on a vessel; or
- That a written report, in narrative form, be used when the diving installation is on a facility.

In either instance, the report must furnish the following information:

- Name and official number (if applicable) of the vessel or facility.
- Name of the owner or agent of the vessel or facility.
- Name of the person in charge.
- Name of the diving supervisor.
- Description of the casualty, including presumed cause.
- Nature and extent of the injury to persons.

29 CFR – Department of Labor – Occupational Safety and Health Administration

Subpart T – Commercial Diving Operations, §1910.440, requires that an employer record the occurrence of any diving-related injury or illness that requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

In May 1994, OSHA further clarified and defined the reporting requirement to state:

Employers are required to orally report any occupational fatality or catastrophe involving in-patient hospitalization of three or more workers within eight hours, per 29 CFR §1910.8. The report must include the following information:

- Company name.
- Location and time of incident.
- Number of fatalities or hospitalized employees.
- Contact person for the company.
- Phone number(s) for the company contact person.
- Brief description of the incident.

EXEMPTIONS FROM FATALITY AND CATASTROPHIC ACCIDENT REPORTING DO NOT EXIST!

Even though most commercial diving companies are exempt from record-keeping requirements (SIC7389), all are required to:

- Orally report as defined above.
- Maintain a log of occupational injuries and illnesses.

ADCI member companies are urged to furnish ADCI with a copy of any report required by either 29 CFR or 46 CFR. In those instances, where the report is initially submitted in an oral format (29 CFR), furnish to ADCI information derived from log entries required by that regulation. Reports should be furnished to ADCI at the same time as submitted to regulatory authorities to ensure that ADCI is able to properly respond to enquiries regarding the actual circumstances rather than having to rely upon media releases that often are inaccurate or embellished.

It is NOT the intent of ADCI to disclose identities of companies, individuals or circumstances contained in reports received, unless these are commonly known as perhaps having been disclosed through a press release or safety notice by the company involved. The PURPOSE of the "system" is to gather information that can then be used in developing accurate statistical data, or where information received may warrant development of a safety notice or other guidance document intended to promote improved safety. The contents of reports may also be used to defend our industry from the actions of unscrupulous parties whose goals are clearly only those of defamation.

7.2.1 ACCIDENT REPORT FORM

ACCIDENT REPORT

To: **Association of Diving Contractors International**

info@adc-int.org, 281-893-5118

From: ______________________________

(Company Name)

Subject: **Casualty/Accident Report**

Date of incident: ______ / ______ / ________

Location of incident: ______________________________

Description of event: ______________________________

____

____

____

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Nature and extent of injury/injuries: ______________________________

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SECTION 8.0

VESSELS AND FLOATING PLATFORMS FOR DIVING OPERATIONS

Association of Diving Contractors International, Inc.

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8.0 VESSELS AND FLOATING PLATFORMS FOR DIVING OPERATIONS

8.1 GENERAL STATEMENT

A dive support vessel (DSV) is defined in this document as a floating platform used to support diving operations. Due to the very diverse and variable types of diving performed throughout the industry, DSVs vary accordingly, ranging from sectional pontoons and crane barges to purpose-built diving vessels with special four-point anchor systems or dynamically positioned vessels. From small craft for day-long projects to dynamically positioned vessels for offshore, long-term operations, DSVs must be carefully selected based on the requirements of the diving project, the diving to be performed, the tools and equipment required, and any potential environmental conditions.

While each diving platform will have its own characteristics that need to be assessed to enable the diving work to be carried out safely and successfully, certain common factors can be identified, and thus the particular "fitness for purpose" for a particular vessel, particular job and particular location can be determined. It is the responsibility of the diving contractor to select or reject the DSV based on the safety of the diving crew. While not all vessels are ideal, most can be adapted or modified, or additional equipment can be added to mitigate the shortcomings and therefore provide a safe working platform for the diving operation.

Much of the safety of the diver is based on the reliability of the diving life-support equipment; therefore, this equipment must be provided with adequate lashing, stowage and protection from the elements and other ongoing operations.

When selecting a DSV, great care must be taken to consider worst case for wind, tide, current and weather conditions. Adequate planning and proper equipment must be immediately available to allow the vessel to move from the dive site should environmental conditions require. While some vessels can withstand severe weather conditions, their ability to move out of the moor is limited to the ability of the anchor support vessel to bring the anchors in. Therefore, great care should be taken to not exceed these operational limits prior to getting the DSV out of harm's way.

- Generally, DSVs are commonly utilized to safely and efficiently provide:
- Transit to and from the work site for the personnel and equipment required.
- Position maintenance during diving operations with adequate accuracy and security.
- Deck space for the life support and safety equipment required.
- Deck space for the tooling required for the divers to perform the work.
- Communications for emergency and commercial purposes.
- Accommodation and messing facilities.

Additional services (encompassing medical facilities, communications, power supplies, craneage, life saving appliances, fire-fighting appliances, etc.).

Each diving contractor will examine the DSV for adequacy in each of the applicable categories above, assuring compliance with their company safety policies and those of the ADCI.

8.2 LIVEBOATING

Live Boating is a diving technique where a single surface-supplied diver performs work underwater while his hose is being tended from the bow of a vessel which is manually operated by the vessel master and underway using its main propulsion system.

ADDITIONAL CONSIDERATIONS

Due to the inherent risks of liveboating operations, all other means of diving operations should be considered if possible. If liveboating has been determined to be the method of diving to be executed, these additional considerations should be taken into account to ensure safe operations:

- Performance of a thorough risk assessment
- Performance of drills for diver recovery, loss of breathing media to diver, and to test the vessel's emergency shutdown device
- Depending on the vessel, shaft rotation indicators, propeller guards, and other barriers to prevent the diver and standby diver's umbilical from coming into contact with the vessel propellers should be considered for utilization
- An assessment of work to be performed, water depth, and the communications available on the vessel should factor into the manning levels of the crew
- Ensure that the dive supervisor has a clear line of sight of the diver's umbilical entering the water and diver's bubbles
- Ensure that there are direct communications between the captain, diving supervisor, standby diver, and tender

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8.2.1 MINIMUM REQUIREMENTS

All equipment and manning levels should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning should be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations. The ADCI recommends that alternate methods other than liveboating are explored.

If a diving operation requires a hand-held tool that is separately tended from the diver, it is highly recommended that it be performed by methods other than liveboating. However, if the job can be performed only through liveboating, only one surface-powered tool can be used at a time. Small umbilicals, (e.g., CP probes and pipe trackers) should be married to the diver's umbilical.

The following are minimum requirements for liveboating operations:

- **No liveboating operation may include planned in-water decompression.**
- **No liveboating operation shall be conducted on scuba.**
- **No liveboating shall be performed within another vessel or barge's anchor spread.**
- **The maximum depth for conducting live boating operations is 130 fsw (39.6 msw).**

1. Minimum Personnel

In all cases, personnel and equipment shall be selected to ensure maximum safety during operations. On small boats/vessels of less than 33 feet (10.05 meters), it may be permissible for the crew to consist of no fewer than three persons (diving supervisor, diver and tender/diver) due to space limitations.

a. Liveboating diving operations (0 – 130 fsw [39.6 msw]) (Vessels larger than 33 feet / 10.05 meters). The dive crew shall consist of a minimum of seven (7) diving qualified personnel.

- One (1) Dive Supervisor
- One (1) Diver
- One (1) Standby Diver
- Two (2) Tender/Divers
- Two (2) personnel that are qualified divers to assist with rescue boat operations

8.2.2 DIVING SUPERVISOR

Must be experienced and knowledgeable in liveboating operations.

8.2.3 PROCEDURES

a. Continuous and easily understandable communications will be maintained between the dive station and wheelhouse at all times.

b. The vessel master is notified before the diver enters or exits the water and the propulsion system must be disengaged.

c. The boat will be maneuvered in such a manner so as to permit the tender/diver or diving supervisor to continuously monitor the direction of the diver's umbilical with respect to the dive control station.

d. The vessel's propulsion system should be stopped before the diver enters or exits the water.

e. Liveboating shall not be done:

- In seas that impede the station-keeping ability of the vessel.
- In other than daylight hours.
- During periods of restricted visibility. (Restricted visibility means any condition in which vessel navigational visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.)
- Any time existing conditions make liveboating unsafe in the opinion of the vessel captain and/or supervisor.

f. A standby diver will be continuously prepared to enter the water when directed by the diving supervisor.

g. All liveboating operations shall be tended from the bow, and the boat shall be operated from the wheelhouse or flying bridge.

8.2.4 MINIMUM EQUIPMENT

a. The vessel shall be acceptable to the diving company and the diving supervisor.

b. A “kill switch” shall be in the immediate vicinity of the operator of the boat for instantaneous shutdown of the engines.

c. For operations on dynamically positioned vessels (see **DP System Section 8.3).**

d. A diver-worn or carried emergency gas supply bottle shall be worn by the diver.

e. A mechanical device to prevent dive umbilical entanglement in the vessel’s propulsion system.

f. During liveboating operations, a third diving hose connected to the manifold shall be available for emergency use except in the case of a vessel 33 feet/10.05 meters or less.

g. A boat ready to be launched with crew in the event of an emergency (for vessels larger than 33 feet/10.5 meters).

h. A method of clear communication between the tender/diver and dive supervisor.

i. For emergency purposes; a means must be available to provide a stable platform for the diver for in-water decompression for vessels over 33’.

8.2.5 VESSEL OPERATOR

The vessel operator must be experienced in liveboating operations and familiar with the scope of underwater tasks including depth and duration of dive.

8.3 DYNAMICALLY POSITIONED VESSELS

8.3.1 INTRODUCTION

These guidelines relate to and are intended to assist in the design and operation of dynamically positioned (DP) diving support vessels. Their purpose is to provide a basis from which designers, suppliers, builders, vessel owners, diving contractors, masters, diving supervisors, and charterers can develop the most suitable equipment and operating procedures for each vessel and to provide a yardstick against which the suitability of dynamically positioned vessels for diving operations can be assessed.

Implementation of the guidelines will vary from vessel to vessel, and the characteristics of each vessel will affect its suitability for particular operations. Even in the short term, this may alter in the light of changes in personnel and system components. It is therefore important that these guidelines be used not only by owners in preparing vessels (or diving operations), but also by potential charterers in assessing vessels suitable for their particular needs.

The general conduct of diving operations from DP vessels should follow the same principles as for other diving operations. In addition, no effort should be spared to establish DP operational reliability and ensure that the effects on the divers are minimized if the vessel does lose station. All those connected with the operation should keep this in mind at all times.

Owners/operators should implement an in-house DP competency assurance process for key DP personnel which is structured, systematic and progressive. It should be noted that DPO certification is only one element in the competency assurance process.

In accordance with IMO, the ADCI requires, at a minimum, vessels to be DP2.

8.3.2 PRINCIPLES

8.3.2.1 Introduction

These guidelines are built around three main and interrelated principlesthat are simply stated in this section. The remaining sections contain guidance on their implementation. Though they cover many aspects of DP diving systems and operations, they are not definitive, and decisions about operations not covered should still be based on these main principles.

8.3.2.2 Single-point Failures

A “catastrophic failure” is defined in these guidelines as a failure that would in itself cause risk to divers. In effect, this means that the failure would cause the vessel to move from its intended position. A fundamental principle of all DP diving vessel design and operation is that no single fault should cause a catastrophic failure. This principle immediately introduces the concept of redundancy. In doing so, it must be stressed that redundancy can be achieved in several ways (not merely by duplication).

8.3.2.3 Capabilities and Limitations of DP Diving Systems

Any system can operate satisfactorily provided it is not subjected to conditions that are outside its operating capabilities. A fundamental principle of DP diving vessel operation is that the operating requirements of the system are never allowed to exceed the vessel’s capabilities in any respect. This principle requires that the vessel’s capabilities and limitations are clearly understood and updated with experience and that indications are provided when predetermined limits are being approached.

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8.3.2.4 Personnel Capabilities

Any equipment or system can work as intended only if it is operated correctly. The more complicated the equipment or system, the greater the demands upon personnel operating it. A fundamental principle of DP diving vessel operation is that relevant personnel should be fully capable of performing the tasks entrusted to them. This requires them to have the necessary background and experience or to have received appropriate training and guidance.

8.3.3 DP SYSTEM

8.3.3.1 Introduction

Implementation of the first principle (single-point failures) involves correct system design. In the context of these guidelines, the DP system is defined as "all equipment and components involved in retaining the vessel in its required position." The principle states that "no single fault should cause a catastrophic failure." To ensure that a DP system adheres to this principle, a failure modes and effects analysis of the main components should always be carried out. Where such an analysis indicates that a single fault could lead to a catastrophic failure, the relevant component, sub-system or its operating procedures should be redesigned to avoid or take account of the effects of the single point of failure. In this section, some design considerations concerning the main components of DP systems are examined. Recommendations concerning condition monitoring are included based on the premise that to react correctly, system operators must be aware of the failure of any main components.

8.3.3.2 Thrust Units

1. Configuration

Thrust unit installations should be designed to minimize potential interference of wash with other thrust units, sensor systems, the diving system and the divers, and the effect of hull surfaces on thrust unit efficiency within the constraint of ship design.

2. Redundancy

Thrust units and, where appropriate, rudders, should be situated to achieve fore and aft, athwart ships, and rotational thrust must be configured so that the loss of any one thrust unit always leaves sufficient thrust in each direction to ensure that the vessel holds position and heading when operating within its forecast operational capability.

3. Failure Mode

In the event of pitch, azimuth, motor speed control malfunction, or when control error becomes unacceptable, the function controlled may remain the same as it was at the time of failure, the pitch may be automatically set to zero, or the thrust unit may be automatically stopped and deselected. Under no circumstances should thrust units assume maximum thrust condition on failure.

4. Emergency Stop

Means should be available whereby any thrust unit may be stopped from any DP control without using the DP computer to generate the command. The means provided should be adequately protected against inadvertent operation.

5. Condition Monitoring

The following list indicates the main functions that, where applicable, should be monitored either by permanent remote means or by local means at frequent intervals.

- Status (online/offline).
- Thruster motor stator winding temperature (high only).
- Thrust unit rpm/pitch ordered and indicated (with display or 80 percent thrust output).
- Oil pressure.
- Hydraulic power-pack status.
- Azimuth ordered and indicated.
- Thrust-bearing temperature.
- Power supply loss.
- Lube oil/hydraulic fluids — pressure/temperature/level.
- Response to command signal deviation.

Note: Monitoring of diesel engines, where used to drive thrusters by direct drive, should be in accordance with design parameters of the system.

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8.3.3.3 Power System

1. Power Factors

Power system design should, so far as possible, provide for generators to be run at power factors that effectively match the characteristics of the load.

2. Redundancy

The power source system, whether individual diesels or central electricity generation plants, should be capable of producing sufficient power to meet the vessel's operational capability subsequent to the failure of any single power unit.

3. Power Management

Arrangements should be provided to ensure that when diving operations are being carried out, non-essential loads are shed in reverse order of importance before power consumption reaches maximum available supply. Power supplies to thrusters to maintain station, as well as to the diving system, should be safeguarded. Arrangements should also be made to ensure that sufficient power is always available to enable the vessel to retain position within a predetermined accuracy in prevailing and foreseeable conditions if any one on-line power unit fails. This may mean providing for running up and bringing online additional power units as power consumption increases.

4. Essential Services

Essential services such as fuel, oil, ventilation and generator cooling should also be designed to avoid system failures stemming from failures of critical components, e.g., filters, pumps, power supplies, etc.

5. Operating Limits

Power operating limits should be specified and alarmed for diesel engines, turbines, motors and generators to avoid engine damage and power factor problems.

6. Distribution Network

Power distribution systems should be such that no single failure can prevent distribution or sufficient power to thrusters to permit the operation of the vessel within its full operational limitations.

7. Condition Monitoring

The following list indicates the main functions that, if applicable, should be monitored either by permanent remote means or by routine local means at frequent intervals.

- Distribution Network
  - Circuit breaker status (auto connect/disconnect equipment).
  - Bus bar voltage.
  - User current levels.
  - Load-shedding trips (online and tripped).
  - Backup power supplies availability (emergency generator or accumulator batteries).
- Diesel Engines
  - RPM.
  - Oil pressure/temperature.
  - High main bearing temperature indication.
  - Auto-start equipment and sequence.
  - Bank and individual exhaust temperature.
  - Oil level.
  - On-line fuel tank level.
  - Fuel pressure.
  - Fuel rack setting (if applicable).
  - Clutch status (if applicable).
  - Jacket water pressure and temperature.
  - Salt water-cooling pressure.
  - Change air pressure (where applicable).
- Generator/Motors

- Bearing lube oil flow and temperature.
- Terminal voltage.
- Current.
- Stator winding temperature (high only).
- Frequency (low)/speed.
- Status (shutdown, standby, online).

8.3.3.4 DP Information Input Systems

1. Position Sensor Redundancy

It is recommended that at least three independent position sensors be available. These need not all work on different principles, but if similar systems are to be considered as independent, they should not be subject to common mode failures (e.g., no single factor should affect more than one system). Whenever DP diving operations are being carried out, at least three independent sensors should be deployed, connected to the DP computer(s), and in use. It is recommended that the third sensor, if not online, should be ready for immediate use as a backup. To aid the correct use of sensors in particular circumstances, manufacturers must provide information about the performance and operational limitations of any position reference sensors supplied for use by DP diving support vessels.

2. Vertical Reference Units/Systems

Two vertical reference units/vertical reference systems should be operating whenever DP diving operations are being carried out and position reference sensors requiring their input are in use. At least one of them should be online.

3. Wind Sensors

Care should be taken in the placement of thewind sensors to minimize the effect of turbulence from superstructures. The effect of helicopter downdraft, though normally limited, should be borne in mind. Two wind sensors should be installed in physically separated positions to take account of failures and false readings resulting from external factors. In some circumstances where interference is unavoidable, the inaccuracies caused by switching off wind sensors may be less than those caused by their false information.

4. Heading Reference Sensors

Two independent heading reference sensors (e.g., gyrocompass) should be running with either both online or one online and one available as immediate back up during DP diving operations. Automatic or manual selection of the on-line compass may be provided.

5. Reliability

Sensors should be designed and proven for continuous reliability in the exposed positions in which they operate.

6. Condition Monitoring

Monitoring of DP information input systems should include:

- Facilities for regular full-function checks.
- Alarms for transducer or circuitry failures.
- Detection of data deviation or corruption.
- Alarm for power supply loss.

7. Position Data Processing

Data from all position sensors should be automatically processed (not manually selected):

- To reject spurious data.
- To stabilize output in the event of failure.
- To select preferred data.
- To alarm if system develops bad geometry or signal loss occurs.
- To permit a smooth changeover between systems.
- To monitor the sensor status.

8.3.4 COMPUTER/CONTROL SYSTEM

1. Purpose

The primary purpose of the DP control system computer is to calculate and order the necessary thrust unit operations required to maintain a vessel in its chosen position. Though it is possible to use the computer for many ancillary functions (e.g., data processing and presentation, power management, etc.), care should be taken to ensure that these cannot prejudice its proper operation in its primary role.

2. Control System Redundancy

There should be at least one backup method of controlling the vessel's thrust units in order to retain position in the event of a failure of the online control system. A second automatic control system can best fulfill this role. If a second automatic system is not fitted, then a joystick control system would be an acceptable backup, provided:

- It affords manual control of fore and aft, athwartships and rotational thrust with automatic control of heading.
- The joystick control lever is situated in the DP control area and located in such a position that the operator has a clear view of the vessel and everything in its vicinity.
- The joystick control system and its power supply are independent of the failed automatic control unit, but provision is made to ensure smooth continuity of thrust unit operation on failure of the automatic control unit.
- Data from a gyrocompass are input directly to the joystick control system.
- A simple display of vessel position relative to its required position is provided independent of the failed unit, but with the means to ensure its correct alignment with the failed unit at the time of failure.
- It is used only to maintain position for short periods of time, e.g., to recover divers in an emergency. It is recommended that the automatic control system(s) incorporate a joystick facility to assist in maneuvering the vessel onto location.

3. Power Supplies

Provision should he made to ensure that power supplies to computer(s)/controller(s) are safeguarded at all times. This could involve provision of duplicated conversion machinery and a backup battery supply. Batteries should have sufficient capacity to maintain the necessary supplies for at least 30 minutes, and a warning of batteries not being fully charged should be provided.

4. Services Redundancy

Where possible, the design should ensure that services are duplicated and are so divided that if local ventilation and cooling fail, or fire or flooding occurs, sufficient services are retained to enable the divers to be recovered safely.

5. DP Console Location

The DP console should be situated so that the DP operator can observe DP controls, see outside the vessel and be aware of deck operations and the vessel's relationship to surface structures, etc.

6. Monitoring Information

Overall monitoring information should be displayed or made available for call-up in a manner that avoids information overload on the DP operator. Data should be displayed in the simplest manner for easy assimilation. The following information should be available to assist in monitoring overall DP performance:

- Thrust unit configuration and rpm or pitch levels ordered and indicated (with display of 80 percent thrust).
- Consumed online power as percentage of total of available (with special indications at 80 percent).
- Available thrust units on standby.
- Position sensor status and validity.
- DP system status and validity.
- Vessel's target and indicated position.
- Vessel's target and indicated heading.
- Alert-level status (manually operated).
- Limited history event recording system.

This should provide an automatic record of changes in the main parameters concerned with the vessel's performance, such as:

- Wind speed and direction.
- Position and heading errors.
- Position reference sensor availability and use.
- Thrust unit availability and use.
- Power unit availability and use.
- Computer availability and use.

8.3.5 COMMUNICATION SYSTEMS

1. Internal Voice Communications

As a minimum requirement, voice communications should be available to ensure the immediate and clear transfer of information between all responsible parties.

As a minimum requirement, direct communications should be provided between DP console and dive control; dive control bell and diver; dive control and life support control; dive control and bell handling control; dive control, DP console and ship's derrick or crane; DP console and master's cabin; dive control, DP console and senior diving supervisor's cabin; and DP console and engine (control) room.

All essential voice communications systems should be provided with 100 redundancy where practicable, either through duplication or provision of an alternative system. Terminals should be situated close to the normal operating positions of personnel for whom they are provided. Primary systems should provide clear voice reproduction and should not detract from users' abilities to perform their main functions.

2. DP Alert System

A system of lights shall be provided in the saturation control room, air or mixed-gas diving control area, working deck and, where applicable, the ROV or submersible control position manually activated from and repeated in the DP control room. The following lights should be used:

- Steady green light to indicate vessel under automatic DP control, normal operational status and confirming the alert system is functional.
- Flashing yellow light to indicate degraded DP operating alert.
- Flashing red light to indicate DP emergency.

A distinctive alarm should sound in the saturation control room, air or mixed-gas diving area, master's cabin, operations superintendent's cabin (if applicable), and senior diving supervisor's cabin in conjunction with the flashing red light. Provision of a means of cancelling the audio and flashing functions of the signals from the receiving positions when they have been noted should be made.

8.3.6 MAINTENANCE OF EQUIPMENT

Proper maintenance of equipment is essential to its correct performance. Clear instructions about the type and frequency of maintenance required by all components of DP systems should be compiled by vessel owners with the aid of manufacturers and suppliers. These should be issued to vessels together with a system to monitor their correct implementation.

8.3.7 CAPABILITIES AND LIMITATIONS

8.3.7.1. Introduction

The second principle (capabilities and limitations of DP diving systems), involves knowledge of a vessel's capabilities and the operating requirements. An awareness of the special limitations of diving from a DP vessel should be present at all times amongst those concerned with the operation. In addition, certain principles should be adopted to minimize the possibility and effects of the risks to divers due to uncontrolled vessel movements. Notwithstanding these principles, the authority of appropriate personnel to order the termination of DP diving operations, if they consider such operations hazardous even when conditions are within the guideline limits, should not be diminished.

8.3.7.2 Vessel's Operational Capability

The maximum continuous operational station-keeping capabilities for DP diving should be forecast for each DP diving support vessel. They should be expressed in terms of direction and magnitude of wind, associated wave drift force and current combinations. They should be defined as "those environmental conditions in which the vessel could maintain chosen position and heading to a satisfactory confidence level with any single-thrust or power unit failed and with power available for the foreseeable diving requirements and the vessel's essential services."

Capability plots or envelopes of these maximum tolerable environmental forces and their relative heading should be produced to assist in defining this information. These should include a statement of the position and heading tolerances, as well as the corresponding confidence levels associated with the capability plots. It should be clearly appreciated that they are only a guide to a vessel's position-keeping capabilities and an indication of those capabilities under certain conditions.

Capability plots should be based initially on vessel design information but should be modified in the light of practical experience. Care should be taken that such modifications are properly reviewed and authorized by the vessel's owner. Detailed explanations of the assumptions made in producing these plots should be provided. For example, the power consumption of the diving system and emergency domestic load, the definition of wind speed and thrust output, the assumed wave drift and current conditions, and details of the means to identify the position-keeping tolerance and corresponding confidence levels should be included.

It should be noted that the requirement to hold station and heading within operational limits with any single-thrust or power unit failed assumes a "worst case" failure. Therefore, in determining the operational limit "envelope," the chosen "worst case" thrust unit will probably vary depending on the relative direction of environmental forces. This should be taken into account.

When determining the vessel's position-holding capability, consideration should also be given to any interactions between thrust units, hull and relative water movement. To simplify the calculation/presentation task, it is proposed that the current force be based on a one-knot current running in the same direction as the chosen wind and wave forces and that the number of "directions" chosen for these coincident forces may be limited to 30û increments.

8.3.7.3 Degraded Operational Capability

The principle of ensuring that no single fault can cause a catastrophic failure allows the vessel to be operated with confidence within its designed operational limitations. If the operational capability is degraded, the operation of the vessel should reflect the new status. There is one principal source of degradation of operational capability, namely loss of redundancy of a subsystem.

8.3.7.4 Positioning Accuracy

The positioning accuracy of a DP vessel is subject to several sources of error that can act cumulatively. A forecast of the position and heading tolerances and the corresponding confidence levels should be included with capability plots and should be taken into account when planning operations close to other vessel installations. Excursions around the intended position, even if causing no worse problems, tend to swing the bell in a manner that, if it becomes excessive, may be dangerous. With surface-supplied air or mixed-gas diving operations, excessive excursions of the vessel could cause hazard to the diver. Reduction to the minimum achievable level should be a matter of priority both on setting up on DP and, if necessary, in the course of DP operations.

8.3.7.5 Operating Procedures

The objective of all operations should be to ensure that a vessel operates effectively and safely. To achieve this, using the design principles already stated, carefully prepared operating procedures should be adopted. These should themselves be based on three main principles:

- Systems are checked on installation and after relevant modification, before starting new charters, and immediately before and periodically during use.
- Operational capability is matched by operational status.
- The procedures adopted should take account of the limitations of the system.
- These principles lead to several outline operating procedures, which are explained below.

1. DP Proving Trials

All the precautions and procedures described herein will be to no avail if the DP system includes uncorrected faults remaining after its original construction. Before a DP diving vessel undertakes DP diving operations after construction or any relevant modification, it should undergo a full series of trials.

These should include testing and tuning in harbor, followed by sea trials, during which the vessel's position-keeping system should be thoroughly tested under normal and breakdown conditions, and should culminate in a DP bell dive. It is stressed that commissioning of systems, piece by piece, cannot replace the need for thorough testing of the total system under working conditions. It is likely that such trials, if properly conducted, would take several days. Where possible, they should be performed partly in a situation where accurate monitoring of the vessel's position can be achieved and partly in open water under realistic environmental conditions. The results of these trials should be used to confirm or refine the vessel's performance capability statements.

As an indication of appropriate DP proving trials, checks of the following could be made:

- **In Harbor**
  - Correct fitting and mounting of all equipment and cabling.
  - Correct wiring of all power supplies, data cabling and equipment.
  - Correct functioning of all equipment (including data input systems, computers, interfacing equipment, thruster units and power supplies) by electronic and functional testing.
  - Effective shielding of all potential sources of electrical interference (including those that may be used only intermittently)
  - Software checks and tuning.
  - Correct functioning of all condition monitoring systems and alarms.
- **At Sea**
  - Correct functioning of all data input systems.
  - Correct functioning of computers and interfacing.
  - Correct functioning of power management systems.
  - Correct functioning of thrust units, including response times.
  - Optimum position-keeping performance by fine-tuning of software.
  - Insure position-keeping accuracy using independent means.
  - Correct functioning of all automatic and manual change-over arrangements and procedures from primary to backup systems.
  - Correct functioning of offset and heading change control.
  - Satisfactory operation of DP system, with bell running and then with divers in water.
  - Position-keeping per ordinance in rough weather.

It is stressed that this list is not definitive, but is included as an indication of the type of testing required.

2. New Charter Assessments

In fulfilling their responsibilities under national regulations, diving contractors and field operators whose operations involve the use of DP diving vessels should, before they permit DP diving operations to be carried out, satisfy themselves about the vessel's suitability for the operations planned. This could involve a thorough assessment of a vessel's DP arrangements in line with these guidelines, including a study of relevant documentation, such as operations manual, FMEA report, capability plot and any other form of DP system assessment available together with summaries of the experience of personnel involved with DP operations based on their operators logs. It should also include a short sea trial during which the actual capability of the vessel and crew to support DP diving in both primary and breakdown conditions is assessed. Such trials could, if the vessel is satisfactory, be completed in eight to 10 hours.

3. Operating Checks

A program of functional checks designed to test the operation of a DP system, including the selection and operation of backup systems, should be performed whenever setting up on DP. For example, these could include (but are not limited to) simulation of failures of online components such as a DP computer, a position reference sensor, a gyro, a generator or a thrust unit. They could also include commanding offsets in both direction and heading. In addition to the successful completion of these checks, the vessel should have held station automatically within the defined degree of accuracy until the master and senior diving supervisor are confident that the system is reliably set up before diving operations are permitted to start. This may take at least 30 minutes.

Repositioning of a vessel under DP control would not require a repeat of this check period. It is recommended that some or all of these checks be repeated periodically while on DP, but when diving is not being carried out and positionkeeping is not crucial. By doing so, the continued correct functioning of the system can be checked while the readiness of operators to deal with emergencies is enhanced. Instructions for the performance of these checks should be prepared and written by the vessel owner with the assistance of the DP system manufacturer and could be produced in the form of a checklist in a card or folder for ease of use. A more comprehensive arrangement could be provided by a purpose-built simulator.

4. DP Alerts

When diving on DP, a clear system to indicate and guide responses to operational capability is important. This system should be based on a minimal number of standard operating status levels representing the capability of the DP system to retain the vessel on station within safe limits. It is recommended that these levels should represent the following conditions:

- **Normal Operational Status (Green Light)**

  The vessel can be defined as in normal operational status when all of the following conditions apply:

  - The vessel is under DP control, and the DP system is operating normally with appropriate backup systems available.
  - Thruster outputs and total power consumption (where applicable) do not exceed 80 percent of maximum thrust and total available power, respectively, for more than brief and isolated periods.
  - Vessel's indicated position and heading is within predetermined limits for all but brief and isolated periods. These limits should he determined for each location.
  - No risk of collision exists.

- **Degraded Operational Status (Yellow Alert)**

  The vessel can be defined as being in degraded operational status when any of the following conditions applies:

  - There is a failure in a sub-system, leaving the DP system in an operational state (possibly after reconfiguration) but with no suitable backup available so that an additional fault occurrence could result in DP system breakdown and assumption of emergency status.
  - Available power units are reduced to the extent that failure of one more could prevent the vessel holding position or heading in existing or foreseeable conditions.
  - Available thrust units are reduced to the extent that failure of one more could prevent the vessel holding position or heading in existing and foreseeable conditions.
  - With all available thrust and power units online, any thrust unit output exceeds 80 percent of its maximum thrust, or total power consumption exceeds 80 percent of total available power for more than brief and isolated periods. Vessel's indicated position deviates beyond predetermined limits for more than brief and isolated periods.
  - Risk of collision exists.
  - Weather conditions are judged to be becoming unsuitable for DP diving.

- **Emergency Status (Red Alert)**

  A vessel can be defined as in emergency status if either of the following conditions applies:

  - System failure results in inability to maintain positioning or heading control.
  - Any external condition exists, including imminent collision, which prevents the vessel from maintaining position.

5. Alert Level Responses

The following responses could be made to different alert levels. Visual and audible signals should be manually initiated by the DP operator.

- **Normal Operational Status (Green Light)**

  Full DP diving operations can be undertaken.

- **Degraded Operational Status (Yellow Alert)**

  The master and senior diving supervisor should be informed. The diving supervisor should be informed. The diving supervisor should order the diver(s) to return immediately to the bell and obtain a seal. A decision should be taken by the senior diving supervisor, in conjunction with the master, in the light of prevailing conditions and any possible mitigating actions available, whether to abort the dive or, where surface-supplied diving is being conducted, prepare to return to the surface. Under this condition, air or mixed-gas divers should be ordered to return to the surface.

- **Emergency Status (Red Alert)**

  The diver(s) should be ordered immediately to return to the bell and obtain a seal. The diving supervisor should order the bell to be recovered as soon as possible after consideration of hazards involved in doing so (e.g., fouling of anchor wires, jacket members, etc.) or, where surface-supplied diving is being conducted, prepare to return to the surface. The DP operator should use all means available to maintain the vessel in position until the divers are sealed in the bell and the bell is clear of obstructions. The diving supervisor and master should be verbally informed as soon as possible. Under this condition, air or mixed-gas divers should be ordered to return to the surface.

6. Communications

Communications between the dive control position and the DP console should be regular and frequent. Each watch-keeper should inform the other about any change in operational circumstances that occurs or that is planned.

The following list gives an indication of the type of information that should be passed:

- **Dive Control to DP Operator**

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- Bell status.
- Diver status.
- Intention to use water jetting or other underwater equipment.
- Possibility of divers, bell equipment, etc., blanking or moving acoustic reference signals.
- Any situation that could develop into an emergency.

• **DP Operations to Dive Control**
- Intention to move vessel.
- Any change in operational status.
- Background information on causes of changes in operational status.
- Any forecast or actual significant changes in weather.
- Ship and helicopter movements in the vicinity.
- Intention to handle down-lines of any description, including repositioning taut wire weight.
- Intent to bring small boats alongside.
- Intent to place anything into the water.

The following list indicates the type of information needed by the DP operator about activities in the vessel:

- Intention to perform and notification of completion of any electrical or mechanical system maintenance or modification that could directly affect online DP equipment or make standby equipment unavailable.
- Intention to start and stop ancillary air/hydraulic units that may reduce pressure on DP or diving-associated equipment.
- Intention to start and stop pumping of bilges, discharge of sewage, galley waste, etc.
- Intention to start and stop the use of radio and radar equipment that may affect the DP system.
- Intention to handle equipment that may affect the trim of the vessel.
- Imminent arrival or departure of helicopter or vessel alongside.

The following list indicates the type of information that should he passed between the DP operator and the platform:

• **Platform to DP Operator**
- Planned movements of vessels and helicopters.
- Planned crane lifts or outside platform work that could interfere with the diving operation, beacon or transponder sites.
- Intention to discharge mud, galley waste, etc.
- Planned blackouts in communications or power and hazardous operations (e.g., well-tests).
- Weather information.
- Other subset operations.

• **Taut Wire Systems**
- Regular inspection and maintenance of the wire should be carried out. It should also be cut back and re-secured to the weight frequently to ensure that wear does not become excessive at either the weight or the sheave.
- Care should be taken in the choice of its position in the vessel to minimize the mechanical limitations of the system. This is particularly important in higher sea states due to the movement of the vessel. It should also be situated as far as practicable from the moon pool or other diving position.
- Care should be taken to ensure that the taut wire does not lift off the bottom or, if it does, that an indication of it having done so is given automatically to the DP operator. Measures should be taken to prevent danger to divers if the taut wire is moved and to avoid interference with the taut wire by divers.
- The taut wire should be lowered to a position as far as possible from subsea pipelines, flow lines or cables, any of which may move. The mechanical limitations to the angle at which the taut wire can effectively operate introduce a limit to the distance from the intended position to which a vessel may deviate. This is of particular importance in shallow water.

- **Short-Range Radio Systems**
  - Vessel operators should be aware of the possibility of temporary loss of information (e.g., due to blanking by other vessels, helicopters, platform equipment, or occasionally rain squalls), and action should be taken to avoid or minimize the effects of this.
  - Remote beacons or transponders mounted on manned production platforms are vulnerable to manual interference. Steps should be taken to ensure that they are not tampered with or "blanked off" and that their power supplies are not interrupted. This could include providing battery backup, connection to the platform's essential service supplies, and placement in accessible positions in accessible positions. A warning signal should indicate that the main power supply has been cut and the system is working on batteries. The owner of the platform should be responsible for the security of equipment located on the platform.
  - Where possible, alterative frequencies or codes should be prepared to cover the possibility of interference but should be allocated with care.
  - The vessel's position and resulting reference station geometry should be carefully considered whenever a move is contemplated.
  - Interference from radar can cause temporary signal failure or error.

7. Down-line Handling and Interference with DP Sensors

The handling of all down-lines from DP ships requires special care in the following respects:

- **Taut Wire Errors**

  Long, horizontally-slung objects that can pivot when suspended in the water can and have come into contact with taut wires that are providing positioning information. Care should be exercised to avoid this.

- **Snagging of Divers**

  Any down-line can snag a diver. Down-lines should be handled only by people experienced in doing so and under supervision of the diving supervisor, if necessary, via the bridge. This is particularly relevant when the vessel is being moved.

- **Moving Acoustic Beacons or Transponders**

  Acoustic devices should be moved only by divers under the supervision of the diving supervisor and on the direct authority of the master, who should be continuously advised of their movement.

- **Down-lines**

  Down-lines should be made up to include a breaking section to reduce the chances of injury to divers.

8. Uncontrolled Movement

The conduct of diving operations from DP vessels, as opposed to other types, requires particular attention to the risk to divers due to vessel movement. The effect of the vessel moving off station can cause failure of main lift wires, life-support and/or communication arrangements between the vessel and bell, vessel and diver(s), or bell and diver(s).

Operating and emergency procedures should be established to minimize the risks, and adequate arrangements should be made for the provision of emergency life-support, communications and relocation devices to allow a successful recovery. The bell or divers should always be positioned with care, and whenever possible, above the level of potential obstructions. The possibility of releasing the tension on the winch wire, umbilical, and clump weight wire, while the bell is deployed, should be considered to avoid dragging it if position is lost.

Generally, divers should not enter confined spaces when diving from DP vessels. However, in special circumstances and with due regard to the provision of particular means to ensure their safety in case of DP failure, such operations may be permitted.

9. Operations Plot and Emergency Plans

A plot displaying the relative positions of the vessel, the bell, divers, the worksite and any known obstruction (e.g., platform, other vessels, mooring wires, wellheads, etc.) together with ship's heading and wind direction and speed should be maintained at all times at the DP control position. The DP watch-keepers should ensure that this plot is always kept up-to-date and that planned emergency procedures have been approved by the diving supervisor to provide for the action to be taken in case of DP or other emergency. These plans should be produced in advance of any diving operations and be reviewed and modified as appropriate.

10. Vessel Movement Limitations

When the bell is launched or divers are deployed, DP diving vessels should be moved only with the full knowledge and consent of those concerned (in particular the divers) under very restricted and controlled circumstances, as follows:

- Under automatic DP control.
- Generally, the vessel should not be moved while divers are in the water. However, in special circumstances and with due regard to hazardous obstructions, the master, with the agreement of the diving supervisor, should be able to authorize limited vessel movements with the divers in the water directed by the diving supervisor. Such movements should not exceed the limitations of the reference sensors and should be made at slow speed. Heading changes should not exceed 15%. When moving, bell divers should be in the close vicinity of the bell (i.e., on the clump weight). .
- Limited movements of the vessel that are greater than those described above should be made only where divers have been recovered to the vessel and with bell divers inside the bell recovered to the vessel or positively clear of any potential hazardous obstructions, including the seabed.
- When moving the vessel on DP, particular consideration should be given to:
  - Where the bell is cross-hauled or the vessel's vertical axis of rotation does not coincide with the moon pool, in addition to the limitations established above, heading changes should not exceed an angle that causes a 10-meter movement of the bell.
  - The possible snagging of down-lines with the bell winch wire and umbilical.

11. DP Operations in Vicinity of Platforms, Etc.

Particular care must be exercised when operating on DP in close proximity to fixed objects, such as production platforms, mooring buoys, etc. When DP diving is undertaken in the vicinity of anchor wires and cables, the inaccuracy in the knowledge of their actual position at any particular time, and the resulting need to keep the bell and bell wires as far from them as possible, should be taken into account.

12. Visual Reference Points

When close to fixed structures, their value as a visual reference to provide an early additional indication of DP failure should be considered.

13. DP Operations in Vicinity of other DP Vessels

When operating on DP close to one another, DP vessels are potentially subject to several forms of mutual interference. These include thruster wash, which may affect both hulls and taut wires; acoustic and radio position reference sensor signals; and intermittent shelter from wind and sea. These factors should be considered when planning such operations and due allowance made for them. This may take the form of assuming less-accurate position-keeping tolerance than would nominally be expected, but it could also include coordination of choice of position reference sensors and frequencies and careful choice of the relative positions of the vessels.

14. DP Operations in Shallow Water

During shallow-water operations, there are indications that the limitations of acoustic and taut-wire reference sensors, in terms of the distance from the intended position at which these sensors can operate correctly, can introduce an extra hazard above those normally associated with their use in deep water. The need to use a surface reference sensor as one of the sensors in such operations is therefore of particular importance. The effect or the strong tidal streams and currents sometimes associated with shallow water should also be taken into account in relation to the position-keeping capabilities of DP vessels.

15. Weather Precautions

Due regard should be paid to any indications of impending weather changes, in particular sudden wind shifts and/or gusts. In winter, sudden changes in direction and increases in strength of wind often occur. The use of onboard meteorological instruments, including barometers, barographs, wind sensors (both fixed and portable), and wet and dry thermometers is necessary to ensure that timely action is being taken to reduce the possibility of loss of position.

In conditions where wind and waves are from opposite sides of the fore and aft line of a vessel, particular care is required, as a wind shift to coincide with wave direction is likely to cause rapid change in resultant force on the vessel. A warning of instability when the weather is from roughly ahead or astern, to be obtained from thrust unit movements alternating frequently through 180° using appreciable thrust. A case has occurred of a complete power failure resulting from a DP ship being struck by lightning. All reasonable precautions in accordance with good marine practice should be taken to ensure that forecasts of changing weather conditions are obtained and acted upon.

These precautions should include:

- Obtaining regular and frequent weather forecasts for the area of operations and use of facsimile facilities and charts.
- Seeking information by radio from other units in the vicinity about prevailing weather conditions in their areas.
- Use of experience and a "seaman's eye" in assessing the prevailing conditions and likely trends.
- The presentation of environmental information measured by the DP system and any trends in conditions that it can provide.

16. Collision Risk

Care should be exercised at all times to ensure that the correct lights and shapes are displayed in accordance with the latest international collision regulations . By the present rules, whereas power-driven and sailing vessels are required to keep out of the way of a vessel restricted in its ability to maneuver (e.g., a DP diving vessel), a vessel engaged in fishing when underway is required only "so far as possible" to do so.

The master of a DP diving vessel should give early warning that it is unable to maneuver to any vessel that appears to be on a collision course using visual and sound signals. The potential use, if properly employed, of a simple automatic collision warning system should not be overlooked. In conditions of reduced visibility, decisions about the suitability of conditions for diving should rest with the master of the vessel.

8.3.8 PERSONNEL CAPABILITIES

The third principle (personnel capabilities) concerns the ability of the personnel onboard to perform the tasks entrusted to them. There should be sufficient personnel having suitable training and experience to ensure the safety of the vessel and all those on board.

8.3.8.1 Authorities

Nothing in these guidelines shall supersede the spirit or letter of legislation covering the authorities of masters of merchant vessels, of supervisory staff responsible for diving, project control, and of offshore installations. It is, however, of fundamental importance that the authorities of all personnel concerned with the management of diving operations conducted from DP vessels be thoroughly and clearly defined. The sections below give general guidelines.

1. The Master

The master of the vessel is ultimately responsible for the safety of his or her vessel and all personnel on board and has ultimate authority to forbid the start or order the termination of diving and DP operations on grounds of safety to personnel on the vessel.

2. Operations Superintendent

The operations superintendent, where present, is responsible for the conduct of all operations carried out from the vessel. As such, he or she has authority to forbid the start or order the termination of diving operations for safety or other reasons. The operations superintendent may not order the start of diving operations.

3. The Diving Supervisor

The diving supervisor is appointed by the employer of the divers to be in overall charge of all diving operations from the vessel and is responsible for all aspects of diving safety. He or she has ultimate authority to permit or forbid the start and order the termination of any diving operations on grounds of diving safety. Other diving supervisors may, as necessary, be appointed by the diving contractor but should be under the control of the diving supervisor. For the purposes of these guidelines, it is assumed that any additional diving supervisors have been vested with the authority and operational responsibility of the diving supervisor when on duty and until relieved.

4. The Client's Representative

The client's onboard representative should, in conjunction with the contractor's senior onboard representative, be responsible to the client for the proper performance or all work in accordance with the contract. He or she may request the start of DP or diving operations and should have the authority to veto the start or order the termination of diving or DP operations on any grounds.

5. Project Liaison

In view of the additional safety factors involved in DP operations, it is essential that close liaison be maintained between the various authorities concerned. Some organizations may include additional supervisory roles, but the above four authorities should represent the minimum forum for planning meetings concerning DP supported diving operations.

6. Priorities

Priorities should be clearly established for dealing with a DP emergency. The authorities of the master and diving supervisor are of fundamental importance at such times. They should cooperate closely to these priorities so that there is no room for doubt or dissension. Priorities should take into account that:

- The safety of life is the first priority. The master has ultimate authority to assess and decide on courses of action in this respect. The advice of the supervisor should be taken into account.
- The safety of property is of lower priority. No effort should be made to safeguard property at the expense or safety to life, but the potential danger to life which some threats to property pose should not be overlooked. The advice of the client's representative and offshore installation owner should be heeded where possible in respect of the safety of offshore installations and equipment.

7. Manning for DP Diving Operations

The requirements for numbers of qualified DP operators will vary. However, every DP vessel engaged in diving operations should meet the following requirements:

- The master of a DP diving support vessel, when performing DP diving operations, should be appropriately trained to be responsible for operating the DP system without supervision.
- DP Operators should be present in the DP control room whenever DP diving operations are being carried out. One of them should hold an appropriate deck officer's qualification to be in charge of the navigational watch. One should be responsible for operating the DP system without supervision. The other should have received suitable instruction on the principles and operation of DP systems. The second watch-keeper may leave the DP control room to attend to ship's business.
- An appropriately trained technician capable of minor fault-finding and maintenance of the DP system should be onboard at all times when DP operations are taking place.
- The period of time for which the watch-keeper referred to above continuously operates the DP system should be limited to avoid loss of concentration. It is unlikely that continuous periods of longer than two hours would be satisfactory, and in some circumstances this may need to be shortened.
- Engine rooms (or engine control rooms) should be manned at all times when on DP.

8.3.8.2 Training and Experience

The amount of training and experience needed by personnel to perform their functions safely varies. However, the following minimum standards are recommended, but some may need to be exceeded in some cases:

- No person should be responsible for operating the DP system in a DP diving vessel without supervision while diving operations are in progress, until he or she has:
  - Received suitable instructions on the principles and operation of DP systems.
  - Attained satisfactory practical experience by completing a suitable period of supervised DP watch-keeping offshore during which he or she has simulated the main subsystem failures, including failure of automatic computer control. It is suggested that a suitable period would be at least 200 hours.
  - Satisfactorily completed approximately 50 hours supervised DP watch-keeping on the vessel concerned during which he or she has simulated the main sub-system failures. To assist the owners to monitor this training, it is recommended that all DP operators maintain a personal log of their DP experience.
  - The technician(s) responsible for minor fault finding and maintenance of the DP control system should have satisfactorily completed a suitable training course.

8.3.8.3 Operations Manual and Records

Clear guidance about the operation of each individual DP diving vessel should be contained in an operations manual prepared specifically for that vessel. The manual should contain sections on at least the subjects outlined in the following subparagraphs.

1. Vessels Operational Limitations and Alert Procedure

The limitations and procedures as defined in Section 8.3.7.5(4) DP Alertsshould be clearly stated.

2. Manning

This section should detail the minimum manning arrangements for the vessel when operating on DP and during diving operations.

3. Responsibilities, Authorities and Duties

The duties, responsibilities and authorities of senior personnel should be described based on the guidance in Section 8.3.8.

4. DP Operations

A description of the DP system fitted on the vessel and guidance on the performance of all DP operations, including procedures for:

- Operating checks.
- Operations of position-reference sensors.
- Duration of DP operating periods.
- Operations in the vicinity of platforms, etc.
- Standard alert levels (with description of warning signals).
- Precautions with regard to weather.
- Measures to prevent collision.

5. Diving Operations

An up-to-date description of the diving system(s) and guidance on the conduct of diving operations as they may be affected by the DP vessel itself, including procedures for:

- Actions to be taken in case of changes in alert-level status.
- Operation of divers in free-flooding and enclosed spaces
- Precautions to guard against thrust unit wash or suction effect.
- Surface support and down-line handling.
- Information to be provided to dive control positions.
- Preparation and use of emergency plans.
- Moving vessel.

6. Priorities

Guidance should be given on the priorities to be adopted in case of emergency. These should follow the guidance given in 8.3.8.1 (No. 6).

7. Communications

Guidance and procedures concerning the transfer of information should be modified to suit the particular vessel. This section should also contain a description of the voice communication systems and alarm systems that are available and should define emergency situations.

8. Records and Report

Details of all records and reports required by the master, senior diving supervisor and others.

8.3.8.4 Information Feedback

Lessons learned in the course of practical DP operations can be of use to others besides those immediately involved. Arrangements for the dissemination of information should he established, so that relevant practical experience and the lessons learned can be made available to others to improve the safety of DP diving operations. This may include dissemination within the vessel and/or the company, and to designers, manufacturers and shipyards.

8.3.8.5 References

International Maritime Organization Publication 645 Guidelines for Vessels W/D

8.3.9 SURFACE-SUPPLIED DIVING FROM DYNAMICALLY POSITIONED VESSELS

All equipment and manning levels should be considered the recommended minimum for approaching this diving application, based on one dive and any applicable decompression required. Increased manning levels and additional equipment may be required for any diving in excess of one dive and any decompression required. Proper pre-job planning should be conducted to ensure that the necessary levels of personnel and equipment are available for diving operations.

1. Minimum Personnel
   - One air or mixed-gas diving supervisor (NOT part of the dive rotation).
   - One manifold operator when mixed-gas [HeO_2] diving.
   - One diver.
   - One standby diver.
   - Two tender/divers.
   - Two LARS/Winch Operators

8.3.9.1 Surface-oriented Diving

The following conditions must be met to perform surface diving from a DP vessel in the DP mode whether over the side or through the moon pool:

- Utilization of an open-bottom bell with emergency on-board gas. (For air or nitrox dives, a stage with emergency on-board gas may be substituted for an open-bottom bell.)
- A tending point on the surface or in-water from which the diver's umbilical can be securely tended. Allowable tending methods need to be addressed in the project JHA and may include the following items:
  - A tender located on the vessel;
  - A tender located in a stage above the surface;
  - An unmanned in-water tending point (e.g. open-bottom bell, diver's hoop {golden gate};
  - An in-water tender;
- Divers (and, if utilized, in-water tender) to have access to surface and on-board gas.
- The bell umbilical and/or diver's umbilical supplying the wet bell and/or divers with appropriate services must be secured to the main lift wire (or secondary lift wire).
- The Diver's (excursion) umbilical is secured to the wet bell so that it is at least 16 feet shorter than the distance to the closest hazard. The umbilical must be appropriately marked.
- Bell umbilical and surface umbilical management plan (should be filed with JHA).
- The diving supervisor must be provided with relevant DP alarms and communications systems to the bridge and/or DP control station.
- The topside tenders must be able to hear all communications between the divers and the supervisor and must be able to talk directly to the supervisor.
- Written procedures, as most regulations in effect in other nations, must be prepared for emergency situations (e.g. changes in alert-level status, alarms, loss of communications, moving the vessel, etc.).
- The dive crew must be familiar with the vessel's overall design and operating characteristics (e.g. position of thrusters, propellers, intakes, obstructions, etc.).

NOTE: During diving operations, it is recommended that all structures or debris should be deeper than the deepest point of the bell to protect the bell in the event of **runoff or black ship circumstances. <u>Operations where the bell is below the shallow point of the underwater obstruction shall require a management of change (MOC).</u>**

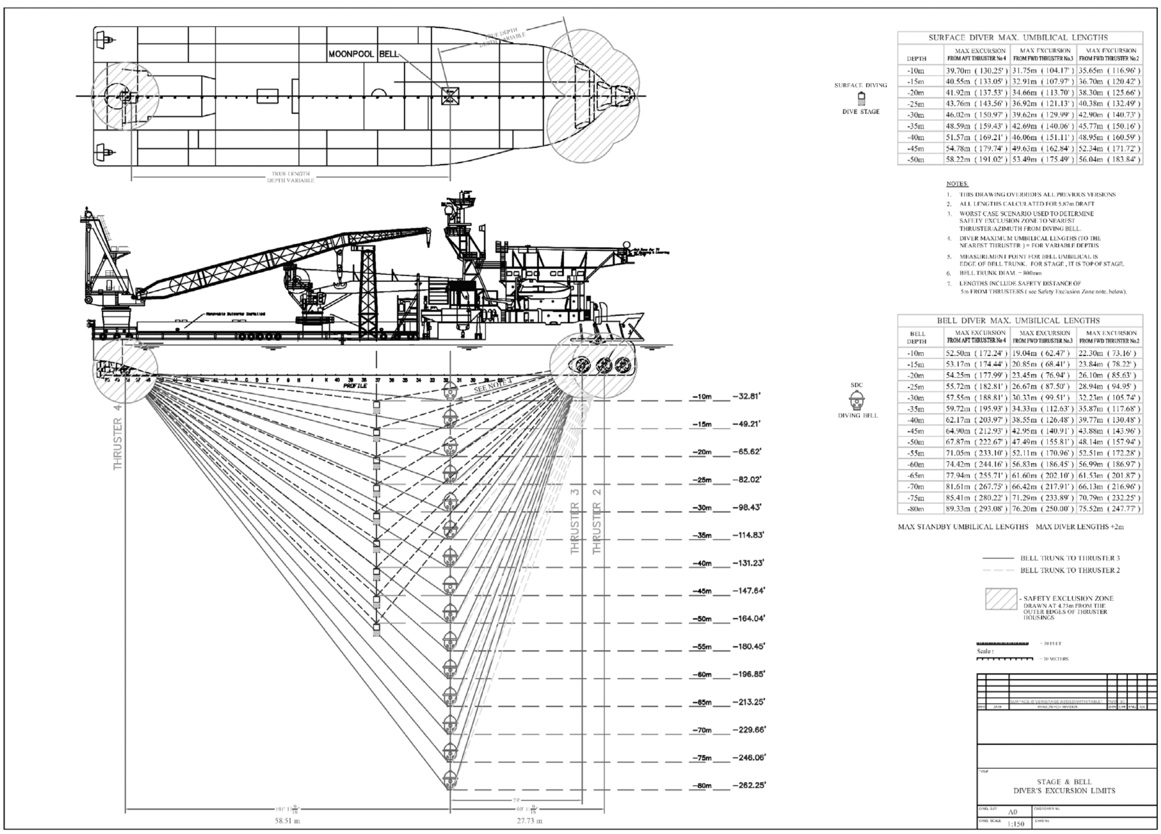
The following requirements for surface and saturation diving operations conducted from a vessel are in effect only when the vessel is operating in the DP mode. "DP mode" is defined as whenever there is any form of motive power in operation, e.g. thrusters or propellers, which automatically maintains the vessel's position (fixed or a predetermined track) by means of thruster force. The DP system consists of a power system, a thruster system, a DP-controlled system with the redundancy built in to maintain or restore its function, e.g. DP II and DP III. Diving operations conducted from a DP II or DP III vessel should not be considered "Live Boating" and may be performed at any time during the day or night, provided a thorough hazard assessment has been performed. The requirements are based on the premise that at no time should the length of umbilical from the tending point to the diver allow the diver to come into contact with the nearest thruster or propeller that is in operating mode. Very great care is needed in the planning and execution of shallow and surface-oriented diving operations to minimize the effect of thrust units on the divers. The effects of thrust unit wash or suction should be carefully considered, and precautions should be taken to guard against them, particularly when the bell or divers pass the potential wash zone. These precautions could include appropriate computer software to avoid any hazardous effects on the operation of the bell or divers.

The use of thrust diagrams when planning dives can also help. Inhibiting or deselecting certain thrusters may be necessary, and the resulting reduction in the vessel's operational limitations should be taken into account. Divers' umbilical lengths and the manner of deploying them (e.g. over the side, from the bell, etc.) should be so chosen that divers and their umbilical are physically restrained from going to positions where they or their equipment could come into contact with the thrust units or be adversely affected by their wash. Furthermore, care should always be taken to prevent umbilical developing a bight, and to respond at once to any indications of a diver being in difficulty, such as unusual tension on or at the angle of the umbilical. There is no simple approach to the problem due to the differences encountered in the vessels and worksites.

8.3.9.2 Bell Umbilical Management and Surface Umbilical Management

-SAMPLE DIAGRAM ONLY-

Safe Umbilical Length Formula



$A^2+B^2=C^2$

The square root of C^2 = Distance to hazard

A = Distance to nearest hazard (stern thruster)

B = Shallowest depth diver will leave bell

C = Distance from depth to nearest hazard

Items 1 and 2 below must be subtracted from (C) to determine maximum safe umbilical length.

1. **MAIN umbilical must be 16 feet (5m) shorter than (C) closest hazard.**
2. **STANDBY umbilical must be 10 feet (3m) shorter than (C) closest hazard.**

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SECTION 9.0

REMOTE OPERATED VEHICLES (ROVs)

Association of Diving Contractors International, Inc.

9.0 REMOTE OPERATED VEHICLES (ROVs)

9.1 INTRODUCTION

The purpose of the guidance contained in this section is directed to the use of ROVs within the commercial diving and underwater industry and to provide general material intended to contribute to the highest possible degree of safety during the conduct of ROV operations. **For specific guidelines and procedures for ROV diver operations, refer to Section 9.3.**

9.2 BACKGROUND

Implementation of these guidelines will vary depending upon the class of ROV used, and it is important to recognize that the great diversity and variety of vehicles make it difficult to definitively state into which class a particular ROV may fall.

The term "remote operated vehicle" (ROV) covers a wide range of equipment, with no single vehicle able to be described as typical. Not only are there numerous differences between basic design, but the same basic ROV can be modified to carry out different tasks. For the purpose of this standard, five different classifications are identified, but it should be recognized that there can be subdivisions within these classes. For example, ROVs launched and recovered in a "garage" or "cage" with a tether management system may be subdivided from those that are free-swimming. Likewise, a large work-class ROV may be tracked just as a small observation vehicle can be mounted to tracks for specialized operations in the observation mode.

9.2.1 CLASSIFICATION SYSTEM

Class I – Pure Observation. Pure observation vehicles are generally considered to be physically limited to video observation and fitted with a video camera, lights and thrusters. However, this is not a fixed "rule," and these types of vehicles have evolved to have an ability to perform other tasks if properly fitted with additional sensing devices.

Class II – Observation with Payload Option. These vehicles are generally somewhat larger than those of a pure observation nature and are capable of carrying additional sensors, such as still cameras, cathodic potential measurement devices, additional video cameras, sonar systems and small manipulators. Class II vehicles should be capable of operating without loss of original function while carrying at least two additional sensors.

Class III – Work Class Vehicles. These vehicles are large enough to carry additional sensors and/or manipulators and commonly have a multiplexing capability to allow additional sensors and tools to operate without being "hard-wired" through the umbilical system. These vehicles are generally larger and more powerful than class I and II vehicles. Wide variations of power, depth rating and capability are possible.

Class IV – Towed or Tracked Vehicles. Towed vehicles may be pulled through the water by a surface craft or winch. Some may have limited propulsion power for limited maneuverability.

a. Tracked vehicles have an ability to move across the bottom. Some may have a limited mid-water column "swimming" capability.
b. Vehicles within this class may derive from those of classes I through III, and thus, their physical attributes may vary widely.

Class V – Prototype or Development Vehicles. Vehicles in this class include those under development or special purpose vehicles that do not fit within one of the other classes.

9.2.2 ROV TASKS

Observation. Observation is the least complicated work mode. It can normally be undertaken by the use of a video camera without additional equipment and is generally conducted by ROVs of the Class I or Class II variety. If the monitoring of divers is entailed, the vehicle will normally be maintained in a near stationary position.

Survey. Surveying activity normally consists of some form of observation of the intended area of operations, whether on the seabed or within an enclosed area such as a pipeline, outfall or tank-like structure. Survey can also be employed as a post construction or equipment installation verification tool.

The general purposes of surveying activity may be:

a. Fixing geographical coordinates.
b. Ensuring the target structure or device is within a permitted corridor or area.
c. Verification of burial.
d. Determination of physical damage.
e. Examination of pipelines or structures.
f. Verification of debris removal.
g. Identification.

Inspection. It is often difficult to distinguish between inspection and survey, particularly as an ROV may carry out both types of tasks in a single dive. Inspection tasks usually concentrate on specific, pre-defined areas of concern and include detailed visual and/or other types of inspection using on-board sensors such as cathodic protection (CP) measurement devices.

Construction. These tasks normally require a larger vehicle capable of deployment of at least one manipulator. Construction vehicles may be employed in such tasks as removal of debris, intervention, connection or removal of lifting devices, or actuation of valve components.

Intervention. Many work-class ROV's have specially designed tool packages able to interface with subsea manifolds, wellheads or control pods to effect installation, removal, maintenance or repair functions.

9.2.3 ROV TOOLS

Tool packages can be varied to suit requirements, with new devices being constantly developed and upgraded. This section provides a brief introduction to some of the more common tools.

When installing or using ROV tools, all relevant manufacturer and industry safety instructions should be applied. Just as with any other piece of equipment, an appropriate maintenance log should be preserved. When operating ROVs in areas where considerable current or surge may be present, planning and assessment techniques should be employed to ensure that the mounted tools will not create a hazard to either the personnel or the vehicle.

Cameras. Cameras can be mounted in a fixed position, on a pan-and-tilt assembly, or held by a manipulator. Video systems with the ability to view in conditions of low-light intensity and still cameras to furnish high-resolution documentation are available. Pan-and-tilt assemblies furnish a capability to allow training of the camera system to permit omnidirectional viewing.

NDT Sensors. The more commonly used sensors for NDT activity are cathodic potential (CP) probes, ultrasonic thickness measurement devices and flooded member detection systems.

Acoustic and tracking. Numerous acoustic systems are available, such as tracking and measurement devices, scanning, profiling, side-scan, sub-bottom profiling, bathymetric and pipe tracking.

Cleaning. ROVs can be used as a platform for cleaning devices used for structures and/or vessels. These devices can range from simple rotary wire or nylon brush systems to more sophisticated units capable of removing calciferous marine growth.

Station-Keeping. Many ROVs are capable of maintaining heading, depth and position. Attachment devices are available to permit the ROV to be located in a virtually fixed location. Some of these devices are:

a. Docking cones and similar stabbing devices.
b. Suction pads and water pumps for hydrostatic attachment on smooth surfaces.
c. Manipulator-mounted hydraulic devices to grip structural members.

Note: Attachment devices should be fitted with a "fail-safe" feature to permit disengagement if power to the vehicle should fail.

9.2.4 ENVIRONMENTAL CONSIDERATIONS

To ensure safety and efficiency of the intended operation, it is necessary to take into consideration both the probable and unanticipated environmental considerations of the intended work site.

Water Conditions. ROVs can operate anywhere from very shallow locations to depths in excess of several thousand meters. Increased depth capabilities are being achieved as the need develops for the conduct of deeper operations. Individual ROVs should not be used below their design depth. When operating ROVs, consideration should be given to:

- Umbilical length and associated drag. These influence the specification of the topside handling system.
- Transit time. Crew members assigned to monitoring the ROV may become distracted during a long transit with the ROV at extreme depths.

Variations in temperature, salinity, depth and acoustic noise should be considered for their possible adverse affects on acoustic tracking and positioning systems. Water characteristics may also have an effect. The following factors should be taken into account when assessing the use of a vehicle for a given task:

- Visibility. Poor visibility can adversely affect an operation and may require the use of sophisticated equipment, such as acoustic imaging systems. Vehicle operation near the seabed may stir up fine-grained sediment that remains in suspension to reduce visibility in low- or zero-current conditions.
- Temperature. Extreme temperatures (both high and low) may affect the reliability of electronics and cause material fracture that leads to structural or mechanical damage, particularly in arctic conditions. Hydraulic oil and lubricants that offer stable properties over the intended temperature range should always be used.
- Salinity. This may vary substantially near river mouths, in tidal estuaries and near outfalls. The resulting variation in water density may affect ROV buoyancy, trim and the accuracy of sonar data.
- Pollutants. The presence of petroleum products or other pollutants can cloud optical lenses, damage plastic materials, affect visibility, block sound transmission or cause a sudden loss of buoyancy. Where pollutants are present, precautions should be taken to protect the in-water portions of vehicles and the topside personnel who handle the ROV during launch, recovery and maintenance.
- Water movement. ROVs are sensitive to water movement, and extra care should be taken in shallow water where surge or thrust from surrounding vessel propellers or thrusters can have an effect on vehicle control.
- Currents. Currents can create considerable problems in ROV operations, but quantitative data on particular current profiles are rarely available.

Simulations and analysis can provide good current prediction, but currents do not remain constant for long, even those close to the seabed. Currents also vary with location, and surface currents can be rapidly affected by wind. Tidal meters and historical data are useful indicators of current strength and direction for particular areas and depths.

Factors that may affect ROV operations, including their maneuverability in current, include:

- Length and diameter (mass) of umbilical.
- Propulsion power.
- Depth and orientation to the direction of the current – a non-uniform current profile.
- Umbilical “strumming” or “spinning” in deep water (this may require the use of specially designed umbilicals).
- Vehicle hydrodynamics (i.e., surface area and profile).
- Sea state and swell can affect every stage of an ROV operation.

Safety must always be carefully considered when launching or recovering an ROV, particularly from a support vessel in rough seas. ROV operators should understand the effect of a heaving support ship on the umbilical attached to a relatively motionless ROV and should be aware that the ROV handling system can be overloaded or that personnel on deck may be exposed to a risk of accident.

In rough conditions, personnel involved with launch and recovery must wear all necessary personal protective equipment and fully understand their own role as well as the roles of others involved in the operation. Good communication is vital for avoiding accidents.

In certain situations, deployment systems incorporating motion compensation can either reduce or better accommodate the effect of wave action and thereby permit ROV operations to be conducted in higher-than-normal sea states while maintaining high safety standards.

- Weather. While ROVs themselves are not normally sensitive to weather, the cost and efficiency of ROV operations can be affected by weather in a number of ways:
  - Wind speed and direction can make station-keeping difficult for the support vessel and adversely affect ROV deployment and recovery.
  - Rain and fog can reduce surface visibility and create a hazard for the support vessel.
  - Adverse combinations of wind, rain, snow, etc., can make the work of ROV crews hazardous for personnel on deck.
  - Hot weather can affect the ROV electronics and related systems. Likewise, hot weather can have an adverse effect on ROV crew personnel on deck.

Operations should therefore be carefully monitored with regard to the safety of both personnel and equipment affected by adverse weather conditions.

- Seabed characteristics. When planning an ROV operation, local seabed conditions and topography should be known in advance. Rocky outcroppings or submerged structures can make collision more likely and add to the risk of abrasion of the vehicle umbilical, or affect signal transmission from sonar or other devices.

9.2.5 OPERATIONAL CONSIDERATIONS

In order to assure the safe and efficient use of ROVs, operators should ensure that the chosen ROV system has been satisfactorily tested prior to use and that it is capable of meeting the operational requirements of the job. The ROV supervisor should commence an operation only after carefully considering:

- System and crew readiness.
- The effects of environmental factors anticipated during the operation.
- Potential risk factors that may be present during the operation.
- The nature and urgency of the intended tasks.

All of these plus a variety of other considerations must be made a part of the job hazard analysis conducted during planning and assessment.

- **Operating procedures.** The operating procedures shall consist, as a minimum, of the ROV contractor's safe practices/operations manual (company procedures) together with any site-specific requirements and procedures. Contingency procedures for emergency action are also a requirement. The management chain of command for an ROV project shall be clearly defined, and the ROV supervisor shall be identified in writing. If operations will continue beyond a single shift per day, an alternate ROV supervisor must be designated.
- Planning and assessment. Specific operating procedures necessary for accomplishment of the intended tasks will be largely determined during the planning process. This process is intended to analyze potential hazards, areas of possible job interference and an assessment of other risks as may be deemed to be possible during the conduct of operations.
- ROV **systems' location and integrity.** During the planning and assessment phase, consideration must be given to the site from which the ROV operations will be conducted. Dependent upon the project, this may be from an offshore platform, vessel, pier, shoreline, small boat or other site. Considerations that must be factored into the operational plan include, but are not limited to:
  - The type of structure or vessel from which the ROV operations will be conducted and an evaluation of whether there is sufficient working area for the ROV, its associated systems and the ROV crew members.
  - Whether the dive control station is in an area of hazard, such as where ignition of gas, vapor or liquid could cause a fire or explosion.
  - Whether surrounding or associated operations can create a hazard either to the ROV, its systems or crew personnel. Examples of this might be where crane or other associated overhead operations are being conducted.
  - The proximity of the ROV to a required handling system with consideration of lateral or horizontal distances that must be traversed in order to launch or fully recover the vehicle.
- **Handling systems.** Handling systems, whether for ROVs or other uses, can be inherently dangerous if care and attention during their use is not maintained.

Detailed operating procedures for each handling system should be readily available at the job site, and ROV operators must be knowledgeable regarding the safe working loads to which that system is limited. When the system is to be secured to a deck by a welding process, non-destructive examination methods should be employed to ensure appropriate integrity of the installation.

- **Testing and periodic examination.** A procedure should be developed for a responsible person to examine ROV handling systems:
  - At least every six months for physical damage, misalignment or evidence of wear at critical points.
  - After any major alteration or repair that may affect its integrity.
  - After having been relocated from one position or site to another.
- **Cables, umbilicals and associated hardware** should be examined at least every six months in accordance with the manufacturer's recommendations and any such regulatory guidance in effect. Appropriate log books and records should be maintained.
- **Communications**. Effective and reliable communications are critical to the safety and success of any operation. All personnel involved in the operation shall be fully aware of the work being undertaken and the status of any unusual situation that may or does arise during the work performed.
  - **Diving operations.** The diving supervisor has ultimate responsibility for the safety of the entire operation when diving operations are taking place. Communications must be maintained at all times between the diving supervisor and ROV supervisor. Refer to Section 9.3 for ROV diver operations.
  - Vessel control. The ROV supervisor shall ensure and maintain effective communication with vessel movement control personnel whenever ROV operations are in progress.
- **ROV operating sites.** ROVs are required to operate from different locations with varying levels of support for the ROV system and crew. Due consideration should be given to the limitations of each location on safety and efficiency. Suitable deck strength, extra supports, external supplies and ease of launch and recovery should be considered.

Prior to mobilization, the ROV supervisor should inspect the site and decide on the optimum location for the ROV system. Umbilical or cable runs should be carefully established to protect against physical damage or interference. Additionally, the length and fleet angles for these runs must be evaluated to protect system integrity and functionality.

When considering the use of vessels of convenience for support of ROV operations, operational limitations may be encountered. Some of these limitations may relate to:

- Lack of maneuverability.
- Lack of navigational accuracy.
- Mooring or anchoring systems.
- Deck space.
- Electrical power reserves.
- Propeller guards.
- Limited personnel accommodations.
- Familiarity with intended type of operations.
- Minimal (or excessive) freeboard.

When intending to conduct operations from a fixed platform, there are a number of specific areas of consideration, such as:

- A need to comply with specific, often onerous, zoning requirements relating to hydrocarbon safety, or other specific regulations of the operator.
- Difficulties of installing surface support equipment.
- Training requirements for ROV crew personnel related to platform-oriented operations.
- Deployment and recovery complications (including tidal effects) caused by the height difference between the platform deck and waterline.
- Hazards created by surrounding activities on the structure.

- **Anchored, moored or DP vessel operating sites** present similar hazards as those of the fixed platform variety, although zoning and hydrocarbon safety requirements will normally apply only to drilling rigs. Where DP vessels are to be utilized, it must be remembered that the vessel propellers/thrusters are in constant use. Care must be assured that the ROV umbilical does not come into incidence with rotating equipment and that the umbilical will not be adversely affected by thrust or wash from same.

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- **Navigation.** The use of acoustic location beacons on some ROVs contribute to navigation, positioning and tracking. In some cases, an ROV can be placed beside a submerged object to establish an accurate position for that object.

In some situations, there is a potential danger of acoustic interference, such as shadowing or noise, if several vessels are operating in the same area or if large-scale construction or survey projects are present. This can be a particular problem if the DP vessel relies on acoustic signals for positioning. Frequencies for acoustic beacons should be selected to avoid interference. In larger projects, these tasks of coordination of frequencies employed may necessitate some form of central control.

- **Manuals and documentation.** To ensure the safe and efficient operation of ROVs, appropriate log books, checklists and manuals are required on site. It is the contractor's responsibility to ensure that each ROV supervisor is supplied with necessary documentation.

Regulations and legislation appropriate to the intended area of operations must also be understood and available at the site of operations.

- **Umbilicals.** Umbilicals can be broadly categorized by their weight and material composition, but they vary in strength, power and signal transmission characteristics.
  - Lightweight umbilicals are generally reinforced with Kevlar for strength, and use some form of appropriate abrasion-resistant material for jacketing.
  - Medium-weight umbilicals may comprise a jack, a stainless-steel braid and a Kevlar® central member.
  - Heavy-weight, or armored, umbilicals can be used for lifting.

ROV supervisors and operators should be aware that the umbilical is limited by its breaking load, safe working load and minimum bend radius.

Periodic and routine inspection and maintenance of umbilicals should be performed in accordance with the manufacturer's design and instructions, and re-termination should be performed as per those instructions.

- **Launch and recovery.** The ROV supervisor is responsible to ensure that a safe launch and recovery of the ROV can be performed and that all members of the ROV and support crew understand what is required. These evolutions should progress in a smooth and logical manner with all personnel involved fully aware of the situation at all times.

The ROV handling system's design parameters should furnish calculations to define launch and recovery limitations based on weather, sea state, support vessel motion and other parameters appropriate to the intended operation.

- **Physical hazards.** In addition to those discussed above, a number of other physical hazards may be encountered during ROV operations. These include:
  - **Intakes/discharges.** ROVs are vulnerable to suction or turbulence caused by water intakes and discharges. The ROV supervisor should establish the presence of any such intake and discharge locations that may create a hazard and establish procedures to minimize their effect.
  - **Diving operations.** When conducting ROV operations in the vicinity of diving operations, certain hazards are introduced, such as possible entanglement of umbilicals, physical contact, electrical hazards and the fact that ROV propellers or thrusters can present a hazard. Close liaison between the ROV and diving supervisors is required.
    - The physical hazards to divers caused by the power, mass and possible inertia of the ROV should not be underestimated.
    - Communication between the ROV and diving supervisors must be effective and continuous and is mandatory. A loss of this communication requires emergency procedures and an immediate stop of the ROV propellers/thrusters/tracks.
  - **Electrical.** ROV electrical requirements are significant and able to create hazardous situations if not properly handled. Care must be taken to ensure that all personnel are protected from any electrical hazards at all times, whether during maintenance, pre-launch, pos- launch or operational conditions.
  - **Water blasting.** Some ROVs carry high-pressure water-blasting equipment. These systems have been known to cause accidents and fatalities and severe damage to equipment when not used correctly. Care must be taken during testing and operation to prevent accidents both during topside and in-water activity.

9.2.6 PERSONNEL

All ROV personnel should be competent to carry out the tasks required of them. The qualifications of ROV personnel are determined by training, experience and actual evaluations of the individual by the employer.

- **Manning.** Safety of personnel is paramount during operations and maintenance; it is the responsibility of the contractor to provide a skilled team of sufficient numbers to ensure safety at all times. When defining the team size, the contractor should consider:
  - Nature of the work being undertaken.
  - Deployment method.
  - Location.
  - Vehicle classification.
  - Operational period.
  - Ability to respond to emergency requirements.

The contractor should provide a sufficient number of properly trained and experienced personnel, able to operate all equipment and provide support function to the ROV team. For safe operations, the team may also need to include additional deck support personnel and other management or technical support personnel. However, personnel not normally employed by the ROV contractor (e.g. clients, vessel crews, etc.) can create a hazard to themselves and others if they lack familiarity with the contractor's procedures, rules and equipment. Therefore, their competence and suitability should be carefully considered before their inclusion in the ROV team.

Safe working practice dictates that personnel should not work alone when dealing with:

- High voltage.
- Heavy lifts.
- High-pressure machinery.
- Umbilical testing.
- Potential fire hazards (welding, burning, etc.).
- Chemicals capable of generating toxic fumes.

9.3 ROV AND DIVER OPERATIONAL PROCEDURES

9.3.1 INTRODUCTION

These recommended guidelines and procedures have been written to cover general guidelines regarding ROV-diver operations. These procedures are intended as guidelines for supervisors and operators.

The essential factor to successfully and effectively conducting simultaneous ROV operations with diver intervention is **COMMUNICATION.** This word will be used often in these procedures. A clear line of communication between ROV crews and dive control is critical.

A job safety analysis is a critical ingredient to assuring that all factors necessary to support the highest levels of safety have been considered.

9.3.2 DEFINITIONS

ROV Remote Operated Vehicle

TMS Tether Management System

LARS Launch and Recovery System

HPU Hydraulic Power Unit

FSW Feet Sea Water

MSW Meter Sea Water

9.3.3 ROV AND DIVE TEAM OPERATIONAL PROCEDURES

COMMUNICATION IS KEY TO SAFE AND EFFICIENT OPERATIONS.

9.3.3.1 PRE-DIVES

In addition to standard pre-dive briefings:

- It is important that all divers and dive supervisors are familiar with all aspects of the ROV.
- Location of thrusters, diver toolbox, manipulator arms, tether and camera locations should be areas of focus during this orientation.
- Camera location is important in order to emphasize to diving personnel the pilot's field of vision.
- Tether is not to be used as a crossover/swim line for divers.
- When mounting a diver toolbox on ROV, place it in a location that takes into consideration that most diving tools have lanyards on them. The diver needs to be able to access the toolbox and tools without getting lanyards or the divers themselves fouled in thrusters.
- Thruster location is important to divers. Divers will have pneumos and tooling with lanyards. Even with thrusters nulled and the pilot holding a dead stick, thrusters will rotate. Divers need to secure all lanyards and pneumo hoses before approaching an ROV.

9.3.3.2 SUBSEA OPERATIONS

- Before the ROV approaches a diver, the diving supervisor must be notified. Slow, easy movements of the ROV are required to prevent injury to diver.
- When the diver approaches the ROV, the diving supervisor must be notified as well as the ROV supervisor or pilot. The ROV should stop all movements in order to allow the diver to approach. When possible, the diver should approach from the front of the ROV, to allow the ROV pilot to view him or her. If the ROV needs to dial in vertical thrust down, in order to hold position, the pilot should notify the dive supervisor that the thrusters are operating during diver's approach.
- Using manipulators with divers:
  - The ROV should place the manipulator in such a position that diver can place a tool in the jaws.
  - The ROV pilot should then inform the diving supervisor that the manipulator jaw is closing. Once this is acknowledged, only then should the pilot close the ROV jaws.
  - The ROV should never try to take a tool from the diver; the diver must place the tool in the manipulator jaws to minimize manipulator movements.
- The ROV tether should never be used for a diver crossover/swim-line.
- When establishing a swim line for a diver:
  - After the ROV has acquired the hook for the crossover line, the diver should pay out the crossover line as the ROV flies to the connection point.
  - The diver should not let out excessive amounts of line during this operation. Line should be kept taut; if the pilot requires additional slack, he or she can then notify the dive supervisor.
  - After the crossover line is established, the diver should secure it so that excessive slack is not floating about for ROV to get tangled in thrusters.
- Tag lines should be cut short or made ROV-friendly from surface. ROV-friendly tag lines are ones that are removable from surface, after tag lines have served their purpose, in over-boarding equipment. If the diver is required to cut tag lines, the pieces cut off should be tied to a retrieval shackle, on down line. The cut off pieces should then be recovered to surface for disposal, to mitigate the possibility of fouling ROV thrusters with rope floating about subsea.
- As stated earlier, the diver should not use the tether as a crossover line. The diver should also try to go under the ROV tether. This will help prevent any entanglement problems with the diver, should the ROV lose hydraulics.
- If the ROV is in a no-visibility situation:
  - The diver should return to the stage or bell, if the ROV needs to perform tasks. If the ROV is not needed and the diver is required to stay on location, the ROV should go dead stick. The pilot should then inform the dive supervisor that the ROV

is in a no-visibility situation and should remain clear from the diver. The ROV pilot should allow the ROV to rise above no-visibility to an area where visibility can be obtained. The ROV should not, for any reason, be flying in a no-visibility situation with a diver in the area.

- The ROV pilot should be aware of all lines in the water. There will usually be at least one down line, running from the surface to the diver work location. Additionally, one or more crossover lines will also be present. This crossover line will run from the stage or bell (when applicable) to the work location.

9.3.3.3 ROV AND DIVER INTERVENTION

- During multi-ROV/multi-diver operations, the ROV should answer to the designated call sign of that system, (e.g., XL19, XL16, Quest, etc). No generic "ROV" communication should be used over radio.
- Dive teams should be referred to as designated teams (e.g., shallow team, deep team, manifold team, etc.).
- It is recommended that dive teams be divided/assigned to particular ROVs.
- When assigning ROVs/divers, the following will be taken into consideration:
  - Launch point of ROV.
  - Deployment point of dive teams.
  - Task at hand.
  - Routing of ROV tethers and diver umbilical.
- Field of operations should be assigned to each ROV/dive team. The ROVs should then work within these areas during operations. If at any time, the ROV is required to leave the established fields of operation, both the ROV and diving supervisors should be notified, to make necessary changes. Both supervisors should ensure all dive and ROV members are aware of any ROV entering designated work area.
- All communications over the radio should be acknowledged and repeated for verification, prior to any task being carried out.

9.3.3.4 SURFACE NAVIGATION SAFETY CREW

The survey (tracking of the ROV) should, in certain instances, be handled by a third-party contractor. In this case, the ROV crews should have to rely upon the survey crew extensively during the course of any multi-ROV operation. Good, clear communication is critical between these two crews. The following recommended guidelines will cover some of the steps that should be established for the successful interface between the two crews.

- The ROV crews should run video and communication lines between the ROV control vans and the survey control van. The two crews should be in constant communication during any and all dives.
- The survey crew should run computer video lines to the ROV control vans and place a monitor in each ROV control van to provide tracking information. The screen on the navigation monitor should display the surface support vessel, the ROV and any subsea structures in the area, etc. This should assist the ROV pilots in navigating the ROV to, from and around the scope of operation.
- The tracking of the ROV is established by the use of the following equipment:
  - ROVs should be tracked by using the LBL or USBL modes. In the LBL mode, the ROV should have a mini ROV NAV system installed. If in USBL mode, the ROV should have a mini beacon installed.
  - A navigation monitor should also be placed in the bridge of the surface support vessel. This should enable the captain of the vessel to track the ROV's movements and keep the surface vessel in the desired position during ROV operations.

9.3.4 PRE-DIVE PROCEDURE

1. Verify sea state conditions are safe to dive.
2. Inform client representative, survey and vessel captain of intent to dive.
3. Verify all cables are secured and clear from entanglement.
4. Verify all static compensators are full and bled of air.
5. Verify all hydraulic compensators are full and bled of air.
6. Inspect system cursor (if applicable).
7. Verify ground strap is attached.
8. Verify good communications from control van to winch/LARS area.
9. Verify with other ROVs the intent to conduct deck checks.

10. Turn on power to TMS; verify TMS hydraulic pressure (if applicable), communications (if applicable), and that current draw is not excessive.
11. Calibrate pan-and-tilt system. (If applicable)
12. Verify TMS tether-in and tether-out functions properly.
13. Verify TMS latch and unlatch functions properly.
14. Turn off power to TMS HPU (if applicable).
15. Turn on instrument power; verify telemetry indicators are good (if applicable).
16. Ensure that the gyro is operational and in the slave setting (if applicable).
17. Verify all GFD values are at acceptable values.
18. Turn on all cameras; verify quality video is received, test-operate all VCRs and re-install SIT cover.
19. Enable light power; verify all lights are variably controlled through controls (if applicable).
20. Turn on sonar power; verify that sonar passes self-test and telemetry is established.
21. Turn on altimeter power and verify reading.
22. Turn on power to "function" manipulator and verify valid telemetry.
23. Verify all personnel are clear of ROV area.
24. Turn on ROV HPU (verify that hydraulic pressure and current draw are not excessive).
25. Test any and all ancillary tooling, with client representative in attendance, if required.
26. Turn on all survey and tracking devices.
27. Verify proper pressures on compensators and system pressure gauges.
28. Verify clearance of operation and speed of pan-and-tilt units.
29. Verify proper operation and speed of five-function manipulator.
30. Verify proper rotation of thrusters and that no excessive noise is heard.
31. Shut down HPU (if applicable).
32. Turn on RF beacon and test the receiver.
33. Turn on the emergency flasher.
34. Remove SIT camera cover.
35. Remove ground strap.
36. Launch ROV.
37. Enter launch time, dive number and task in operations log book

9.3.5 POST-DIVE PROCEDURE

1. Turn off power and attach ground strap to the ROV.
2. Install all camera covers. (It is very important to ensure the SIT camera cover is installed.)
3. Turn off emergency flasher.
4. Turn off emergency RF beacon.
5. Wash down system with fresh water.
6. Visually inspect ROV and TMS for damage and debris.
7. Inspect thrusters for damage, debris or excessive wear.
8. Check and fill all compensators and bleed off air.
9. Inspect umbilical at the top of the mushroom for signs of wear.

9.3.6 MULTI-ROV OPERATIONAL PROCEDURES

This section describes the recommended actions necessary to safely deploy multiple ROV systems for operations. It will also address the personnel and equipment safety issues associated with deploying the ROV systems.

The steps presented in the pre-dive checklist must be completed before an ROV system can be deployed.

- Once all pre-dive checks are completed and the hydrophone pole is deployed (if applicable), all personnel shall man their assigned duty stations. The ROV supervisors should conduct a brief tasking meeting. At this time, it should be decided which ROV will be the primary (or lead) of the dive. The primary ROV shall have right of way over other ROVs in that theatre of operations.

- The ROV superintendent should inform the captain of the vessel of intent to dive.

  NOTE: It is recommended that only one ROV is launched at a time. Before any functions are conducted that would cause any substantial power draw, the pilot of that ROV is to inform the other ROV of his or her intentions.

- The lead ROV pilot shall man the ROV consoles in the control van.
- The lead ROV co-pilot shall man the winch.
- The lead ROV supervisor shall be the LARS observer and relay information to the winch operator.
- The ROV pilot shall verify with the captain of the vessel that the captain will maintain a heading that puts the vessel bow into the seas if practical, which should reduce any rocking motion of the vessel.
- The LARS observer shall make sure all non-essential personnel remain clear of the launch area.
- On the ROV pilot's command, the winch operator should boom the LARS A-frame over the side of the vessel. The winch operator must make sure that no tension is put on the umbilical during this maneuver.
- When the A-frame is at its full limit, over the side of the vessel, the slack should be taken out of the umbilical and slight tension put on it.
- The LARS observer should be watching the seas and swells and set the timing for the winch operator to lower the ROV system.
- At the LARS observer's command, the winch operator should tension up (low tension) the umbilical to compress the shock absorbers on the swing frame approximately 3/4 of their stroke, then open the swing frame latches and begin to lower the ROV system.
- Due to the extreme forces exerted upon the ROV system while traversing the interface zone, the winch operator must rely upon the LARS observer to set his or her timing for lowering the ROV system (through the interface zone). Once the ROV system is successfully deployed through the interface zone, the LARS observer will return to the control van and assume the responsibilities of supervising the overall operation.
- When the ROV system is approximately 50 feet below the surface, the ROV pilot should give the winch operator the command to all stop. This should allow the ROV pilot to turn on the TMS and ROV HPUs and the winch operator to change the winch to high tension (if applicable).
- Once the HPUs have been turned on, the ROV pilot should give the winch operator the command to continue down to a safe standby depth 200 fsw.
- At this time, the secondary ROV will perform the above-mentioned steps for launch.
- Once the secondary ROV has made it through the interface zone and has hydraulics up, the OK can be given to the lead ROV to continue descent.
- If a third or subsequent ROV is to be deployed, the above steps should be carried out for each ROV.
- During the descent of the ROV systems, all ROVs should continually monitor the attitude and distance of the other ROV's umbilical. This is to prevent any entanglement of the umbilicals during ROV descent. This can be done using the ROV's sonar.
- During the descent of the ROV systems, the winch operator must be aware of the umbilical and watch for snap-loading it, due to the rocking of the support vessel. If this occurs snap-loadingmay be lessened by not paying out umbilical when the vessel rocks towards the launch side of the vessel.
- The lead ROV system should be stopped approximately 50 feet above the work site.
- The secondary ROV should be stopped at 70 feet above the work site and subsequent systems at ascending intervals.
- Upon reaching working depth, the ROV pilots should give the command for the winch operator to "all stop on the winch." At this time, the winch operator should stop paying out umbilical, ensure that the winch brake is set, and turn the winch HPU off. After the winch HPU is turned off, the winch operator shall go into the control van and assume the responsibilities as co-pilot.
- Once the ROV system has been stopped at the proper working depth, the ROV pilot shall monitor the depth display to determine if there is any heaving of the system due to the rocking of the support vessel. If the system is heaving up and down, the pilot should monitor the heaving action, set his or her timing and wait for a lull. When there is a lull in the heaving that the pilot has determined will last long enough, he or she should disengage the ROV from the TMS.
- Upon determining that the timing is right to disengage the ROV, the pilot will give the ROV a little up thrust command, tether out on the TMS and open the TMS latches. Once the latch indicator indicates that the TMS latches are open, the ROV pilot will change the vertical thrust command from a little up to medium down while continuing the tether out command on the TMS.
- Upon successfully separating the TMS and ROV, the pilot may proceed to the work site while continuing to pay out tether from the TMS. The tether should be kept snug but not tight.
- All subsequent ROVs may deploy to their respective work sites after the lead ROV has established itself to its work site. Note that before departing the TMS, a confirmation must be obtained from the other ROVs currently at their work sites.

- Extreme care and constant monitoring of the work areas is to be maintained, as there may be a number of umbilicals, wire ropes, sonar reflectors/buoys and crane wires in the water at the same time. Never fly blind from one area to another, including returning to the TMS. Always inform the other ROV systems of your intent and when you have completed your move.

9.3.6.1 SYSTEM RECOVERY

This section will describe the actions necessary to safely recover an ROV system from operations. It will also address the personnel and equipment safety issues associated with recovering an ROV system.

- Upon making the decision to return to the TMS for recovery to the surface, the ROV pilot must first ensure that the vehicle and the tether are free of any obstructions.
- Once the vehicle and the tether are free of any obstructions, the ROV pilot should put the joystick commands in the reverse position.
- The pilot may then use the rear-facing camera to fly back to the TMS, keeping the tether in view at all times.
- While flying back to the TMS, the pilot must make sure to clear the tether of any obstacles and keep enough slack in the tether to compensate for any heaving action that may be acting upon the TMS.
- The ROV pilot must make sure to take any turns out of the tether prior to docking the ROV and TMS together.
- The pilot must ensure that he or she is bringing the ROV back to the TMS at a depth that would have the ROV approaching the TMS at least 10 to 20 feet below the TMS. Whenever possible, the ROV should not be tethered back in to the TMS at a depth above that of the TMS.
- Upon visually seeing the TMS in the rear-facing camera, the pilot should start judging the amount of heave action acting upon the TMS, if any, and start determining the timing for latching the ROV back into the TMS.
- As the pilot is determining the timing for re-entry into the TMS, he or she should ensure that the TMS latches are open.
- Once the pilot has determined the timing, he or she should then position the ROV directly under the TMS and orientate the ROV to the compass heading the ROV was on at the time the ROV was deployed from the TMS. Then, the pilot should bring in the remaining tether while exerting a small amount of down thrust. The pilot must then fly the lifting bail of the ROV into the docking guide of the TMS.
- When the lifting bail of the ROV is in the docking guide of the TMS, the pilot should look to see if the fail-safe latch indicator is on. If the fail-safe latch indicator is on, the pilot should then apply a half up thrust command, tether in, and close the TMS main latches. The pilot should then look to see if the latch indicator is on. If the latch indicator is on, it is safe to start the ascent of the ROV system to the surface. If the fail-safe or main latch indicators do not come on, the pilot must give the ROV a vertical down command and tether out, then fly the ROV down and away from the TMS. Then determine what caused the failed latch attempt and try again.
- When the ROV pilot has successfully latched the TMS and ROV together, he or she should give the winch operator the command to bring the system to the surface and inform the vessel captain that the ROV is back in the TMS.
- The winch operator must make sure all non-essential personnel are clear of the area.
- The winch operator must make sure that the winch brake releases and begin to bring in the ROV system.
- The ROV pilot should periodically communicate to the winch operator the depth of the ROV.
- The ROV supervisor should report to the LARS skid to serve as the LARS observer and assist the winch operator with the recovery of the ROV system.
- When the ROV pilot reports to the winch operator that the ROV system has reached 100 fsw, the winch operator should stop the ascent of the ROV system and switch to low tension (if applicable), then continue the ascent at approximately 30 feet per minute. The winch operator must rely upon the LARS observer to establish the timing to retrieve the ROV system through the interface zone.
- As the winch operator retrieves the ROV system from the interface zone, he or she must slowly winch in the ROV system until it comes into contact with the swing frame. Upon initial contact with the swing frame, the damping ring should counteract any swinging of the ROV system.
- When the swinging of the ROV system has subsided, the winch operator should winch in slowly until the shock absorbers on the swing frame have compressed approximately 3/4 of their stroke, and then close the latches on the swing frame until the latch indicators disappear.
- When the latches have been closed, the winch operator should slowly pay out enough umbilical to take the tension off of the umbilical.
- The winch operator should then begin to boom the ROV system inboard while manipulating the swing frame in order to keep the ROV system level.
- The winch operator should continue to boom the ROV system inboard until the ROV system sets down onto the LARS skid. Post-dive checks should then take place.

- Inform the captain of the vessel, survey and client representative that the ROV is back on deck.
- Ensure hydrophone pole is up (if applicable).

9.3.6.2 DATA COLLECTION

The following are only recommended guidelines for data collection.

Data collection is a very important aspect of any ROV operation. The actual work that is to be done is only half of the operation, and the job is not complete without the concise and orderly collection of the pertinent data.

This section will detail the necessary steps and procedures required for the systematic and orderly collection of data encountered during an ROV operation.

Video Recording

It is recommended that all contractor ROV system control vans be outfitted with a minimum of two video recorders. One should be designated as the job footage recorder and the other one as the "black box" recorder.

Black Box

The ADCI recommends, when possible, that a black box recorder be available. It is also recommended the black box video recorder is in the record mode at all times during any ROV operation. Like the black box recorder on any aircraft, it records continuously during the operation. This is done so that if something goes wrong, the event will be captured on the video. Because of the use and nature of the black box recorder, the following guidelines shall be used:

- The black box recorder will be labeled "black box."
- The black box recorder will be turned on prior to any dive and left on until the system is back on deck.
- When the black box VCR reaches the end of the tape, and there is no information recorded that needs to be saved, the tape will be rewound and recorded over. It is suggested that a rotation of tapes or discs be performed, allowing 12 consecutive hours of operations to be recorded before previous operations are taped over.

9.3.7 EMERGENCY VEHICLE RECOVERY PROCEDURE

The following is to serve as recommended general guidelines for emergency recovery procedures while operating onboard the vessel. This is only a reference document, and all decisions concerning ROV equipment and ROV personnel will be made by the ROV supervisor on site. For individual system procedures, please refer to that system's emergency recovery procedures. Various determining factors will include, but not be limited to, weather conditions, sea state, current conditions, navigation, vehicle status and vessel status. A pre-job meeting will be held with the ROV crew, vessel personnel and client representatives. All pertinent personnel arriving after the beginning of job shall also be briefed. In case of one or more of the following events occurring, the primary consideration is, and shall always be, **personnel safety**.

9.3.7.1 VEHICLE HPU FAILURE

Vehicle HPU failure will normally be indicated by a hard fault to ground on the HPU ground fault detector causing a GFI on the HPU breaker. Telemetry and video should still be operational and should aid in a successful recovery.

- The ROV supervisor should inform all pertinent personnel on the vessel of situation.
- If liveboating, the ROV pilot should inform the captain to hold the vessel steady and into the seas. If the vessel is tied up to another vessel or structure, the pilot should inform the captain of the situation and to stand by for immediate response.
- If the ROV vessel is positively buoyant, the pilot should have the winch operator begin to slowly raise the TMS while the pilot begins to tether in. If, for some reason, the vehicle is negative or descending very slowly, the pilot can tether in immediately. Before attempting to dock into the TMS, the winch operator should slowly lower the TMS to assist in latching the vehicle.
- Once the ROV is in the TMS with visual verification and the TMS caged light is illuminated, the winch operator should lower the TMS and the pilot should toggle the TMS latch switch.
- The vehicle can now be recovered following normal operating procedures.
- Once the vehicle is on deck, repairs should begin.

9.3.7.2 VEHICLE INSTRUMENTATION FAILURE

- If loss of telemetry to the vehicle occurs, the vehicle should continue to have video signals and HPU controls should automatically enter fail-safe mode. In fail-safe mode, the vehicle should automatically zero all horizontal thruster controls and enter auto depth mode to maintain depth when the telemetry signal was lost. This should aid in latching the ROV into the TMS and normal recovery thereafter.
- If loss of all instrumentation occurs, HPU and instrument breakers should be shut down if they have not already tripped.
- Recover ROV as per HPU failure.

9.3.7.3 TETHER SEPARATION

- If there are indications that the tether has been separated (no latch indication, tether counter continues far past zero), the TMS should be shut down and raised to the surface.
- The ROV supervisor should alert the captain and appoint lookouts at posts around the vessel.
- The ROV supervisor should confer with survey personnel and the captain to track the ROV if still receiving survey transponder beacon signal from the ROV. The captain should keep vessel within 100 feet of the vehicle during its ascent. If the vessel were tied to a structure, the ROV supervisor should inform the captain to untie the vessel from the structure as soon as the TMS is recovered to surface.
- If no signal is being received from transponder beacon, the ROV supervisor should have surveyors raise hydrophone pole.
- If survey information indicates the vehicle transponder is functional and the vehicle is not ascending, survey should take fix on the ROV's location, and the captain should get GPS coordinates. The ROV contractor's office should be informed immediately and personnel on the vessel wait for further instructions.
- If survey information indicates the vehicle was ascending and loses signal at shallow depths (out of hydrophone operational cone), lookouts should be alerted and an RF beacon locator used to track the ROV.
- Once the ROV is located on the surface, the vessel should position itsself so that the ROV is on the starboard mid section of vessel (recovery zone). The ROV crew should place a recovery sling onto the ROV. At this point, the crane on the starboard side of the vessel should be used to recover the ROV and place it back onto the LARS frame.
- Recovery personnel should be outfitted with life vests and should attempt to hook the vehicle at the lifting bell, if possible. Depending on where the tether parted, using choker slings, or even using the tether itself, may aid in recovery.
- Once the vehicle is on deck, ROV crew should secure the ROV to the LARS.
- The ROV contractor's office should be informed immediately.
- The crew should begin tether replacement and any other repairs required.

9.3.7.4 TMS FAILURE

- If indications arise that the TMS is no longer operational, the ROV supervisor should inform the vessel captain immediately. If the vessel is anchored to a structure, the captain should stand by for immediate response and alert other vessels in the area to stay clear.
- If the vessel is liveboating, the captain should slowly begin moving the vessel to a clear area while the ROV pilot follows the vessel, to ensure the tether is clear.
- If possible, the captain should put the vessel screws in neutral until the tether is secured. If this is not possible, the captain should then position the vessel so that current should carry the tether away from the stern of the boat. The captain should not use bow thruster unless an emergency arises.
- The ROV pilot should obtain visual of TMS and have the winch operator raise the TMS to surface at a speed determined by the pilot.
- Depending on amount of tether deployed and surface conditions, the ROV pilot should stop ascension as the TMS is recovered to surface. The tether should be hauled onto deck by the deck officer and secured so as to not let the tether drift to the stern of the boat. The tether amount and angle should be monitored at all times, until the TMS is returned to water.
- Repairs to the TMS should begin immediately, while the ROV pilot, captain and survey personnel keep in constant communication and verify the location of the ROV.
- Once the TMS is repaired, the tether should be deployed be deck officer as the TMS is launched into the water. Once the TMS is in the water, the ROV pilot should obtain visual contact as soon as possible and follow the TMS down to safe latching depth. The ROV and TMS should then be recovered to surface as per normal procedures, and complete system checks should take place. The ROV contractor's office should be informed of the incident.

- If the TMS is not repairable on deck, the ROV should be brought along the starboard side of the vessel (recovery zone), where preparations should be made to lift the ROV onto the LARS with the starboard side crane. Once the TMS and ROV are on the LARS and secured, repairs should begin, and the ROV contractor's office should be notified.

9.3.7.5 LAUNCH AND RECOVERY SYSTEM FAILURE

- In event of LARS failure, the ROV pilot, if not already latched into the TMS, should do so immediately.
- The ROV supervisor should immediately inform the client representative and the captain of the vessel of the situation. The captain should slowly guide the vessel to a clear area if it is not tied up, or remain in place if the vessel is moored to a platform or barge.
- The ROV crew should begin to effect repairs to the LARS once the vessel is cleared in position to do so.
- The ROV contractor's office should immediately be informed of situation.
- Once repairs are effected, the ROV should be recovered immediately, and complete system checks should be performed.
- If repairs are not possible because of equipment limitations, the ROV supervisor should immediately report to the contractor's office to arrange express shipment of required replacement parts. If weather conditions permit, the ROV should be kept in water until such repairs can be made with continuous monitoring of system. (HPUs may be shut off.)
- Depending on which component of the LARS is not functional, various attempts to recover the ROV may be made using the system charge cart.
- The charge cart can be connected to the winch to haul the vehicle to surface. Once the TMS is sucked into the latching collar, hydraulics must be readily available to the swing frame latch circuit to close latches. Once the latches have the TMS mushroom in place, hydraulic supply can be switched between functions to land vehicle.
- If winch failure occurs, recovery of the vehicle may be attempted using crane sheaves to haul the umbilical to deck. The umbilical will be laid out across the back deck until the TMS mushroom is in the docking collar and latches are engaged. Extreme care should be taken during this procedure to to prevent damage to the umbilical during this procedure, although there is considerable risk of this occurring. **This procedure should occur only if all other conditions point to it (e.g., weather deterioration, vessel damage, etc.).**
- If A-frame damage has occurred but the winch is still operational, the ROV and TMS will be recovered into the docking collar. If the A-frame must be landed at this time, crane rigging to the A-frame boom and opening of hydraulic flow to the boom rams will be completed. Once the crane is secured to the boom, the hydraulic lines will be opened to allow free flow, and the boom can then be manipulated into its landing position. **This procedure should occur only if all other conditions point to it (e.g., weather deterioration, vessel damage, etc.).**

9.3.7.6 VEHICLE ENTANGLEMENT

- In case of vehicle entanglement, the ROV supervisor should immediately inform the captain of the vessel, client representative and survey personnel. Survey personnel should record the current location of the ROV and plot boat drop for the vessel. The captain should also lock the location into the vessel's GPS in case of survey equipment failure.
- The ROV crew should watch entanglement of the ROV on the black box tape to discern any useful information to aid in recovery.
- If the vehicle cannot be recovered through ROV power, the pilot should haul the tether in with the TMS until it is tight. If tether management does not aid in freeing the ROV, then the ROV supervisor should call the ROV contractor's office to inform of current situation.
- Depending on the depth of the vehicle entanglement and operation considerations, inquiries should be made to the client for possible use of divers in freeing the vehicle.
- Last considerations include the use of a winch to pull the vehicle free. **However, this option should be used only after consultation with the ROV contractor's office or if extremely dangerous working conditions exist.**

9.3.7.7 ROV SYSTEM POWER FAILURE

- In the instance of complete system power failure, the ROV pilot should immediately shut off all system breakers and inform the client representative, the captain of the vessel, and survey crew of situation. Survey crew should track the vehicle, while the captain maneuvers the vessel to clear the area if the situation dictates.

- The ROV crew should trace down the source of the problem, beginning with generator status. If a problem is found, the crew should begin repairs immediately. The ROV contractor's office should be informed of the situation.
- If repairs cannot be effected immediately, the ROV supervisor should inform the client and captain of situation and give an ETA on repairs. The ROV supervisor should instruct the captain to post lookouts on all corners of bridge to spot the ROV in the event of tether separation the while system is down. If system components are needed but not in stock, the ROV supervisor should inform the ROV contractor's office for immediate shipment of parts. In the event of this situation, the TMS can be recovered to deck and the ROV can be recovered using the starboard crane on the vessel. All electrical safety practices must be followed.
- If the source of the problem is determined to be with the generator and repairs cannot be implemented in a timely manner (10 minutes), the ROV crew should change power cables to the backup generator or ship's emergency power. The supervisor should contact the ROV contractor's office to inform them of the situation and arrange for repair parts or shipment of new generator.

Once again, these procedures should be used as guidelines only, and the supervisor will make all final decisions on site. Any circumstances considered out of the normal scope of operations will require consultation with the ROV contractor's office before extreme actions are taken. These procedures are to be addressed to the entire ROV crew and any relevant personnel onboard the vessel.

SECTION 10.0

ADCI COMPLIANCE AUDIT PROCEDURES

Association of Diving Contractors International, Inc.

10.0 ADCI COMPLIANCE AUDIT PROCEDURES

10.1 INTRODUCTION AND PURPOSE OF AUDITS

The Association of Diving Contractors International (ADCI) offers three different types of audits for contractors and associate member schools that conduct diving operations. The first type of audit that the contractors and schools will become familiar with is the ADCI self-audit report. This report is conducted internally by company personnel and should be submitted with all other application information as part of the application process or as mandated by the association on a periodic basis. The purpose of this audit is to provide applying companies and schools with a clear idea of the necessary recommended and required items for compliance with the ADCI consensus standards. When required, the ADCI will direct existing members to submit a revised self-audit protocol so that updated information about the contractor or school will be available for review. The ADCI encourages contractors and schools to use the self-audit report as a tool to perform internal audits annually, to ensure compliance to the ADCI Consensus Standards.

The second type of audit that the association offers is the ADCI diving contractor audit report. This protocol is to be completed by a third party designated by the ADCI executive director, in agreement with the submitting contractor. This audit is performed as the last step of the application process for contractor or associate member school applicants. This audit protocol can also be utilized as part of the membership review process for a contractor or associate member school. The purpose of this audit is to provide a degree of assurance to the ADCI board of directors that the company applying for admission or under review is capable of adherence to the ADCI consensus standards.

The third type of audit that the ADCI offers is the saturation diving inspection and checklist protocol. This protocol is utilized with contractors who are engaged in saturation diving operations. This protocol is to be completed by a third party, designated by the ADCI executive director, in agreement with the submitting contractor. The purpose of this audit is to provide a degree of assurance to the ADCI board of directors that the company engaging in saturation diving operations is capable of adherence to the ADCI consensus standards' recommended guidelines for saturation diving operations.

10.3 COMPLIANCE AUDITS

ADCI Diving Contractor Audit Report (on Page 166)

ADCI Saturation Diving Inspection and Checklist Protocol (on Page 213)

ADCI Pre-dive Safety Checklist (on Page 229)

DIVING CONTRACTOR AUDIT REPORT

Chapter I: Contractor's Information

1. GENERAL INFORMATION	
Contractor's Name	
Contractor's Address	
Contractor's Telephone	
Contractor's Facsimile	
Contractor's Email	
Contractor's Website	
Business License Number	
Contractor's Business Scope	
Organization Chart	(Copy for attached)
President or General Manager's Name	
Safety Manager's Name	
QA/QC Manager's Name	
Diving Manager's Name	
Diving Supervisors' Names	
Number of Divers	
Number of Tenders	
Number of Other Personnel	
Others	

2. PERSONNEL INFORMATION

DIVING SUPERVISORS' LIST

Name of Diving Supervisors	Number and Valid Date of Certificate of Appointment Letter of Supervisors	Number and Valid Date of Other Certifications or Required Documentation	Valid Date of Health Certificate	Medical Record

DIVERS' LIST				
Name of Divers	Number and Valid Date of Certificate of Divers	Number and Valid Date of Other Certifications or Required Documentation	Valid Date of Health Certificate	Medical Record

OTHER PERSONNEL LIST (LST / DMT / SATURATION TECHNICIANS)				
Name of Other Personnel	Number and Valid Date of Certificate	Number and Valid Date of Other Certifications or Required Documentation	Valid Date of Health Certificate	Medical Record

EQUIPMENT LIST (1)			
Items	Name of Equipment	Availability	Remark

EQUIPMENT LIST (2)			
Items	Name of Equipment	Availability	Remark

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DIVING CONTRACTOR AUDIT REPORT

Chapter II: Personnel Requirements

1. DIVING SUPERVISORS			
ITEM	DESCRIPTION	AUDIT RESPONSE	REMARK
1	Formal Supervisor Training Course	Yes ❏ No ❏	
2	Supervisor Certification	Yes ❏ No ❏	
3	Supervisor Appointment Letter	Yes ❏ No ❏	
4	Number and Valid Date of Other Certifications or Required Documentation	Yes ❏ No ❏	
5	Health Certificate and Valid Current Physical	Yes ❏ No ❏	
2. DIVERS			
ITEM	DESCRIPTION	AUDIT RESPONSE	REMARK
1	Formal Diver Training Course	Yes ❏ No ❏	
2	Diver Certification	Yes ❏ No ❏	
3	Current Diving Physical: Fit for Diving?	Yes ❏ No ❏	
4	Number and Valid Date of Other Certifications or Required Documentation	Yes ❏ No ❏	
5	NDT Certificate (if needed)	Yes ❏ No ❏	
6	Welding Certificate (if needed)	Yes ❏ No ❏	
7	Water-jetting Operating Certificate (if needed)	Yes ❏ No ❏	
8	H2S Training Certificate (if needed)	Yes ❏ No ❏	

DIVING CONTRACTOR AUDIT REPORT

Chapter III: Equipment and System

SCOPE				
Maintenance Records of Life-support Equipment				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**
1	Equipment Logs	Suitable equipment logs must be established and maintained in a correct and current condition.	Yes ❑ No ❑	
2	Unique Identity	All equipment must have a unique identity traceable to the equipment log.	Yes ❑ No ❑	
3	Content of Entries	Entries made in the equipment log must describe the nature of the work performed, including the dates of modification, repair or test; the name of the individual performing the work or test; and the particular piece of equipment involved.	Yes ❑ No ❑	
4	Signature	Any equipment repair and maintenance must be signed by divers or technicians.	Yes ❑ No ❑	
5	Instruction	Inspection and maintenance for any helmets or masks must be in accordance with instruction of manufacturer.	Yes ❑ No ❑	
DIVER'S DRESS				
Dry Suits				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**
1	Preventing Over-inflation Device	If fitted with valves, have a means of preventing over–inflation, which could result in an uncontrolled ascent.	Yes ❑ No ❑	
2	Material	Be constructed of material suitable to the environment in which it is to be used.	Yes ❑ No ❑	
3	Environmental Protection	Protect the diver from the environment, whether temperature or hazardous material.	Yes ❑ No ❑	
Hot Water Suits				
1	Water Flow	Flow sufficient water to maintain the diver in thermal balance at the desired temperature.	Yes ❑ No ❑	
2	Temperature Withstanding	Be capable of withstanding operating temperature.	Yes ❑ No ❑	
3	Bypass Device	Have a means to allow the diver to bypass incoming water prior to it entering the suit.	Yes ❑ No ❑	
4	Backup System	If diving in extreme environment, have a backup hot water supply, or alternatively, terminate the dive immediately and bring the diver to the surface if hot water supply is lost.	Yes ❑ No ❑	

Harnesses				
1	Material	Be made of material of suitable strength to lift the diver and his/her equipment from the water.	Yes ❑ No ❑	
2	Quick-release Device	Have a mechanical quick-release between the harness and the umbilical.	Yes ❑ No ❑	
3	Strain-protection Construction	Be constructed and fitted to prevent an unconscious diver from slipping free of the harness or from a strain being placed on mask or helmet.	Yes ❑ No ❑	
4	Usage	Not be used as a weight belt.	Yes ❑ No ❑	
5	Prevent Restriction of Diver's Breathing	Be designed to prevent restriction of the diver's breathing when his/her full weight is supported by the harness. Complies with ADCI current guidelines. (CS 6.1, Section 6.3.4)	Yes ❑ No ❑	
Weight Belts				
1	Weight	Be of sufficient weight to maintain the diver at working depth.	Yes ❑ No ❑	
2	Usage	Not be used as an attachment for the diving umbilical.	Yes ❑ No ❑	
3	Release Buckle	Be equipped with an appropriate release buckle.	Yes ❑ No ❑	
4	Avoid Accidental Disengagement	Be attached to the diver in a manner to avoid accidental disengagement.	Yes ❑ No ❑	
Diver-worn or Carried Emergency Gas (Bailout)				
1	Suitability	Be manufactured to recognized codes or standards. (CS 6, 6.3.6)	Yes ❑ No ❑	
2	Cylinder Overpressure Relief Disk	Be equipped with an overpressure relief device	Yes ❑ No ❑	
3	Annual Inspection	Be inspected internally and externally for damage or corrosion within 1 year.	Yes ❑ No ❑	
4	Hydrostatic Testing and Stamp	Be hydrostatically tested to the requirements of the code of manufacturer by an authorized test facility within 5 years and **stamped** with the date of test.	Yes ❑ No ❑	
5	Record and Certificate	Have a unique identity with results of all tests being **recorded** or **certified** in the equipment log.	Yes ❑ No ❑	
6	Regulator	Have a regulator on the cylinder capable of delivering the proper pressure and flow to the diver's helmet or mask in accordance with the flow characteristics recommended by the helmet or mask manufacturer.	Yes ❑ No ❑	
7	Prevent Disengagement Device	Have a means of attachment to the helmet or mask that prevents accidental disengagement.	Yes ❑ No ❑	
8	Sufficient Capacity	Be of sufficient capacity to permit return of the diver to the surface or to the diving stage at a travel rate of 10 meters/minute.	Yes ❑ No ❑	
9	Sufficient Capacity	Capable of providing 4 minutes of EGS at depth.	Yes ❑ No ❑	
10	Appropriate Content	Be charged with an appropriate breathing gas mixture to accommodate mode of diving/depth requirement.	Yes ❑ No ❑	

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HELMETS & MASKS				
General				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Suitability for Usage	Be appropriate for the task intended.	Yes ❑ No ❑	
2	Capability of Ventilation	Be capable of ventilating the required gas when supplied at the pressure recommended by the manufacturer of the equipment at any depth at which they are operated.	Yes ❑ No ❑	
3	PP CO_2	Be capable of maintaining the diver's respired CO_2 partial pressure below 0.02 ATA.	Yes ❑ No ❑	
4	Communication	Be fitted with two-way communications	Yes ❑ No ❑	
5	Non-return Valve	Be equipped with a non-return valve in the main gas supply that closes readily and positively. Have check valves with springs not exceeding 3 psi cracking pressure.	Yes ❑ No ❑	
6	Material	Be made of corrosion-resistant material.	Yes ❑ No ❑	
7	Over-pressure Protection	Be protected from over-pressurization.	Yes ❑ No ❑	
8	Marking	Each helmet or mask should have a unique serial number.	Yes ❑ No ❑	
9	Maintenance	Each helmet or mask must be subject to regular planned maintenance and a **record** of such maintenance should be available.	Yes ❑ No ❑	
10	Inspection and Testing	Inspection and function test at atmospheric pressure at least annually with **record** or **certificate.**	Yes ❑ No ❑	
HOSES				
Breathing Gas Hoses				
1	Burst Pressure	Have a minimum burst pressure equal to 4 times the maximum working pressure.	Yes ❑ No ❑	
2	Flow Rating	Flow rating to meet intended use.	Yes ❑ No ❑	
3	Connector Pressure	Connector pressure equal to or greater than the system on which they are installed.	Yes ❑ No ❑	
4	Material	Have fittings of corrosion-resistant material that cannot be accidentally disengaged.	Yes ❑ No ❑	
5	Collapse Prevention	Be kink-resistant or arranged to prevent kinking.	Yes ❑ No ❑	
6	Annual Testing	Examine visually and pressure test to 1.5 times the design working pressure of the system, ADCI CS 6, 6.5.2.	Yes ❑ No ❑	
7	Testing After Repair	Examine visually, pressure after initial construction and after each repair and alteration with record.	Yes ❑ No ❑	
8	Suitability	Be suitable for breathing gas service.	Yes ❑ No ❑	

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Umbilicals				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Burst Pressure	Have a minimum burst pressure equal to 4 times the maximum working pressure.	Yes ❑ No ❑	
2	Flow Rating	Flow rating not less than the system in which it is installed or used and suitable for the service intended.	Yes ❑ No ❑	
3	Connector Pressure	Connector pressure equal to or greater than the system on which they are installed.	Yes ❑ No ❑	
4	Material	Have fittings of corrosion-resistant material that cannot be accidentally disengaged.	Yes ❑ No ❑	
5	Collapse Prevention	Be collapse-resistant or arranged to prevent collapse.	Yes ❑ No ❑	
6	Annual Testing	Examine visually and pressure test to1.5 times the design working pressure of the system.	Yes ❑ No ❑	
7	Testing After Repair	Examine visually, pressure after initial construction and after each repair and alteration with record.	Yes ❑ No ❑	
8	Marking	Umbilical must be marked for length using a recognized system that allows easy visual identification of the length paid out.	Yes ❑ No ❑	
9	Maintenance Plan	Be marked with a unique identity and subjected to a planned maintenance program.	Yes ❑ No ❑	
10	Composition	Consist of a breathing gas hose, communications cable, a means of determining the diver's depth and an included strength member, when required.	Yes ❑ No ❑	
11	Material	Have a minimum member made of material unaffected by immersion in water for extended period.	Yes ❑ No ❑	
12	Minimum Break Strength	Have a minimum hose assembly break strength of 1,000 lbs.	Yes ❑ No ❑	
13	Security	The diver's end of the umbilical must be fitted with a means that allows it to be securely fastened to the diver's safety harness without putting any strain on the individual whip ends.	Yes ❑ No ❑	
14	Standby Diver	The umbilical assembly used for the standby diver must be of sufficient length to reach the primary diver at the farthest distance he/she can proceed from the dive station.	Yes ❑ No ❑	
Oxygen Hoses for Breathing Gas				
1	Burst Pressure	Have a minimum burst pressure equal to 4 times the maximum working pressure	Yes ❑ No ❑	
2	Flow Rating	Flow rating not less than the system in which it is installed or used and suitable for the service intended.	Yes ❑ No ❑	
3	Connector Pressure	Connector pressure equal to or greater than the system on which they are installed.	Yes ❑ No ❑	

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4	Material	Have fittings of corrosion-resistant material that cannot be accidentally disengaged.	Yes ❑ No ❑	
5	Collapse Prevention	Be collapse-resistant or arranged to prevent collapse.	Yes ❑ No ❑	
6	Annual Testing	Examine visually and pressure test to 1.5 times the design working pressure of the system, ADCI CS 6.1, 6.5.4.	Yes ❑ No ❑	
7	Testing After Repair	Examine visually, pressure after initial construction and after each repair or alteration.	Yes ❑ No ❑	
8	Oxygen Cleaning	Hose assemblies used in systems containing greater than 50% oxygen are to be cleaned for oxygen service.	Yes ❑ No ❑	
9	Marking	Hoses used for 100% oxygen service should be identified by a consistent color code or tagged "FOR OXYGEN USE ONLY."	Yes ❑ No ❑	
10	Lubricants	Lubricants used to assemble fittings on hoses for oxygen service must be compatible with oxygen.	Yes ❑ No ❑	
11	Hose and Fittings	Hose and fittings must be brass or other alloys suitable for O^2 use.	Yes ❑ No ❑	
COMPRESSOR SYSTEMS				
Compressors & Gas Pumps for Life Support				
1	Personnel Protection	Have suitable personnel protection around rotating machinery.	Yes ❑ No ❑	
2	Instruction	Have the necessary instruction to facilitate operations	Yes ❑ No ❑	
3	Suitability	Be of the proper type, pressure and flow rate, suitable for service intended.	Yes ❑ No ❑	
4	Pollution Protection	Have its air intake positioned to be clear of exhaust fumes and other contaminants.	Yes ❑ No ❑	
5	Piping	Have piping system in accordance with recognized codes of standards.	Yes ❑ No ❑	
6	Flexible Hoses	Have flexible hoses in accordance with "hoses requirement." ADCI CS 6, 6.5.1.	Yes ❑ No ❑	
7	Electrical Controls	Have electrical controls, wiring and drive units meeting the jurisdictional requirements when so equipped.	Yes ❑ No ❑	
8	Oxygen Transfer	Be cleaned for oxygen service when used with mixtures of greater than 50% oxygen and equipped using rising stem type valve.	Yes ❑ No ❑	
9	Access	Be easily accessible to diving personnel, both for routine maintenance and during an emergency.	Yes ❑ No ❑	
Recording of Maintenance and Repairs				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**

012930

1	Entries of Repair	Entries must be made in the equipment log for all maintenance and repairs performed on the compressor and gas system.	Yes ❑ No ❑	
2	Quality Tests	Results of air quality tests must be retained to document their results and accomplishment.	Yes ❑ No ❑	
3	Unique Identity	Compressors must have a unique identity incorporating manufacturer, model, serial number, maximum rates outlet pressure, rated flow capacity and safety valve settings.	Yes ❑ No ❑	
4	Planned Maintenance	Compressor units must be subjected to planned maintenance.	Yes ❑ No ❑	
Volume Tanks				
1	Manufacture	Be designed, fabricated, inspected, tested and certified in accordance with recognized codes or statutory or classification society requirements.	Yes ❑ No ❑	
2	Pressure Gauge	Be equipped with a pressure gauge.	Yes ❑ No ❑	
3	Check Valve	Be equipped with a check valve on the inlet side.	Yes ❑ No ❑	
4	Relief Valve	Be equipped with a relief valve as required by code of manufacturer.	Yes ❑ No ❑	
5	Drain Valve	Be equipped with condensate drain valve located at its lowest point.	Yes ❑ No ❑	
6	Annual Inspection	Be inspected internally and externally within 1 year for damage or corrosion with **record.**	Yes ❑ No ❑	
7	Pneumatically Testing	Be pneumatically tested to maximum allowable working pressure (M.A.W.P.) within 1 year for the breathing mixture normally used with **record.**	Yes ❑ No ❑	
8	Hydrostatic Testing	Be hydrostatically tested to 1.3 times maximum allowable working pressure (M.A.W.P.), ADCI CS 6, 6.11.1 (12) within 5 years or after any repair, modification or alteration to the pressure boundary and **marked** with the test date.	Yes ❑ No ❑	
9	Record and Certificate	Have a unique identity with results of all tests being recorded in the equipment **log** with **certificate**.	Yes ❑ No ❑	
Filtration				
1	Filters	Filters, when installed to prevent contamination, must meet or exceed the flow rate and pressure rating of the compressor or piping system in which they are installed and be able to deliver breathing gas in compliance with recognized purity standards for extended operation	Yes ❑ No ❑	
Air Purity Requirements				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**

012931

1	Quality Testing	All compressor, transfer pumps or booster pumps used for breathing air service must be subjected to a quality test in last 6 months.	Yes ❑ No ❑	
2	Selecting Point	Tests must be taken at the discharge point that would normally supply the breathing gas system, the diver's hose or cylinder fill point.	Yes ❑ No ❑	
3	Testing Record	Documentation of these tests must be kept on file and available upon request.	Yes ❑ No ❑	
DIVER ENTRY & EGRESS SYSTEM				
Diving Ladder and Stage				
1	Capability	Be capable of supporting the weight of two divers plus their gear.	Yes ❑ No ❑	
2	Material	Be made of corrosion-resistant material or be maintained free corrosion.	Yes ❑ No ❑	
3	Purpose	Be suitable for the purpose intended	Yes ❑ No ❑	
4	Ladder Length	Ladder must extend a minimum of 1 meter (3 feet) below surface where installed.	Yes ❑ No ❑	
5	Safety Chain and Hand Holds	Stage be provided with a safety chain and internal hand holds for diver safety during launch and recovery.	Yes ❑ No ❑	
6	Cylinder and Regulator	Stage be provided with breathing gas cylinder and regulator for emergency breathing if required.	Yes ❑ No ❑	
PVHO – CHAMBER				
Diving Pressure Vessels				
1	Manufacture	Equipment must be built in accordance with recognized regulations and codes and must be subject to a planned maintenance system.	Yes ❑ No ❑	
2	Annual Inspection	Each pressure vessel must be examined and tested for mechanical damage or deterioration and must likewise be examined and tested after any repair, modification or alternation within 1 year with **record.**	Yes ❑ No ❑	
3	Pressure Testing	Each pressure vessel and piping must be pressure leak tested annually with Record to maximum allowable working pressure (M.A.W.P.) marked on the nameplate.	Yes ❑ No ❑	
Decompression Chambers (DDC)				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**

1	Accordance	Meet requirements of item 6.12.2.1.	Yes ❑ No ❑	
2	Type	Be twin-lock and / or multiple-place.	Yes ❑ No ❑	
3	Dimension	Have sufficient internal dimensions to accommodate two persons lying in a horizontal position (except designated diving bells, transfer locks and emergency rescue chambers).	Yes ❑ No ❑	
4	Ingress and Egress	Permit ingress and egress of personnel and equipment while the occupants remain pressurized.	Yes ❑ No ❑	
5	Locking Device Operating	Have a means of operating all installed man-way locking devices from both sides of a closed hatch, except disabled shipping dogs.	Yes ❑ No ❑	
6	Internal Illumination	Have illumination of the interior sufficient to allow operation of any controls and allow for visual observation, diagnosis or medical treatment.	Yes ❑ No ❑	
7	Visual Capability	Have a visual capability that allows the interior to be observed from the exterior.	Yes ❑ No ❑	
8	Pressure Capability	Have a minimum pressure capability of 6 ATA, or the maximum depth of the dive for dives deeper than 10 ATA.	Yes ❑ No ❑	
9	Pressurization Rate	Be capable of a minimum pressurization rate of 18.3 meters (60 feet) and at least 9 meters (30 feet) per minute thereafter.	Yes ❑ No ❑	
10	Decompression Rate	Be capable of a decompression rate of 9-10 meters (30 feet) per minute.	Yes ❑ No ❑	
11	Oxygen Concentration	Have a means to maintain an atmosphere below a level of 25% oxygen by volume, ADCI CS 6, 6.12.2.1 (11).	Yes ❑ No ❑	
12	CO_2 Concentration	Have a means of maintaining an atmosphere below 1% surface equivalent carbon dioxide by volume.	Yes ❑ No ❑	
13	Mufflers or Silencers	Have mufflers/silencers on blow down and exhaust outlets.	Yes ❑ No ❑	
14	Suction Guards	Have suction guards on exhaust line openings inside each compartment.	Yes ❑ No ❑	
15	Piping Arrangement	Have piping arranged to ensure adequate circulation.	Yes ❑ No ❑	
16	Flexible Hoses	Have all installed flexible hoses meet the requirements of **item 6.5: Hoses.**	Yes ❑ No ❑	
17	Penetrations Mark	Have all penetrations clearly marked as to service.	Yes ❑ No ❑	
18	Regulation for Piping	Have piping in accordance with recognized codes/regulations or classification society to which it was built.	Yes ❑ No ❑	
19	Calibration for Depth Gauge	Have a calibration of each depth gauge within 6 months with **certificates.**	Yes ❑ No ❑	

Decompression Chambers (DDC) *cont'd.*

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK

012933

20	Pressure-relief Device	Have a pressure-relief device as per recognized codes of construction.	Yes ❑ No ❑	
21	Relief-valve Pressure Testing	Have the relief valve pressure setting tested with 1 year with **certificates.**	Yes ❑ No ❑	
22	Breathing System	Have an installed breathing system with a minimum of one mask per occupant per lock plus one spare mask per lock. (In sat systems, more may be required). For DDC, minimum of two in inner lock and two for outer lock.	Yes ❑ No ❑	
23	Supply Capability of Breathing Gas	Have the capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work (4.5ACFM).	Yes ❑ No ❑	
24	Non-return Valve	Have a non-return valve on through-hull penetrators supplying any built-in breathing system (BIBS).	Yes ❑ No ❑	
25	Communication System	Have a two-way voice communication system between the occupants and the operator and also between other occupants in separate compartments of the same PVHO or an attached PVHO. There shall be a secondary means of communication.	Yes ❑ No ❑	
26	Extinguishing Fire	Be equipped with a readily available means for extinguishing fire.	Yes ❑ No ❑	
27	Electrical System	When fitted, have electrical systems designed for the environment in which they will operate.	Yes ❑ No ❑	
28	Exhaust Space	Chamber exhaust and BIBS should not vent into an enclosed space	Yes ❑ No ❑	
29	External Illumination	The chamber, its general area and controls should be adequately illuminated for operations at night.	Yes ❑ No ❑	
30	Heat Buildup to Viewports	If external lights are used to illuminate the chamber internally, they must not be placed in a manner that subjects viewports to heat buildup.	Yes ❑ No ❑	
31	Communications Between Two Locations	If the chamber is located away from the dive control station, there must be a suitable means of communications between the two locations.	Yes ❑ No ❑	

GAUGES

Gauges utilized with diving equipment or systems must:

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Suitability	Be suitable for purpose intended.	Yes ❑ No ❑	
		When used to indicate a diver's depth:		
2	Range and Graduation	Be of appropriate range and graduation.	Yes ❑ No ❑	
3	Consistent	Be graduated in units consistent with the decompression tables to be utilized.	Yes ❑ No ❑	
4	Calibration	Be calibrated to a known standard every 6 month with certificate	Yes ❑ No ❑	

Gauges utilized with diving equipment or systems must: ***cont'd.***

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK

5	Discrepancy	Be recalibrated when a discrepancy exists exceeding 2% of full scale.	Yes ❑ No ❑	
6	Calibration Mark	Be marked with a label, tag or sticker indicating date of last calibration and date due, which will not interfere with full-scale visibility.	Yes ❑ No ❑	
7	Calibrations Log	Have calibrations documented in the equipment **log.**	Yes ❑ No ❑	
8	Pressure-limiting Device	A pressure-limiting device may be fitted to gauges being over-pressurized.	Yes ❑ No ❑	

TIMEKEEPING DEVICES				
Devices utilized to monitor a diver's exposure time under pressure must:				
1	Suitability	Be suitable for purpose and easily readable, and have suitable backup.	Yes ❑ No ❑	

COMPRESSED GAS EQUIPMENT				
Gas Storage Cylinders and Tubes				
High-pressure gas cylinders or tubes must:				
1	Manufacture Standard	Be manufactured to recognized code or standard.	Yes ❑ No ❑	
2	Over-pressure Relief Device	Be equipped with an over-pressure relief device.	Yes ❑ No ❑	
3	Protection for Valve and Regulator	If rack-mounted into banks of cylinders or tubes, have valves and regulators protected from damage caused by falling objects.	Yes ❑ No ❑	
4	Hydrostatic Testing and Stamp	Be hydrostatically tested according to manufacturer and/or regulatory authorities, and stamped with the test date.	Yes ❑ No ❑	
5	Annual Internal and External Inspection	Visually inspected internally and externally for damage or corrosion within 1 year if used underwater.	Yes ❑ No ❑	
6	Contents Label	Be labeled as to contents. Fire-hazard warning signs must be erected in the vicinity of stored oxygen.	Yes ❑ No ❑	
7	Storage	Be stored in a well-ventilated area, protected from overheating and secured from falling. Fire-warning signs must be erected in the vicinity of stored oxygen.	Yes ❑ No ❑	
8	Contents and Pressure Records	A record must be kept in a designated place of the contents and pressure of each cylinder, quad or bank. These records must be updated daily when the system is in use.	Yes ❑ No ❑	

HANDLING SYSTEMS				
General *Handling systems intended for the launch or recovery of a diver or divers between the surface dive location and the work location by either bell or stage must:*				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**
1	Manufacture	Be designed, manufactured, installed and tested in accordance with applicable design codes, standards and regulations.	Yes ❑ No ❑	
2	Suitability	Be designed such that the drive system and not the brakes control operation under normal conditions.	Yes ❑ No ❑	
3	Brake Function	Be fitted with a mechanical brake capable of holding 1.25 times the safe working load of the winch.	Yes ❑ No ❑	
4	Brake Function	Be designed so that the load can be stopped and held in position if the power supply fails, is disengaged, is switched off, or if operating control is released.	Yes ❑ No ❑	
5	Controls	Have controls located or equipped to afford the operator both a view and control of the lifting operation.	Yes ❑ No ❑	
6	Function Testing	After any installation, alteration repair or failure, be thoroughly examined and be functionally and load-tested to 1.25 times the safe working load of the handing system	Yes ❑ No ❑	
7	Wire and Ropes	Have wire ropes and fittings that are installed, terminated and maintained in accordance with design criteria and/or manufacturer's recommendations.	Yes ❑ No ❑	
8	Inspection	Visually inspected every 6 months for damage, deterioration or deformation.	Yes ❑ No ❑	
9	Certificates	Periodically examined and tested to recognized applicable codes and standards.	Yes ❑ No ❑	
10	Working Load	Have wire ropes and fittings that are rated 8 times the system's safe working load.	Yes ❑ No ❑	
11	Spooling Device	Have a spooling arrangement fitted if fleeting angle exceeds 2 degrees.	Yes ❑ No ❑	
12	Man Rating Winch	Man rating winch has been equipped.	Yes ❑ No ❑	
13	Secondary Means of Recovery	Secondary system available for backup.	Yes ❑ No ❑	
14	Standby Diver's LARS	Standby diver's launch and recovery system.	Yes ❑ No ❑	

DIVING CONTRACTORS' AUDIT REPORT

Chapter IV: Operation Procedures

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Safety Practices /Operations Manual	There must be a safe practices/operations manual at the job site.	Yes ❑ No ❑	
		The manual has met the requirement of the ADCI CS.	Yes ❑ No ❑	
		The manual contains related government regulations, safety procedures, checklists, assignments and responsibilities of diving personnel, equipment procedures and checklists, emergency procedures, etc.	Yes ❑ No ❑	
		The manual contains a definitive statement regarding the use of drugs or alcohol.	Yes ❑ No ❑	
2	Emergency Aid	Developed and maintained a contact list for emergency response.	Yes ❑ No ❑	
		The emergency contact list has been made available at the contractor's principal place of business and at the dive site.	Yes ❑ No ❑	
		The contact list includes decompression chamber, hospital, air or ground transportation, on-call diving physician, national rescue center, etc.	Yes ❑ No ❑	
		Two-way communications are available at the dive site as required.	Yes ❑ No ❑	
3	First Aid	First aid supplies are appropriate and available for the type of operation being conducted.	Yes ❑ No ❑	
		First aid kit is readily accessible in a clearly marked container at the work site.	Yes ❑ No ❑	
		First aid handbook is available at the diving location.	Yes ❑ No ❑	
		A bag-type manual resuscitator/defibrillator is available at the diving location.	Yes ❑ No ❑	
		The first aid kit's contents meet with the ADCI recommendations.	Yes ❑ No ❑	
4	Planning and Assessment	There was a dive plan established for each operation.	Yes ❑ No ❑	
		The dive plan included a job safety analysis.	Yes ❑ No ❑	
		The dive plan included personnel assignments, tasks and responsibilities.	Yes ❑ No ❑	
		The dive plan included operational equipment preparation.	Yes ❑ No ❑	
		The dive plan included decompression procedure and treatment procedure.	Yes ❑ No ❑	
		The dive plan included all emergency procedures.	Yes ❑ No ❑	

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DIVING CONTRACTORS' AUDIT REPORT

Chapter IV: Operation Procedures cont'd

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
5	Team Briefing	There was a safety meeting conducted before any dive operation.	Yes ❑ No ❑	
		During the meeting, dive team members were briefed on underwater tasks, safety procedures and any hazards, related to the underwater operation.	Yes ❑ No ❑	
		Before/after each dive, the diver's physical condition was reported and recorded.	Yes ❑ No ❑	
6	Inspection of Systems, Equipment and Tolls	Checklists were used to confirm that the systems and equipment are in safe working order.	Yes ❑ No ❑	
7	Decompression Chamber	For any diving excess of 30 MSW/100 FSW, a chamber must be available and ready for use at the diving site.	Yes ❑ No ❑	
		The minimum capability of chamber must be not less than 6 ATA.	Yes ❑ No ❑	
		The chamber must be a dual-lock decompression chamber.	Yes ❑ No ❑	
8	Standby Diver	Standby diver must be assigned for any diving operation.	Yes ❑ No ❑	
		Prior to commencement of the operation, the standby diver's equipment must be fully verified as functioning correctly and thereafter maintained in that condition until completion of the diving.	Yes ❑ No ❑	
9	Warning Display	For areas that support marine traffic, an appropriate warning display must be exhibited near the work site so that it has all-around visibility.	Yes ❑ No ❑	
10	Reserve Breathing Supply	A diver-carried reserve breathing supply must be provided for all diving operations.	Yes ❑ No ❑	
		Diver-carried reserve breathing gas supplied must provide a positive indication to the diver that his/her reserve has been actuated (e.g., gauges, etc.).	Yes ❑ No ❑	
11	Communications	There must be a properly functioning two-way audio-communication system between the diver and supervisor.	Yes ❑ No ❑	
		There must be a properly functioning two-way audio-communication system between the supervisor and others, such as winch operator, master, etc.	Yes ❑ No ❑	

DIVING CONTRACTORS' AUDIT REPORT

Chapter IV: Operation Procedures cont'd

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
12	Company Record of Dive	Diving contractor must establish and maintain a record of each diving operation.	Yes ❏ No ❏	
		The content of the record meets with ADCI CS requirements.	Yes ❏ No ❏	
13	Personal Protective Equipment	The appropriate protective equipment was worn when personnel were working at diving location.	Yes ❏ No ❏	
14	Job Safety Analysis (JHA)	Provide a written document identifying hazards associated with each step of the job and ways to mitigate potential hazards.	Yes ❏ No ❏	
		Assign a specific person the responsibility of implementing the safety procedures or protection required.	Yes ❏ No ❏	
		The JHA must be reviewed and updated whenever new equipment, products or procedures are introduced into the work site.	Yes ❏ No ❏	
15	Assignment and Responsibilities	Designate, in writing, a qualified person as diving supervisor to be in charge of each diving project.	Yes ❏ No ❏	
		Diving supervisor's responsibilities must be defined in writing.	Yes ❏ No ❏	
		Diver's responsibilities must be designated in writing.	Yes ❏ No ❏	
		Standby diver's responsibilities must be designated in writing.	Yes ❏ No ❏	
		Tender's responsibilities must be designated in writing.	Yes ❏ No ❏	
		LST's responsibilities must be designated in writing, if there is one assigned to the job.	Yes ❏ No ❏	
		Diving physician's responsibilities must be designated in writing, if there is one.	Yes ❏ No ❏	

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16	Safety Procedure Checklist	Is there a pre-dive checklist that can show all safety precautions have been taken prior to dive operations?	Yes ❑ No ❑	
17	Equipment Procedure Checklist	Is there a pre-dive checklist that can show all equipment is operational ready?	Yes ❑ No ❑	
	Minimum Dive Team Member	The minimum number of personnel comprised a diving team is never less than three. (Careful consideration should be given to the location and scope of work to be performed to determine safe manning and equipment levels.)	Yes ❑ No ❑	
	Minimum Qualification of Personnel	Do diving personnel meet the minimum qualifications, as outlined in the ADCI CS?	Yes ❑ No ❑	
	Minimum Equipment	Does the contractor's equipment meet the minimum requirements, as outlined in the ADCI CS?	Yes ❑ No ❑	
18	Hand-held Power Tools	Does the contractor have operating procedures for hand-held power tools?	Yes ❑ No ❑	
19	Welding and Burning	Does the contractor have procedures for underwater welding and burning?	Yes ❑ No ❑	
20	Emergency Procedure	Does the contractor have any emergency procedures for loss of breathing media, loss of communications, etc.?	Yes ❑ No ❑	
		Does the emergency procedure satisfy the requirements of ADCI CS?	Yes ❑ No ❑	

COMMERCIAL DIVER TRAINING PROGRAM AUDIT REPORT

Chapter I: School / Program Information

1. General Information	
School's Name	
School's Address	
School's Telephone	
School's Facsimile	
School's Email	
School's Website	
Business License Number	
Organization Chart	(Copy for attached)
Director's Name	
Safety Manager's Name	
QA/QC Manager's Name	
Senior or Lead Instructor's Name	
Number of Instructors	
Number of Students	
Number of Other Personnel	

2. PERSONNEL INFORMATION				
DIVING INSTRUCTOR'S LIST				
Name of Diving Instructors	Number and Valid Date of Certificate of Appointment Letter of Instructor	Number and Valid Date of Other Certifications or Required Documentation	Valid Date of Health Certificate	Medical Record

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Name	Number and Valid Date of Other Certifications or Required Documentation	Valid Date of Health Certificate	Medical Record

3. EQUIPMENT LIST

Items	Name of Equipment with UI designation	Availability	Remark

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COMMERCIAL DIVER TRAINING PROGRAM AUDIT REPORT

Chapter II: Personnel Requirements

DESCRIPTION	AUDIT RESPONSE	REMARK
Formal Supervisor Training Course	Yes ❑ No ❑	
Supervisor Certification	Yes ❑ No ❑	
Instructor Appointment Letter	Yes ❑ No ❑	
Number and Valid Date of Other Certifications or Required Documentation	Yes ❑ No ❑	
Health Certificate and Valid Current Physical	Yes ❑ No ❑	
DESCRIPTION	**AUDIT RESPONSE**	**REMARK**
Formal Diver Training Course	Yes ❑ No ❑	
Diver Certification	Yes ❑ No ❑	

Chapter III: Equipment and Systems

SCOPE				
Maintenance Records of Life-support Equipment				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**
1	Equipment Logs	Suitable equipment logs must be established and maintained in a correct and current condition.	Yes ❑ No ❑	
2	Unique Identity	All equipment must have a unique identity traceable to the equipment log.	Yes ❑ No ❑	
3	Content of Entries	Entries made in the equipment log must describe the nature of the work performed, including the dates of modification, repair or test; the name of the individual performing the work or test; and the particular piece of equipment involved.	Yes ❑ No ❑	
4	Signature	Any equipment repair and maintenance must be signed by divers or technicians.	Yes ❑ No ❑	
5	Instruction	Inspection and maintenance for any helmets or masks must be in accordance with instruction of manufacturer.	Yes ❑ No ❑	

DIVER'S DRESS

Dry Suits

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Preventing Over-inflation Device	If fitted with valves, have a means of preventing over–inflation, which could result in an uncontrolled ascent.	Yes ❑ No ❑	
2	Material	Be constructed of material suitable to the environment in which it is to be used.	Yes ❑ No ❑	
3	Environmental Protection	Protect the diver from the environment, whether temperature or hazardous material.	Yes ❑ No ❑	

Hot Water Suits

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Water Flow	Flow sufficient water to maintain the diver in thermal balance at the desired temperature.	Yes ❑ No ❑	
2	Temperature Withstanding	Be capable of withstanding operating temperature.	Yes ❑ No ❑	
3	Bypass Device	Have a means to allow the diver to bypass incoming water prior to it entering the suit.	Yes ❑ No ❑	
4	Backup System	If diving in extreme environment, have a backup hot water supply, or alternatively, terminate the dive immediately and bring the diver to the surface if hot water supply is lost.	Yes ❑ No ❑	

Harnesses

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Material	Be made of material of suitable strength to lift the diver and his/her equipment from the water.	Yes ❑ No ❑	
2	Quick-release Device	Have a mechanical quick-release between the harness and the umbilical.	Yes ❑ No ❑	
3	Strain-protection Construction	Be constructed and fitted to prevent an unconscious diver from slipping free of the harness or from a strain being placed on mask or helmet.	Yes ❑ No ❑	
4	Usage	Not be used as a weight belt.	Yes ❑ No ❑	
5	Prevent Restriction of Diver's Breathing	Be designed to prevent restriction of the diver's breathing when his/her full weight is supported by the harness. Complies with ADCI current guidelines (CS 6, 6.3.4.).	Yes ❑ No ❑	

Weight Belts				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Weight	Be of sufficient weight to maintain the diver at working depth.	Yes ❏ No ❏	
2	Usage	Not be used as an attachment for the diving umbilical.	Yes ❏ No ❏	
3	Release Buckle	Be equipped with an appropriate release buckle.	Yes ❏ No ❏	
4	Avoid Accidental Disengagement	Be attached to the diver in a manner to avoid accidental disengagement.	Yes ❏ No ❏	

Diver-worn or Carried Emergency Gas (Bailout)				
1	Suitability	Be manufactured to recognized codes or standards including ADCI CS 6, 6.3.6.	Yes ❏ No ❏	
2	Cylinder Overpressure Relief Disk	Be equipped with an overpressure relief device.	Yes ❏ No ❏	
3	Annual Inspection	Be inspected internally and externally for damage or corrosion within 1 year.	Yes ❏ No ❏	
4	Hydrostatic Testing and Stamp	Be hydrostatically tested to the requirements of the code of manufacturer by an authorized test facility within 5 years and stamped with the date of test.	Yes ❏ No ❏	
5	Record and Certificate	Have a unique identity with results of all tests being recorded or certified in the equipment log.	Yes ❏ No ❏	
6	Regulator	Have a regulator on the cylinder capable of delivering the proper pressure and flow to the diver's helmet or mask in accordance with the flow characteristics recommended by the helmet or mask manufacturer.	Yes ❏ No ❏	
7	Prevent Disengagement Device	Have a means of attachment to the helmet or mask that prevents accidental disengagement.	Yes ❏ No ❏	
8	Sufficient Capacity	Be of sufficient capacity to permit return of the diver to the surface or to the diving stage at a travel rate of 10 meters/minute.	Yes ❏ No ❏	
9	Sufficient Capacity	Capable of providing 4 minutes of EGS at depth.	Yes ❏ No ❏	
10	Appropriate Content	Be charged with an appropriate breathing gas mixture to accommodate mode of diving/depth requirement.	Yes ❏ No ❏	

HELMETS AND MASKS				
General				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Suitability for Usage	Be appropriate for the task intended.	Yes ❑ No ❑	
2	Capability of Ventilation	Be capable of ventilating the required gas when supplied at the pressure recommended by the manufacturer of the equipment at any depth at which they are operated.	Yes ❑ No ❑	
3	PP CO_2	Be capable of maintaining the diver's respired CO_2 partial pressure below 0.02 ATA.	Yes ❑ No ❑	
4	Communication	Be fitted with two-way communications.	Yes ❑ No ❑	
5	Non-return Valve	Be equipped with a non-return valve in the main gas supply that closes readily and positively. Have check valves with springs not exceeding 3 psi cracking pressure.	Yes ❑ No ❑	
6	Material	Be made of corrosion-resistant material.	Yes ❑ No ❑	
7	Over-pressure Protection	Be protected from over-pressurization.	Yes ❑ No ❑	
8	Marking	Each helmet or mask should have a unique serial number.	Yes ❑ No ❑	
9	Maintenance	Each helmet or mask must be subject to regular planned maintenance and a record of such maintenance should be available.	Yes ❑ No ❑	
10	Inspection and Testing	Inspection and function test at atmospheric pressure at least annually with record or certificate.	Yes ❑ No ❑	
HOSES				
Breathing Gas Hoses				
1	Burst Pressure	Have a minimum burst pressure equal to 4 times the maximum working pressure.	Yes ❑ No ❑	
2	Flow Rating	Flow rating to meet intended use.	Yes ❑ No ❑	
3	Connector Pressure	Connector pressure equal to or greater than the system on which they are installed.	Yes ❑ No ❑	
4	Material	Have fittings of corrosion-resistant material that cannot be accidentally disengaged.	Yes ❑ No ❑	
5	CollapsePrevention	Be kink-resistant or arranged to prevent kinking.	Yes ❑ No ❑	
6	Annual Testing	Examine visually and pressure test to 1.5 times the design working pressure of the system within 1 year with record. ADCI CS 6, 6.5.2	Yes ❑ No ❑	
7	Testing After Repair	Examine visually and pressure after each repair and alteration and after initial construction with Record.	Yes ❑ No ❑	
8	Suitability	Be suitable for breathing gas service.	Yes ❑ No ❑	

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Umbilicals				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Burst Pressure	Have a minimum burst pressure equal to 4 times the maximum working pressure.	Yes ❑ No ❑	
2	Flow Rating	Flow rating not less than the system in which it is installed or used and suitable for the service intended.	Yes ❑ No ❑	
3	Connector Pressure	Connector pressure equal to or greater than the system on which they are installed.	Yes ❑ No ❑	
4	Material	Have fittings of corrosion-resistant material that cannot be accidentally disengaged.	Yes ❑ No ❑	
5	Collapse Prevention	Be collapse-resistant or arranged to prevent collapse.	Yes ❑ No ❑	
6	Annual Testing	Examine visually and pressure test to 1.5 times the design working pressure of the system.	Yes ❑ No ❑	
7	Testing After Repair	Examine visually and pressure test after each repair and alteration with record	Yes ❑ No ❑	
8	Marking	Umbilical must be marked for length using a recognized system that allows easy visual identification of the length paid out.	Yes ❑ No ❑	
9	Maintenance Plan	Be marked with a unique identity and subjected to a planned maintenance program.	Yes ❑ No ❑	
10	Composition	Consist of a breathing gas hose, communications cable, a means of determining the diver's depth and an included strength member, when required.	Yes ❑ No ❑	
11	Material	Have a minimum member made of material unaffected by immersion in water for extended period.	Yes ❑ No ❑	
12	Minimum Break Strength	Have a minimum hose assembly break strength of 1,000 lbs.	Yes ❑ No ❑	
13	Security	The diver's end of the umbilical must be fitted with a means that allows it to be securely fastened to the diver's safety harness without putting any strain on the individual whip ends.	Yes ❑ No ❑	
14	Standby Diver	The umbilical assembly used for the standby diver must be of sufficient length to reach the primary diver at the farthest distance he/she can proceed from the dive station.	Yes ❑ No ❑	

Oxygen Hoses for Life Support				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Burst Pressure	Have a minimum burst pressure equal to 4 times the maximum working pressure.	Yes ❑ No ❑	
2	Flow Rating	Flow rating not less than the system in which it is installed or used and suitable for the service intended.	Yes ❑ No ❑	
3	Connector Pressure	Connector pressure equal to or greater than the system on which they are installed.	Yes ❑ No ❑	
4	Material	Have fittings of corrosion-resistant material that cannot be accidentally disengaged.	Yes ❑ No ❑	
5	Collapse Prevention	Be collapse-resistant or arranged to prevent collapse.	Yes ❑ No ❑	
6	Annual Testing	Examine visually and pressure test to 1.5 times the design working pressure of the system with record ADCI CS 6, 6.5	Yes ❑ No ❑	
7	Testing After Repair	Examine visually and pressure after each repair and alteration and after initial construction with Record.	Yes ❑ No ❑	
8	Oxygen Cleaning	Hose assemblies used in systems containing greater than 50% oxygen are to be cleaned for oxygen service.	Yes ❑ No ❑	
9	Marking	Hoses used for 100% oxygen service should be identified by a consistent color code or tagged "FOR OXYGEN USE ONLY."	Yes ❑ No ❑	
10	Lubricants	Lubricants used to assemble fittings on hoses for oxygen service must be compatible with oxygen.	Yes ❑ No ❑	
11	Hose and Fittings	Hose and fittings must be brass or other alloys suitable for O^2 use.	Yes ❑ No ❑	

COMPRESSOR SYSTEMS

Compressors and Gas Pumps for Life Support

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Personnel Protection	Have suitable personnel protection around rotating machinery.	Yes ❑ No ❑	
2	Instruction	Have the necessary instruction to facilitate operations.	Yes ❑ No ❑	
3	Suitability	Be of the proper type, pressure and flow rate, suitable for service intended.	Yes ❑ No ❑	
4	Pollution Protection	Have its air intake positioned to be clear of exhaust fumes and other contaminants.	Yes ❑ No ❑	
5	Piping	Have piping system in accordance with recognized codes of standards.	Yes ❑ No ❑	
6	Flexible Hoses	Have flexible hoses in accordance with "hoses requirement." ADCI CS 6, 6.5.1.	Yes ❑ No ❑	
7	Electrical Controls	Have electrical controls, wiring and drive units meeting the jurisdictional requirements when so equipped.	Yes ❑ No ❑	
8	Oxygen Transfer	Be cleaned for oxygen service when used with mixtures of greater than 50% oxygen and equipped using rising stem type valve.	Yes ❑ No ❑	
9	Access	Be easily accessible to diving personnel, both for routine maintenance and during an emergency.	Yes ❑ No ❑	

Recording of Maintenance and Repairs

1	Entries of Repair	Entries must be made in the equipment log for all maintenance and repairs performed on the compressor and gas system.	Yes ❑ No ❑	
2	Quality Tests	Results of air quality tests must be retained to document their results and accomplishment.	Yes ❑ No ❑	
3	Unique Identity	Compressors must have a unique identity incorporating manufacturer, model, serial number, maximum rates outlet pressure, rated flow capacity and safety valve settings.	Yes ❑ No ❑	
4	Planned Maintenance	Compressor units must be subjected to planned maintenance.	Yes ❑ No ❑	

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
Volume Tanks				
1	Manufacture	Be designed, fabricated, inspected, tested and certified in accordance with recognized codes or statutory or classification society requirements.	Yes ❑ No ❑	
2	Pressure Gauge	Be equipped with a pressure gauge.	Yes ❑ No ❑	
3	Check Valve	Be equipped with a check valve on the inlet side.	Yes ❑ No ❑	
4	Relief Valve	Be equipped with a relief valve as required by code of manufacturer. Relief valves tested annually with record.	Yes ❑ No ❑	
5	Drain Valve	Be equipped with condensate drain valve located at its lowest point.	Yes ❑ No ❑	
6	Annual Inspection	Be inspected internally and externally within 1 year for damage or corrosion with record.	Yes ❑ No ❑	
7	Pneumatically Testing	Be pneumatically tested to maximum allowable working pressure (M.A.W.P.) within 1 year for the breathing mixture normally used with record.	Yes ❑ No ❑	
8	Hydrostatic Testing	Be hydrostatically tested to 1.3 times maximum allowable working pressure (M.A.W.P), ADCI CS 6, 6.11.1 (12) within 5 years or after any repair, modification or alteration to the pressure boundary and stamped with the test date.	Yes ❑ No ❑	
9	Record and Certificate	Have a unique identity with results of all tests being recorded in the equipment log with certificate.	Yes ❑ No ❑	
Filtration				
1	Filters	Filters, when installed to prevent contamination, must meet or exceed the flow rate and pressure rating of the compressor or piping system in which they are installed and be able to deliver breathing gas in compliance with recognized purity standards for extended operationcertified in accordance with recognized codes or statutory or classification society requirements.	Yes ❑ No ❑	
Air Purity Requirements				
1	Quality Testing	All compressor, transfer pumps or booster pumps used for breathing air service must be subjected to a quality test in last 6 months.	Yes ❑ No ❑	
2	Selecting Point	Tests must be taken at the discharge point that would normally supply the breathing gas system, the diver's hose or cylinder fill point.	Yes ❑ No ❑	
3	Testing Record	Documentation of these tests must be kept on file and available upon request.	Yes ❑ No ❑	

DIVER ENTRY AND EGRESS SYSTEM				
Diving Ladder and Stage				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**
1	Capability	Be capable of supporting the weight of two divers plus their gear.	Yes ❑ No ❑	
2	Material	Be made of corrosion-resistant material or be maintained free corrosion.	Yes ❑ No ❑	
3	Purpose	Be suitable for the purpose intended	Yes ❑ No ❑	
4	Ladder Length	Ladder must extend a minimum of 1 meter (3 feet) below surface where installed.	Yes ❑ No ❑	
5	Safety Chain and Hand Holds	Stage be provided with a safety chain and internal hand holds for diver safety during launch and recovery.	Yes ❑ No ❑	
6	Cylinder and Regulator	Stage be provided with breathing gas cylinder and regulator for emergency breathing if required.	Yes ❑ No ❑	
PVHO – CHAMBER				
Diving Pressure Vessels				
1	Manufacture	Equipment must be built in accordance with recognized regulations and codes and must be subject to a planned maintenance system.	Yes ❑ No ❑	
2	Annual Inspection	Each pressure vessel must be examined and tested for mechanical damage or deterioration and must likewise be examined and tested after any repair, modification or alternation within 1 year with record.	Yes ❑ No ❑	
3	Pressure Testing	Each pressure vessel and piping must be pressure leak tested annually with **Record** to maximum allowable working pressure (M.A W.P.) stamped on the nameplate.	Yes ❑ No ❑	

Decompression Chambers (DDC)

ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Accordance	Meet requirements of item 6.12.2.1	Yes ❑ No ❑	
2	Type	Be twin-lock and/or multiple-place.	Yes ❑ No ❑	
3	Dimension	Have sufficient internal dimensions to accommodate two persons lying in a horizontal position (except designated diving bells, transfer locks and emergency rescue chambers).	Yes ❑ No ❑	
4	Ingress and Egress	Have sufficient internal dimensions to accommodate two persons lying in a horizontal position (except designated diving bells, transfer locks and emergency rescue chambers).	Yes ❑ No ❑	
5	Locking Device Operating	Have a means of operating all installed man-way locking devices from both sides of a closed hatch, except disabled shipping dogs.	Yes ❑ No ❑	
6	Internal Illumination	Have illumination of the interior sufficient to allow operation of any controls and allow for visual observation, diagnosis or medical treatment.	Yes ❑ No ❑	
7	Visual Capability	Have a visual capability that allows the interior to be observed from the exterior.	Yes ❑ No ❑	
8	Pressure Capability	Have a minimum pressure capability of 6 ATA, or the maximum depth of the dive for dives deeper than 10 ATA.	Yes ❑ No ❑	
9	Pressurization Rate	Be capable of a minimum pressurization rate of 18.3 meters (60 feet) and at least 9 meters (30 feet) per minute thereafter.	Yes ❑ No ❑	
10	Decompression Rate	Be capable of a decompression rate of 9-10 meters (30 feet) per minute.	Yes ❑ No ❑	
11	Oxygen Concentration	Have a means to maintain an atmosphere below a level of 25% oxygen by volume. ADCI CS 6, 6.12.2.1 (11)	Yes ❑ No ❑	
12	CO_2 Concentration	Have a means of maintaining an atmosphere below 1% surface equivalent carbon dioxide by volume.	Yes ❑ No ❑	
13	Mufflers or Silencers	Have mufflers/silencers on blow down and exhaust outlets.	Yes ❑ No ❑	
14	Suction Guards	Have suction guards on exhaust line openings inside each compartment.	Yes ❑ No ❑	
15	Piping Arrangement	Have piping arranged to ensure adequate circulation.	Yes ❑ No ❑	
16	Flexible Hoses	Have all installed flexible hoses meet the requirements of item 6.5: Hoses.	Yes ❑ No ❑	
17	Penetrations Mark	Have all penetrations clearly marked as to service.	Yes ❑ No ❑	
18	Regulation for Piping	Have piping in accordance with recognized codes/regulations or classification society to which it was built.	Yes ❑ No ❑	

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Decompression Chambers (DDC) *cont.'d*				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
19	Calibration for Depth Gauge	Have a calibration of each depth gauge within 6 months with certificates.	Yes ❑ No ❑	
20	Pressure-relief Device	Have a pressure-relief device as per recognized codes of construction.	Yes ❑ No ❑	
21	Relief-valve Pressure Testing	Have the relief valve pressure setting tested with 1 year with certificates.	Yes ❑ No ❑	
22	Breathing System	Have an installed breathing system with a minimum of one mask per occupant per lock plus one spare mask per lock. (In sat systems, more may be required). For DDC, minimum of two in inner lock and two for outer lock.	Yes ❑ No ❑	
23	Supply Capability of Breathing Gas	Have the capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work (4.5ACFM).	Yes ❑ No ❑	
24	Non-return Valve	Have a non-return valve on through-hull penetrators supplying any built-in breathing system (BIBS).	Yes ❑ No ❑	
25	Communication System	Have a two-way voice communication system between the occupants and the operator and also between other occupants in separate compartments of the same PVHO or an attached PVHO. There shall be a secondary means of communication.	Yes ❑ No ❑	
26	Extinguishing Fire	Be equipped with a readily available means for extinguishing fire.	Yes ❑ No ❑	
27	Electrical System	When fitted, have electrical system designed for the environment in which they operate.	Yes ❑ No ❑	
28	Exhaust Space	Chamber exhaust and BIBS should not vent into an enclosed space.	Yes ❑ No ❑	
29	External Illumination	The chamber, its general area and controls should be adequately illuminated for operations at night.	Yes ❑ No ❑	
30	Heat Buildup to Viewports	If external lights are used to illuminate the chamber internally, they must not be placed in a manner that subjects viewports to heat buildup.	Yes ❑ No ❑	
31	Communications Between Two Locations	If the chamber is located away from the dive control station, there must be a suitable means of communications between the two locations.	Yes ❑ No ❑	

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GAUGES				
Gauges utilized with diving equipment or systems must:				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Suitability	Be suitable for purpose intended.	Yes ❑ No ❑	
When used to indicate a diver's depth:				
2	Range and Graduation	Be of appropriate range and graduation.	Yes ❑ No ❑	
3	Consistent	Be graduated in units consistent with the decompression tables to be utilized.	Yes ❑ No ❑	
4	Calibration	Be calibrated to a known standard every 6 months with certificate.	Yes ❑ No ❑	
5	Discrepancy	Be recalibrated when a discrepancy exists exceeding 2% of full scale.	Yes ❑ No ❑	
6	Calibration Mark	Be marked with a label, tag or sticker indicating date of last calibration and date due, which will not interfere with full-scale visibility.	Yes ❑ No ❑	
7	Calibrations Log	Have calibrations documented in the equipment log.	Yes ❑ No ❑	
8	Pressure-limiting Device	A pressure-limiting device may be fitted to gauges being over-pressurized.	Yes ❑ No ❑	
TIMEKEEPING DEVICES				
Devices utilized to monitor a diver's exposure time under pressure must:				
1	Suitability	Be suitable for purpose and easily readable, and have suitable backup.	Yes ❑ No ❑	

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COMPRESSED GAS EQUIPMENT				
Gas Storage Cylinders and Tubes				
High-pressure gas cylinders or tubes must:				
ITEM	**DESCRIPTION**	**DIVING OPERATIONS REQUIREMENT**	**AUDIT RESPONSE**	**REMARK**
1	Manufacture Standard	Be manufactured to recognized code or standard.	Yes ❑ No ❑	
2	Over-pressure Relief Device	Be equipped with an over-pressure relief device.	Yes ❑ No ❑	
3	Protection for Valve and Regulator	If rack-mounted into banks of cylinders or tubes, have valves and regulators protected from damage caused by falling objects.	Yes ❑ No ❑	
4	Hydrostatic Testing and Stamp	Be hydrostatically tested according to manufacturer and/or regulatory authorities, and stamped with the test date.	Yes ❑ No ❑	
5	Annual Internal and External Inspection	Visually inspected internally and externally for damage or corrosion within 1 year if used underwater.	Yes ❑ No ❑	
6	Contents Label	Be labeled as to contents. Fire-hazard warning signs must be erected in the vicinity of stored oxygen.	Yes ❑ No ❑	
7	Storage	Be stored in a well-ventilated area, protected from overheating and secured from falling. Fire-warning signs must be erected in the vicinity of stored oxygen.	Yes ❑ No ❑	
8	Contents and Pressure Records	A record must be kept in a designated place of the contents and pressure of each cylinder, quad or bank. These records must be updated daily when the system is in use.	Yes ❑ No ❑	

HANDLING SYSTEMS				
General ***Handling systems intended for the launch or recovery of a diver or divers between the surface dive location and the work location by either bell or stage must:***				
ITEM	DESCRIPTION	DIVING OPERATIONS REQUIREMENT	AUDIT RESPONSE	REMARK
1	Manufacture	Be designed, manufactured, installed and tested in accordance with applicable design codes, standards and regulations.	Yes ❑ No ❑	
2	Suitability	Be designed such that the drive system and not the brakes control operation under normal conditions.	Yes ❑ No ❑	
3	Brake Function	Be fitted with a mechanical brake capable of holding 1.25 times the safe working load of the winch.	Yes ❑ No ❑	
4	Brake Function	Be designed so that the load can be stopped and held in position if the power supply fails, is disengaged, is switched off, or if operating control is released.	Yes ❑ No ❑	
5	Controls	Have controls located or equipped to afford the operator both a view and control of the lifting operation.	Yes ❑ No ❑	
6	Function Testing	After any installation, alteration repair or failure, be thoroughly examined and be functionally and load-tested to 1.25 times the safe working load of the handing system.	Yes ❑ No ❑	
7	Wire and Ropes	Have wire ropes and fittings that are installed, terminated and maintained in accordance with design criteria and/or manufacturer's recommendations.	Yes ❑ No ❑	
8	Inspection	Visually inspected every 6 months for damage, deterioration or deformation.	Yes ❑ No ❑	
9	Certificates	Periodically examined and tested to recognized applicable codes and standards.	Yes ❑ No ❑	
10	Working Load	Have wire ropes and fittings that are rated 8 times the system's safe working load.	Yes ❑ No ❑	
11	Spooling Device	Have a spooling arrangement fitted if fleeting angle exceeds 2 degrees.	Yes ❑ No ❑	
12	Man Rating Winch	Man rating winch has been equipped.	Yes ❑ No ❑	
13	Secondary Means of Recovery	Secondary system available for backup.	Yes ❑ No ❑	
14	Standby Diver's LARS	Standby diver's launch and recovery system.	Yes ❑ No ❑	

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COMMERCIAL DIVER TRAINING PROGRAM AUDIT REPORT

Chapter IV: Operation Procedures

Operation Procedures				
ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
1	Safety Practices/ Operations Manual	There must be a Safe Practices and Operations Manual at the instructional dive site.	Yes ❑ No ❑	
		The manual has met the requirement of the ADCI CS.	Yes ❑ No ❑	
		The manual contains related government regulations, safety procedures, checklists, assignments and responsibilities of students and instructional personnel, equipment procedures and checklists, emergency procedures, etc.	Yes ❑ No ❑	
		The manual contains a definitive statement regarding the use of drugs or alcohol.	Yes ❑ No ❑	
2	Emergency Aid	Developed and maintained a contact list for emergency response.	Yes ❑ No ❑	
		The emergency contact list has been made available at the school or remote location instructional dive sites.	Yes ❑ No ❑	
		The contact list includes decompression chamber, hospital, air or ground transportation, on-call diving physician, national rescue center, etc.	Yes ❑ No ❑	
		Two-way communications are available at the instructional dive site as required.	Yes ❑ No ❑	
3	First Aid	First aid supplies are appropriate and available for the type of operation being conducted.	Yes ❑ No ❑	
		First aid kit is readily accessible in a clearly marked container at the work site.	Yes ❑ No ❑	
		First aid handbook is available at the diving location.	Yes ❑ No ❑	
		A bag-type manual resuscitator/defibrillator is available at the diving location.	Yes ❑ No ❑	
		The first aid kit's contents meet with the ADCI recommendations.	Yes ❑ No ❑	

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ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
4	Planning and Assessment	There was a dive plan established for each operation.	Yes ❑ No ❑	
		The dive plan included a job safety analysis.	Yes ❑ No ❑	
		The dive plan included personnel assignments, tasks and responsibilities.	Yes ❑ No ❑	
		The dive plan included operational equipment preparation.	Yes ❑ No ❑	
		The dive plan included decompression procedure and treatment procedure.	Yes ❑ No ❑	
		The dive plan included all emergency procedures.	Yes ❑ No ❑	
5	Team Briefing	There was a safety meeting conducted before any instructional dive operation.	Yes ❑ No ❑	
		During the meeting, students were briefed on underwater tasks, safety procedures and any hazards, related to the underwater operation.	Yes ❑ No ❑	
		Before/after each dive, the diver's physical condition was reported and recorded.	Yes ❑ No ❑	
6	Inspection of Systems, Equipment and Tolls	Checklists were used to confirm that the systems and equipment are in safe working order.	Yes ❑ No ❑	
7	Decompression Chamber	For any diving excess of 30 MSW/100 FSW, a chamber must be available and ready for use at the diving site.	Yes ❑ No ❑	
		The minimum capability of chamber must be not less than 6 ATA.	Yes ❑ No ❑	
		The chamber must be a dual-lock decompression chamber.	Yes ❑ No ❑	
8	Student Standby Diver	Student standby diver must be assigned for any diving operation.	Yes ❑ No ❑	
		Prior to commencement of the operation, the student standby diver's equipment must be fully verified as functioning correctly and thereafter maintained in that condition until completion of the diving.	Yes ❑ No ❑	
9	Warning Display	For areas that support marine traffic, an appropriate warning display must be exhibited near the work site so that it has all-around visibility.	Yes ❑ No ❑	

Operation Procedures *cont.'d*

ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
10	Reserve Breathing Supply	A diver-carried reserve breathing supply must be provided for all diving operations.	Yes ❑ No ❑	
		Diver-carried reserve breathing gas supplied must provide a positive indication to the diver that his/her reserve has been actuated (e.g., gauges, etc.).	Yes ❑ No ❑	
11	Communications	There must be a properly functioning two-way audio-communication system between the student and instructor.	Yes ❑ No ❑	
		There must be a properly functioning two-way audio-communication system between the instructor and others, such as winch operator, master, etc.	Yes ❑ No ❑	
12	School Record of Dive	The school must establish and maintain a record of each diving operation.	Yes ❑ No ❑	
		The content of the record meets with ADCI CS requirements.	Yes ❑ No ❑	
13	Personal Protective Equipment	The appropriate protective equipment was worn when personnel were working at diving location.	Yes ❑ No ❑	

14	Job Hazard Analysis (JHA)	Provide a written document identifying hazards associated with each step of the job and ways to mitigate potential hazards.	Yes ❑ No ❑	
		Assign a specific person the responsibility of implementing the safety procedures or protection required.	Yes ❑ No ❑	
		The JHA must be reviewed and updated whenever new equipment, products or procedures are introduced into the work site.	Yes ❑ No ❑	
		Diving instructor's responsibilities must be defined in writing.	Yes ❑ No ❑	
		Student/Diver's responsibilities must be designated in writing.	Yes ❑ No ❑	
		Student/Standby diver's responsibilities must be designated in writing.	Yes ❑ No ❑	
		Student/Tender's responsibilities must be designated in writing.	Yes ❑ No ❑	
15	Safety Procedure Checklist	Is there a pre-dive checklist that can show all safety precautions have been taken prior to dive operations?	Yes ❑ No ❑	

ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
16	Equipment Procedure Checklist	Is there a pre-dive checklist that can show all equipment is operational ready?	Yes ❏ No ❏	
	Minimum Qualification of Personnel	Do instructional diving personnel meet the minimum qualifications, as outlined in the ADCI CS?	Yes ❏ No ❏	
	Minimum Equipment	Does the school's equipment meet the minimum requirements, as outlined in the ADCI CS?	Yes ❏ No ❏	
17	Hand-held Power Tools	Does the school have operating procedures for hand-held power tools?	Yes ❏ No ❏	
18	Welding and Burning	Does the school have procedures for underwater welding and burning?	Yes ❏ No ❏	
19	Emergency Procedure	Does the school have any emergency procedures for loss of breathing media, loss of communications, etc.?	Yes ❏ No ❏	
		Does the emergency procedure satisfy the requirements of ADCI CS?	Yes ❏ No ❏	

COMMERCIAL DIVER TRAINING PROGRAM AUDIT REPORT

Chapter VI: Facility

Classrooms			
ITEM	REQUIREMENT	RESPONSE	REMARK
1	Classrooms have adequate seating	Yes ❑ No ❑	
2	Classrooms have an adequate number of desks/tables	Yes ❑ No ❑	
3	Classrooms contain audio/visual equipment	Yes ❑ No ❑	
4	Classroom possesses adequate lighting	Yes ❑ No ❑	
Technical Library			
1	Technical Library contains necessary texts to complement learning objects	Yes ❑ No ❑	
2	Technical Library contains training materials to complement learning objectives	Yes ❑ No ❑	
(Practical) Training Facilities			
1	In-Water Facilities	Yes ❑ No ❑	
2	Rigging	Yes ❑ No ❑	
3	Welding	Yes ❑ No ❑	
4	Chamber Operations	Yes ❑ No ❑	

Chapter VII: Staff

Instructional Staff			
1	Adequate number of instructional staff to support student population (maximum 20:1 ratio recommended)	Yes ❑ No ❑	
2	Instructors possess at least two years of full-time field experience in commercial surface supplied diving	Yes ❑ No ❑	
3	Instructors possess current First-Aid and CPR certifications	Yes ❑ No ❑	
4	Instructors are trained in emergency policies and procedures	Yes ❑ No ❑	
Office Staff			
1	Adequate number of administrative staff to support student population and administrative needs	Yes ❑ No ❑	

Chapter VIII: Curriculum

1	The school's curriculum meets or exceeds the requirements for ANSI/ACDE-01-2009	Yes ❑ No ❑	

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Chapter IX: Equipment

ITEM	REQUIREMENT	RESPONSE	REMARK
	Practical Training (Hands-on)		
1	Equipment used is consistent with that which the students will use in the industry	Yes ❑ No ❑	
2	Manufacturer's operational manuals are available for students' reference and review	Yes ❑ No ❑	
3	Instruction manuals are available for students' reference and review	Yes ❑ No ❑	
4	Equipment and tools are available for hands-on helmet and mask repair and maintenance	Yes ❑ No ❑	
5	Equipment that will be used in the field on working dives are available for hands-on training	Yes ❑ No ❑	
6	Students are provided training with at least two different types of diving helmets common to industry, including a "demand" and a "freeflow" type helmet	Yes ❑ No ❑	
	Equipment available for student training/use		
1	Diving compressor(s)	Yes ❑ No ❑	
2	Decompression chamber(s)	Yes ❑ No ❑	
3	Hot-water supply system	Yes ❑ No ❑	
4	Gas racks	Yes ❑ No ❑	
5	Welding machines	Yes ❑ No ❑	
6	Underwater cutting/welding equipment	Yes ❑ No ❑	
7	Hydraulic/pneumatic tools	Yes ❑ No ❑	
8	Water jet	Yes ❑ No ❑	
9	Air lift	Yes ❑ No ❑	
10	Topside and underwater rigging and mechanical projects	Yes ❑ No ❑	
11	Equipment for teaching the operation and maintenance of marine engines and compressors	Yes ❑ No ❑	
12	Lifting devices and other rigging equipment common to the diving industry	Yes ❑ No ❑	
13	Properly constructed umbilicals	Yes ❑ No ❑	
14	First-aid and CPR training equipment	Yes ❑ No ❑	

Chapter X: Training Aids

1	Books and training aids contain current information and are appropriate for individual courses and modules	Yes ❑ No ❑	
2	Audio-visual aids and appropriate computer technology are used to compliment instruction	Yes ❑ No ❑	

Chapter XI: Physical Examinations

ITEM	REQUIREMENT	RESPONSE	REMARK
1	All students have passed a medical exam prior to entrance into the training program	Yes ❑ No ❑	
2	ADCI medical requirement and forms are utilized for student fitness-to-dive examinations	Yes ❑ No ❑	

Chapter XII: Physical Fitness

1	The importance of physical fitness is emphasized to students throughout the training program	Yes ❑ No ❑	

Chapter XIII: Industry Input

1	Students are educated about employers' hiring policies regarding drugs and alcohol	Yes ❑ No ❑	
2	Students are educated on the responsibilities of tenders, tender/divers, divers and standby divers	Yes ❑ No ❑	
3	Students are educated on the rules and regulations for the USCG, OSHA, as well as the guidelines contained in the ADCI Consensus Standards for Commercial Diving and Underwater Operations	Yes ❑ No ❑	

Chapter XIV: Safety

1	Safety and compliance with federal, state and flag state standards, as well as industry best practices are emphasized throughout the training program	Yes ❑ No ❑	
2	Students are instructed that the basic responsibility for both personal and operational safety lies with each individual	Yes ❑ No ❑	

Chapter XV: Documentation

1	Documentation of all training successfully completed must be made available to the student (transcripts, diplomas, certificates)	Yes ❑ No ❑	

Chapter XVI: Issuance of Certification

1	Issuance of ADCI Entry Level Tender/Diver certifications are in adherence to ADCI Consensus Standards requirements (625 hours of formal commercial surface supplied diver training)	Yes ❑ No ❑	

Chapter XVII: Drug Policy

1	A program is in place for providing a drug and alcohol free workplace	Yes ❑ No ❑	
2	The substance abuse policy is very visible and is strictly enforced	Yes ❑ No ❑	

ADCI Saturation Diving Inspection and Checklist Protocol

SATURATION COMPLEX				
ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
1	Saturation System Classed (Construction Code)		Yes ❑ No ❑	**What is the PVHO Construction Code?**
2	Current Diving System Safety Certificate (IMO requirement).		Yes ❑ No ❑	
3	Testing	Tested annually to maximum allowable working pressure or if modification to the pressure boundary was made (non-welding).	Yes ❑ No ❑	
4	Fire-suppression System-External Chamber(s) Location	Fire suppression equipment and methods are available for the entire area of the saturation complex.	Yes ❑ No ❑	**What is the certification date?**
5	Chambers' Viewports (Within date inspected for crazing, clarity, scratches or any damage. External protection.)	A. Manufactured in accordance with a recognized standard. (ASME/PVHO 1).	Yes ❑ No ❑	
		B. Certification date.	Yes ❑ No ❑	
		C. External lights are mounted in a manner that will not damage view ports.	Yes ❑ No ❑	
		D. Viewport protective device.	Yes ❑ No ❑	
6	Saturation Complex (External Condition)	A. Free of damage and excessive corrosion as defined by construction code.	Yes ❑ No ❑	
		B. Doors/hatches are numbered and properly labeled.	Yes ❑ No ❑	
		C. Penetrators are fitted with a stop pressure loss.	Yes ❑ No ❑	
		D. Seals and mating areas/faces must be free of debris and in good condition.	Yes ❑ No ❑	
		E. Lock (med./food) are equipped with a safety interlocked system that is fitted with a clamping device that secures the outer lock door.	Yes ❑ No ❑	
		F. All valves are marked, labeled and free from rust or corrosion. Designed, built and fit for purpose.	Yes ❑ No ❑	
		G. Fitted with relief valves to address over-pressurization. ASME re-sealable valves to fit 10% over MAWP.	Yes ❑ No ❑	
		H. Two-way communications between the med./food lock and the dive control station are available.	Yes ❑ No ❑	
		I. The environmental control unit (ECU) is fit to purpose and designed to meet dynamic and static loads.	Yes ❑ No ❑	
		J. The ECU is fitted with a non-return valve.	Yes ❑ No ❑	

SATURATION COMPLEX *cont'd.*				
ITEM	**DESCRIPTION**	**REQUIREMENT**	**RESPONSE**	**REMARK**
7	Saturation Complex (Internal Condition)	A. Free of internal damage and excessive corrosion (see construction code).	Yes ❑ No ❑	
		B. Tested for hull integrity to maximum allowable working pressure (recommend the use of 20% He).	Yes ❑ No ❑	
		C. All gas hull penetrators are fitted with valves to stop pressure loss.	Yes ❑ No ❑	
		D. Seals on mating areas/faces must be free of debris/damage and in operational condition.	Yes ❑ No ❑	
		E. All valves are marked, labeled and free from rust or corrosion. Designed, built and fit for purpose.(e.g. brass, or alloy for O_2 percentage mixtures).	Yes ❑ No ❑	
		F. Proper protection on piping for all exhausts (suction guard).	Yes ❑ No ❑	
		G. Diffusers fitted for all inlet piping.	Yes ❑ No ❑	
		H. Two-way communication between diving personnel inside of each compartment of the saturation complex and the dive control station.	Yes ❑ No ❑	
		I. Back-up communications available (sound-powered phone with call button or growler).	Yes ❑ No ❑	
		J. BIBS, equipped with an overboard dump system, is available for each diver in every compartment, plus one spare mask/ hose assembly for back-up in each compartment.	Yes ❑ No ❑	
		K. Documentation for testing of BIBS prior to each sat run.	Yes ❑ No ❑	
		L. Adequate berthing for divers (bunks).	Yes ❑ No ❑	
		M.Adequate internal lighting for personnel to properly identify all valves and equipment.	Yes ❑ No ❑	
		N. Adequate lighting for outside visual and video monitoring.	Yes ❑ No ❑	
		O. Doors/hatches must be able to be secured and unsecured from both sides.	Yes ❑ No ❑	
		P. Doors/hatches can be secured in the open position.	Yes ❑ No ❑	
		Q. Doors hatches clearly labeled/numbered.	Yes ❑ No ❑	
		R. Sanitary facilities adequate to accommodate the divers for the duration of the saturation run.	Yes ❑ No ❑	
		S. Shower and sinks are available for diving personnel.	Yes ❑ No ❑	
		T. All toilets fitted with safety interlocks for flushing.	Yes ❑ No ❑	
		U. Means available for fire suppression. (i.e.e.g., hyperbaric extinguisher or built-in system).	Yes ❑ No ❑	
		V. Internal (caisson) depth gauges for divers to read their current depth. Enter calibration date in remark section.	Yes ❑ No ❑	
		W. The environmental control unit (ECU) is designed and fit for purpose to control the inside atmosphere of the saturation complex.	Yes ❑ No ❑	
		X. When applicable, oxygen injection is sited at the ECU discharge point.	Yes ❑ No ❑	

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BELL LAUNCH AND RECOVERY SYSTEM (LARS)

ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
1	Weight of equipment to be lifted is documented for both air and in-water (bell).		Yes ❑ No ❑	
2	Safe working load (SWL) is clearly marked on the crane, winch, A-frame or davit, etc		Yes ❑ No ❑	
3	Man-riding Winches	A. Winches are man-rated and certified by manufacturer or other competent entity.	Yes ❑ No ❑	
		B. Operating instructions and emergency procedures are displayed and available for operator review.	Yes ❑ No ❑	
		C. Testing records and documentation are available for review.	Yes ❑ No ❑	
		D. The main brake will automatically activate when returned to the neutral position or if there is a loss of power.	Yes ❑ No ❑	
		E. A secondary backup brake is present.	Yes ❑ No ❑	
		F. The Operating lever is clearly marked, indicating all positions (raise, lower, neutral)	Yes ❑ No ❑	
		G. The operating lever returns to the neutral position when released by the winch operator.	Yes ❑ No ❑	
		H. Clutch mechanism has a means of preventing disengagement during operation.	Yes ❑ No ❑	
		I. Secondary means of power is available for the operation of the winch.	Yes ❑ No ❑	
		J. Winch is capable of accepting the full length of the wire being used.	Yes ❑ No ❑	
		K. Winch guards are fitted to the drum to prevent entanglement with clothing or other objects from with the machinery.	Yes ❑ No ❑	
		L. Level-winding component is part of the winch to ensure even spooling of bell wire and other man-rated winch wires.	Yes ❑ No ❑	
		M. Wire and umbilical are marked at designated intervals.	Yes ❑ No ❑	
		N. Emergency breathing apparatus with communications is available for winch operator.	Yes ❑ No ❑	
4	Main Lift Wires	A. Lift wires are non-rotating and designed and fit for purpose.	Yes ❑ No ❑	
		B. Connection of the bell wire has suitable retaining means for the removable pin.	Yes ❑ No ❑	
		C. Periodic inspection and lubrication is performed and documented for the main lifting wires.	Yes ❑ No ❑	
		D. Testing records and documentation are available for review.	Yes ❑ No ❑	
5	Secondary Means of Recovery	A. An independent secondary means of recovery is available for the bell.	Yes ❑ No ❑	
		B. Secondary means of recovery has the ability to position the bell where it can mate-up with the chamber system.	Yes ❑ No ❑	
		C. Winch meets man-riding requirements.	Yes ❑ No ❑	

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BELL LAUNCH AND RECOVERY SYSTEM (LARS) *cont'd.*

ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
6	Guide Wires	A. Guide wire system is fitted to restrict lateral or rotational movement of the bell in the water.	Yes ❑ No ❑	
		B. Guide wire winch is used as secondary means of bell recovery. (If yes, all of the requirements for man-riding and man-rated lifting equipment will apply.)	Yes ❑ No ❑	
7	Cross-haul System (Management of change study to insure safe operational practices are followed)	A. Testing records and documentation are available for review for the winch and its purpose.	Yes ❑ No ❑	
		B. Testing records and documentation are available for wire rope(s) and its purpose.	Yes ❑ No ❑	
8	Heave Compensation (This is only warranted in areas of extreme sea states or design parameter.)	A. A heave compensation system is fitted to the launch and recovery system (LARS).	Yes ❑ No ❑	
		B. Operating instructions are available at the dive control station.	Yes ❑ No ❑	
9	Lift Attachment Points	A. Main attachment point is of an approved and industry-recognized design (pad eye).	Yes ❑ No ❑	
		B. There is a secondary attachment point on the diving bell.	Yes ❑ No ❑	
		C. Testing records and documentation are available for review.	Yes ❑ No ❑	
10	Bell Clamp	A. Safety interlock system is fitted to clamping mechanism (bell and chamber).	Yes ❑ No ❑	
		B. Testing records and documentation are available for review.	Yes ❑ No ❑	
11	Hydraulic Unit	A. Hydraulic unit is in operational condition.	Yes ❑ No ❑	
		B. Testing and maintenance documents are available for review.	Yes ❑ No ❑	
12	Fire Suppression	Plans, equipment and procedures are in place for the suppression of fires in the area of LARS/handling system.	Yes ❑ No ❑	

DIVING BELL[2]

ITEM	DESCRIPTION	REQUIREMENT	RESPONSE	REMARK
1	PVHO (Bell)	A. Bell must be built and designed to a recognized code or class and fit for purpose.	Yes ❑ No ❑	
		B. Testing and inspection documents are available for review.	Yes ❑ No ❑	
2	Hatches	A. Hatches allow for free access to divers or personnel (even when resting on the sea floor or the deck).	Yes ❑ No ❑	
		B. Hatches can be secured in the open position.	Yes ❑ No ❑	
		C. Seals on mating faces are clean and free of damage.	Yes ❑ No ❑	
		D. All hatch seals and sealing surfaces should be inspected prior to pressurization.	Yes ❑ No ❑	
3	Viewports	A. Designed and fit for purpose.	Yes ❑ No ❑	
		B. Conforms to ASME/PVHO 1.	Yes ❑ No ❑	
		C. Free of scratches and cracks.	Yes ❑ No ❑	
		D. Testing and inspection documentation is available for review.	Yes ❑ No ❑	

DIVING BELL[2] *cont'd.*				
ITEM	**DESCRIPTION**	**REQUIREMENT**	**RESPONSE**	**REMARK**
4	Ballast Release System (NOTE: Not all bells are equipped with a ballast release system.)	A. Ballast weight system is designed to prevent accidental release. (Bell's physical position should not cause the ballast release system to be compromised.)	Yes ❑ No ❑	
		B. Weights are designed and fitted for release from inside of the bell.	Yes ❑ No ❑	
		C. Two independent actions must be performed to release the weights.	Yes ❑ No ❑	
		D. Fail safe is in place for systems that are operated pneumatically or hydraulically from being compromised by pressure changes internally or externally in the bell.	Yes ❑ No ❑	
		E. Testing and inspection documentation is available for review.	Yes ❑ No ❑	
5	Bell Buoyancy and Stability (Note: Not all bells are designed to be buoyant.)	A. Documentation of test for buoyancy and stability is available for review.	Yes ❑ No ❑	
6	Bell (External)	A. Manufacturer information and serial number are clearly visible on the outside of the bell.	Yes ❑ No ❑	
		B. Anodes are clearly visible and in satisfactory condition.	Yes ❑ No ❑	
		C. Paint and insulation is in good condition.	Yes ❑ No ❑	
		D. All penetrators are designed and fit for purpose.	Yes ❑ No ❑	
		E. All gas penetrators are fitted with devices to prevent catastrophic pressure loss.	Yes ❑ No ❑	
		F. All penetrators are clearly marked, indicating function.	Yes ❑ No ❑	
		G. All valves are marked indicating function.	Yes ❑ No ❑	
		H. Emergency manifold available.	Yes ❑ No ❑	
		I. Connections for emergency gas/hot water (in accordance with IMO).	Yes ❑ No ❑	
		J. A copy of emergency tapping code has been attached /posted on the bell externally.	Yes ❑ No ❑	
		K. The lift attachment point (pad eye) has been designed and it is fit for the purpose.	Yes ❑ No ❑	
		L. There is a secondary lift attachment point on the diving bell.	Yes ❑ No ❑	
		M. Testing and inspection documents for the lift attachment points (primary and secondary) is available for review.	Yes ❑ No ❑	
		N. Sufficient onboard gas is available (as mandated).	Yes ❑ No ❑	
		O. Testing and inspection documentation for the onboard gas cylinders is available for review.	Yes ❑ No ❑	
		P. Transponder and strobe are fitted to the bell for tracking its location.	Yes ❑ No ❑	
		Q. Testing and inspection documentation for the transponder is available for review.	Yes ❑ No ❑	
		R. External lights illuminating the bell (recommend 360 degrees).	Yes ❑ No ❑	
		S. External battery pack is available and fit for purpose.	Yes ❑ No ❑	
		T. Testing and inspection documentation for the external battery pack is available for review.	Yes ❑ No ❑	
		U. Testing and maintenance documentation for the all bell umbilicals is available for review.	Yes ❑ No ❑	

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DIVING BELL[2] *cont'd.*				
ITEM	**DESCRIPTION**	**REQUIREMENT**	**RESPONSE**	**REMARK**
7	Bell (Internal)	A. Bell volume accommodates the designed manning level according to class and or construction code.	Yes ❑ No ❑	
		B. Paint and internal insulation is in good condition.	Yes ❑ No ❑	
		C. All gas and electrical penetrators are designed and fit for purpose.	Yes ❑ No ❑	
		D. All penetrators are clearly labeled, indicating their function.	Yes ❑ No ❑	
		E. All valves are clearly labeled, indicating their function.	Yes ❑ No ❑	
		F. Bell is equipped with internal and external depth gauges.	Yes ❑ No ❑	
		G. Calibration documentation for the depth gauges is available for review.	Yes ❑ No ❑	
		H. Bell heating system is available for divers.	Yes ❑ No ❑	
		I. Hot water system is available for bell divers.	Yes ❑ No ❑	
		J. System for heating divers' gas is available.	Yes ❑ No ❑	
		K. Gas monitoring equipment to analysis bell atmosphere is available.	Yes ❑ No ❑	
		L. Testing and maintenance documentation for the bell gas monitoring system is available for review.	Yes ❑ No ❑	
		M.Bell equipped with CO_2 scrubber and spare canisters.	Yes ❑ No ❑	
		N. Adequate internal bell lighting.	Yes ❑ No ❑	
		O. All gas inlet piping is fitted with diffusers.	Yes ❑ No ❑	
		P. Bell occupants survival equipment.	Yes ❑ No ❑	
		Q. Inspection and maintenance documentation for bell occupants survival equipment are available for review.	Yes ❑ No ❑	
		R. Bell breathing gas supplies.		
		1. Gas cylinder pressures can be read from the inside of the bell.	Yes ❑ No ❑	
		2. Testing and inspection documents for onboard bell gas cylinders are available for review.	Yes ❑ No ❑	
		3. Secondary gas backup supply is independently available for bellman and divers.	Yes ❑ No ❑	
		4. A full-face mask or BIBS that can access gas from either primary or secondary bell gas supplies.must be available for all bell occupants.	Yes ❑ No ❑	
		5. System for monitoring and safe delivery of O_2 is available to prevent excess O_2 build-up.	Yes ❑ No ❑	
		S. Communications available between diving control and all divers/bellmen.		
		1. Through-water communications is available between the bell and dive control.	Yes ❑ No ❑	
		2. Sound-powered phone with growler or signaling device is available for communication between dive control and bell occupants.	Yes ❑ No ❑	
		3. Tapping Code is posted inside of Bell.	Yes ❑ No ❑	
		T. A system for recovery of an injured diver is available at the bell (block-nd-tackle with jam cleat).	Yes ❑ No ❑	

DIVING BELL[2] *cont'd.*				
ITEM	**DESCRIPTION**	**REQUIREMENT**	**RESPONSE**	**REMARK**
7	Bell (Internal)	U. First aid kit is equipped and fit for purpose.		
		1. Maintenance documents for the bell first aid kit are available for review.	Yes ❑ No ❑	
		V. Seating for bellmen is fitted with restraining harness.	Yes ❑ No ❑	
		W. Divers' umbilicals are in certification and fit for use.	Yes ❑ No ❑	
		X. bell emergency procedures manual is available for reference by bell occupants.	Yes ❑ No ❑	

LIFE-SUPPORT CONTROL CENTER (LSCC)				
ITEM	**DESCRIPTION**	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	All manuals and written procedures are available for use and review.		Yes ❑ No ❑	
2	Logs and other required sheets are available for use and review.		Yes ❑ No ❑	
3	Environment	1. Lighting in the LSCC is fit for use.	Yes ❑ No ❑	
		2. LSCC atmosphere and temperature are suitable and fit for use.	Yes ❑ No ❑	
		1. All communications are hard-wired.	Yes ❑ No ❑	
		2. Two-way communications between LSCC and all compartments within the saturation complex.	Yes ❑ No ❑	
		A. Secondary back-up communications available.	Yes ❑ No ❑	
4	Communications	3. Two-way communications are available between LSCC and diving control.	Yes ❑ No ❑	
		4. Two-way communications are available between all food locks (exterior) and LSCC.	Yes ❑ No ❑	
		5. Two-way communications are available between the LSCC and emergency evacuation system (EES).	Yes ❑ No ❑	
		6. Maintenance documents for communications are available for review.	Yes ❑ No ❑	
		1. Life-support panel is fitted with gauges to monitor the depth of all compartments in the saturation complex.	Yes ❑ No ❑	
		2. Life-support panel is fitted with gauges to monitor the gas supply pressures.	Yes ❑ No ❑	
5	Gauges	A. Gauges are fitted to show the line pressures coming in and also leaving the panel.	Yes ❑ No ❑	
		B. Panel cross-over valves are designated and fit for purpose and does not compromise accurate gas readings.	Yes ❑ No ❑	
		C. Gauges are clearly labeled with date of calibration.	Yes ❑ No ❑	
6	Panel Pipework/Valves	1. All pipework and valves must be designed and fit for purpose.	Yes ❑ No ❑	
		2. Testing and inspection documents for pipework and valves are available for review.	Yes ❑ No ❑	

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LIFE-SUPPORT CONTROL CENTER (LSCC) *cont'd.*				
ITEM	**DESCRIPTION**	**REQUIREMENT**	**RESPONSE**	**REMARK**
7	LSCC Electrical Equipment	1. Emergency lighting available and fit for purpose.	Yes ❑ No ❑	
		2. All warnings and labels for electrical equipment are displayed.	Yes ❑ No ❑	
		3. Testing and maintenance documentation for LSCC electrical equipment is available for review.	Yes ❑ No ❑	
8	LSCC Fire-suppression System	1. Fire-suppression system for the LCSS is designed and fit for purpose.	Yes ❑ No ❑	
		2. Testing and inspection documentation for the LSCC fire-suppression system is available for review.	Yes ❑ No ❑	
9	First Aid Kit	1. First aid kit is available and fit for purpose.	Yes ❑ No ❑	
		2. Maintenance documents for the LSCC first aid kit are available for review.	Yes ❑ No ❑	
10	Breathing Apparatus	1. Emergency breathing apparatus, fitted with communications is available for all personnel assigned to the LSCC.	Yes ❑ No ❑	
		2. Maintenance and inspection documentation for the LSCC.	Yes ❑ No ❑	
11	Alarms	1. Vessel and facility alarms are audible and linked to LSCC.	Yes ❑ No ❑	
		2. Oxygen analyzer with (audio/visual) high/low alarm must be fitted in the LSCC.	Yes ❑ No ❑	
		3. Testing and inspection documentation for the LSCC oxygen alarms and analyzers are available for review.	Yes ❑ No ❑	
12	Video Monitoring	Video monitoring and recording of the entire saturation complex is available for personnel in the life-support control center (LSCC).	Yes ❑ No ❑	
13	General Atmosphere and Temperature Monitoring	1. CO_2 analyzers are fitted throughout the saturation complex and monitored in the LSCC.	Yes ❑ No ❑	
		2. Primary backup CO_2 analyzers are fitted throughout the saturation complex and monitored in the LSCC.	Yes ❑ No ❑	
		3. O_2 analyzers are fitted throughout the saturation complex and monitored in the LSCC.	Yes ❑ No ❑	
		4. Primary backup O_2 analyzers are fitted throughout the saturation complex and monitored in the LSCC.	Yes ❑ No ❑	
14	System Gas Supplies	1. Primary and secondary gas supplies are available for all compartments of the saturation complex at all times.	Yes ❑ No ❑	
		2. Primary and secondary gas supplies are independently set up to provide breathing gas to the diver, bell and all chamber compartments.	Yes ❑ No ❑	
		3. Metabolic O_2 make-up system must be designed and fit for purpose.	Yes ❑ No ❑	
		4. Metabolic O_2 make-up system is fitted with a fail-safe to ensure safe flow and delivery.	Yes ❑ No ❑	
		5. System is in place for the delivery of treatment gas (via BIBS) to bell occupants and all occupants in the saturation complex.	Yes ❑ No ❑	

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MAIN BELL UMBILICAL			
ITEM	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	1. Main ell umbilical is designed and fit for purpose.	Yes ❑ No ❑	
	2. Testing and inspection documents for the main bell umbilical are available for review.	Yes ❑ No ❑	
	3. Main bell umbilical deployment system is designed and fit for purpose.	Yes ❑ No ❑	
	4. Umbilical winch is fitted with a fail-safe that suspends the paying out of the umbilical when it is at rest or in neutral.	Yes ❑ No ❑	
	5. Testing and maintenance documents for the umbilical winch are available for review.	Yes ❑ No ❑	
	6. Main bell umbilical is attached to the bell with a strain relief system.	Yes ❑ No ❑	

DIVER HEATING SYSTEM			
ITEM	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	**Hot water system for divers is designed and fit for purpose.**		
	1. A secondary backup hot water system is available.	Yes ❑ No ❑	
	2. Testing and maintenance documentation is available for review (gauge calibration, electrical, pressure vessels, etc.).	Yes ❑ No ❑	
	3. Dive control has indication displays of the temperature of the hot water supplied to the diver.	Yes ❑ No ❑	
	4. Alarm system is fitted to the system to alert dive control if temperature limits have been compromised (Hi-Lo/audio/visual).	Yes ❑ No ❑	
	5. Hot water system is located in an area that will not pose a risk of fire or contamination of breathing air (compressors).	Yes ❑ No ❑	
	6. Hot water system is fitted with spill tray, when required.	Yes ❑ No ❑	
	7. Fuel tank is designed to mitigate accidental overflow, when required.	Yes ❑ No ❑	
	8. Fire suppression system and procedures are in place in the event of fire.	Yes ❑ No ❑	
	9. Testing and maintenance documentation for fine suppression equipment is available for review.	Yes ❑ No ❑	

DIVING UMBILICAL(S)			
ITEM	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	**Diving umbilicals are designed and fit for purpose.**		
	1. Umbilical are properly marked for visual identification of the amount paid out.	Yes ❑ No ❑	
	2. Standby diver/bellman's umbilical is greater in length than the primary diver's.	Yes ❑ No ❑	
	3. Procedures for bell and surface umbilical management are available for review.	Yes ❑ No ❑	
	4. Testing, maintenance and inspection documents for diving umbilicals are available for review.	Yes ❑ No ❑	
2	**Diver-Worn Emergency Gas Supply (Bailout Bottle/Emergency Rebreather)**		
	1. Diverworn emergency gas supply for all bell occupants.	Yes ❑ No ❑	
	2. EGS is designed and fit for purpose (4-minute minimum EGS duration for deepest depth of dive).	Yes ❑ No ❑	
	3. All EGS cylinders/SLS are marked with the name and mixture percentages.	Yes ❑ No ❑	
	4. Testing and inspection documents for cylinders /SLS are available for review.	Yes ❑ No ❑	
3	**Whips and Connectors for EGS and Helmets**		
	1. Fittings and connections are fit for purpose (as recommended by manufacturer).	Yes ❑ No ❑	
	2. Testing and maintenance documents for whips and connectors are available for review.	Yes ❑ No ❑	

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COMPRESSORS AND PUMPS

ITEM	REQUIREMENT	RESPONSE	REMARK
1	**Compressor is designated and fit for purpose**		
	1. Compressors are located in accessible area for dive team personnel.	Yes ❑ No ❑	
	2. Testing, maintenance (filters, etc.) and operation documentats for all pumps and compressors are available for review.	Yes ❑ No ❑	
	3. Fire-suppression system and procedures are available in the event of a fire.	Yes ❑ No ❑	
	4. Testing and inspection documentation for fire-suppression equipment are available for review.	Yes ❑ No ❑	
	5. Compressors are equipped with safety devices.	Yes ❑ No ❑	
	a. Solenoid switches.	Yes ❑ No ❑	
	b. Relief valves.	Yes ❑ No ❑	
	c. Other manufacturer-recommended or supplied safety devices.	Yes ❑ No ❑	

AIR AND GAS RECEIVERS

ITEM	REQUIREMENT	RESPONSE	REMARK
1	**All air and gas receivers are designed and manufactured to a recognized code and fit for a purpose.**	Yes ❑ No ❑	
	1. Testing and inspection documentation is available for review.	Yes ❑ No ❑	

ELECTRICAL SUPPLIES

ITEM	REQUIREMENT	RESPONSE	REMARK
1	**All electrical supplies and equipment are designed and fit for purpose.**	Yes ❑ No ❑	
	1. Testing and inspection documentation is available for review.	Yes ❑ No ❑	

EXTERNAL ENVIRONMENTAL CONTROL UNIT

ITEM	REQUIREMENT	RESPONSE	REMARK
1	**All components of the external environmental control unit are designated and fit for purpose.**	Yes ❑ No ❑	
	1. Testing and inspection documentation is available for review.	Yes ❑ No ❑	

012975

INDIVIDUAL DIVING EQUIPMENT			
ITEM	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	**Helmets**		
	1. Helmets are labeled with unique serial number (as recommended by manufacturer).	Yes ❑ No ❑	
	2. Helmets are designed and fit for purpose.	Yes ❑ No ❑	
	3. Testing, maintenance and inspection documents are available for review.	Yes ❑ No ❑	

HIGH-PRESSURE GAS STORAGE			
ITEM	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	1. Sufficient quantities of gas are available for the scope of work to be performed, plus other required medical and emergency backup supplies.	Yes ❑ No ❑	
	2. Gas supplies are located in an area of minimal risk of damage to cylinders.	Yes ❑ No ❑	
	3. All cylinders are label with name and percentage of contents.	Yes ❑ No ❑	
	4. Cylinders containing 25% O_2 or greater are stored in a vented area, free of fire hazards.	Yes ❑ No ❑	
	5. Enclosed locations containing HP gas are fitted with:	Yes ❑ No ❑	
	a. O_2 analyzer with a HI /LOW alarm.	Yes ❑ No ❑	
	b. Hazard signs.	Yes ❑ No ❑	
	c. Lights and remote alarm to the vessel bridge and dive control.	Yes ❑ No ❑	
	d. Emergency air packs are available.	Yes ❑ No ❑	
	e. External condition of cylinders is free from rust and corrosion.	Yes ❑ No ❑	
	f. Testing and inspection documents are available for review.	Yes ❑ No ❑	
	g. Gas cylinders.	Yes ❑ No ❑	
	h. Pressure vessels.	Yes ❑ No ❑	
	i. Valves and pipe work.	Yes ❑ No ❑	
	j. Relief valves and bursting discs exhaust gas to a safe area.	Yes ❑ No ❑	
	k. Analyzers.	Yes ❑ No ❑	
	l. Fire suppression for HP gas storage.	Yes ❑ No ❑	
	m. Fire-suppression system and procedures are available in all areas where HP gas is stored.	Yes ❑ No ❑	
	n. Fire-detection systems are fitted in unmanned and enclosed areas where HP gas is stored.	Yes ❑ No ❑	
	o. Testing, maintenance and inspection documentation is available for review.	Yes ❑ No ❑	
	p. Updated records are maintained of the contents and pressures of each cylinder or bank/quad of gas.	Yes ❑ No ❑	
	q. Gas mixes of O_2 that are 25% or greater.	Yes ❑ No ❑	
	r. Dedicated compressors and pumps are available for these mixtures.	Yes ❑ No ❑	
	s. Valves used are slow opening (needle or stem) valves.	Yes ❑ No ❑	
	t. Hard piping is fitted for the delivery of the gas.	Yes ❑ No ❑	

GAS RECLAIM (DIVER)[2]			
ITEM	REQUIREMENT	RESPONSE	REMARK
1	**Reclaim system is designed and fit for purpose.**	Yes ❑ No ❑	
	1. All helmets and masks designated for use with the gas reclaim system are designed and fit for purpose.	Yes ❑ No ❑	
	2. Compressors and pumps used as parts of the gas reclaim system are designed and fit for purpose.	Yes ❑ No ❑	
	3. Gas reclaim system is located in the dive control center.	Yes ❑ No ❑	
	4. Audio/visual Hi/Low alarm is fitted on the gas reclaim panel.	Yes ❑ No ❑	
	5. Operating procedures for the gas reclaim system are available in the dive control center.	Yes ❑ No ❑	
	6. Gas reclaim system is fitted with an O_2 flow control device to prevent exceeding established metabolic consumption levels.	Yes ❑ No ❑	
	7. O_2 and HeO_2 flow control are fitted with a fail-safe in the event of power failure.	Yes ❑ No ❑	
	8. Gas analyzers:	Yes ❑ No ❑	
	a. O_2 analyzer with hi /low alarm is fitted on the downstream supply to the diving bell at the dive control center.	Yes ❑ No ❑	
	b. CO_2 analyzer with hi /low alarm is fitted on the downstream supply to the diving bell at the dive control station (completely independent of the O_2 analyzer).	Yes ❑ No ❑	
	c. Testing, maintenance and calibration documentation for all gas analyzers is available for review.	Yes ❑ No ❑	

012977

EMERGENCY EVACUATION SYSTEM[3] (HYPERBARIC RESCUE CHAMBER/SELF-PROPELLED HYPERBARIC LIFE BOAT)			
ITEM	REQUIREMENT	RESPONSE	REMARK
GAS RECLAIM SYSTEM AND PURIFICATION (CHAMBER)			
ITEM	REQUIREMENT	RESPONSE	REMARK
1	**Gas Bags**		
	1. Bag for recovering gas is located in an area that allows for full inflation.	Yes ❑ No ❑	
	2. Over-inflation alarm and monitor are fitted available at the dive control center.	Yes ❑ No ❑	
	3. A relief valve or bursting disc is in place for possible over-inflation of the bag.	Yes ❑ No ❑	
	4. Testing, maintenance and inspection documentation for the gas bags, relief valves, and bursting discs is available for review.	Yes ❑ No ❑	
2	**O_2 and CO_2 Analyzers**		
	1. O_2 and CO_2 analyzers are fitted in the gas reclaim system for the chamber.	Yes ❑ No ❑	
	2. Testing, maintenance and inspection documentation for the chamber reclaim system is available for review.	Yes ❑ No ❑	
3	**Compressors and pumps for chamber gas reclaim systems are designed and fit for purpose.**		
	1. Testing, maintenance and inspection documentation is available for review.	Yes ❑ No ❑	
4.	**Pipe-work/Valves**		
	1. All valves are clearly labeled.	Yes ❑ No ❑	
	2. All valves are operable and free of corrosion.	Yes ❑ No ❑	
	3. Testing and inspection documentation is available for review.	Yes ❑ No ❑	
5	**Cylinders Containing Used Gas**		
	1. Cylinders are clearly marked.	Yes ❑ No ❑	
	2. Testing and inspection documentation is available for review	Yes ❑ No ❑	
6	Operating instructions for the chamber reclaim system are available at the dive control center.	Yes ❑ No ❑	

EMERGENCY EVACUATION SYSTEM[3] (HYPERBARIC RESCUE CHAMBER/SELF-PROPELLED HYPERBARIC LIFE BOAT)			
ITEM	**REQUIREMENT**	**RESPONSE**	**REMARK**
1	List the type of dedicated EES fitted to the system. (NOTE: The system diving bell **cannot** be used as the EES.)		
	1. EES is designed and fit for purpose.	Yes ❑ No ❑	
	2. Deployment drills documentation for the EES and applicable LARS is available for review (minimum one deployment annually is required, ADCI CS 6th Ed.)	Yes ❑ No ❑	
	3. EES is clearly marked in accordance with international, flag state or regulatory requirements.	Yes ❑ No ❑	
	4. EES has been float tested, as outlined in ADCI CS 6th Ed. (annually or when system undergoes modification).	Yes ❑ No ❑	
	5. There is a dedicated hardwire two-way voice communication system between the EES and the dive control center.	Yes ❑ No ❑	
	6. A copy of the emergency tapping code is indelibly posted on the EES both internally and externally.	Yes ❑ No ❑	
	7. Locator devices are:		
	a. Fitted with strobe light.	Yes ❑ No ❑	
	b. Fitted with distress beacon.	Yes ❑ No ❑	
	c. Fitted with radar reflector.	Yes ❑ No ❑	

012979

EMERGENCY EVACUATION SYSTEM[3] (HYPERBARIC RESCUE CHAMBER/SELF-PROPELLED HYPERBARIC LIFE BOAT)			
ITEM	REQUIREMENT	RESPONSE	REMARK
	8. EES gas supply has:		
	a. O_2 and other life support gas required, based on operational parameters; onboard to support the number of occupants for a period of 72 hours at metabolic oxygen consumption rate.	Yes ❑ No ❑	
	9. A primary and secondary means to remove CO_2 from the EES atmosphere (e.g. battery and lung-powered).	Yes ❑ No ❑	
	10. EES has onboard batteries to meet the demand of the electrical load for 72 hours.	Yes ❑ No ❑	
	11. EES has a suitable first aid kit (containing sea sickness tablets) in a suitable container that is clearly marked and accessible.	Yes ❑ No ❑	
	12. ESS is capable to transfer supplies and equipment under pressure.	Yes ❑ No ❑	
	13. EES has a detailed written procedure for evacuation and deployment available at the dive control center.	Yes ❑ No ❑	
	14. Connected to the saturation system and pressurized to shallower storage depth as a minimum (during all diving or decompression operations).	Yes ❑ No ❑	
	15. Compatible life-support control system (LSCS) is available within 24 hours (maximum) of the EES location.		
	a. LSCS is stored at a different location than the saturation system.	Yes ❑ No ❑	
	16. EES LSCS contains:		
	a. Two-way communications with the EES and sound-powered phones with growler.	Yes ❑ No ❑	
	b. Gas control panels.	Yes ❑ No ❑	
	c. Gas suitable for maintaining depth.	Yes ❑ No ❑	
	d. Emergency gas for BIBS.	Yes ❑ No ❑	
	e. Fitted with O_2 and CO_2 analyzers.	Yes ❑ No ❑	
	f. Written copy of procedures.	Yes ❑ No ❑	
	17. Shall have a means to recover and tow.	Yes ❑ No ❑	
	18. Gas cylinders on the EES are labeled with contents.	Yes ❑ No ❑	
	19. Testing and inspection documentation is available for review.	Yes ❑ No ❑	
	20. EES (External)		
	a. Paint work is free from corrosion and rust.	Yes ❑ No ❑	
	b. Seals on mating faces are clean and undamaged.	Yes ❑ No ❑	
	c. Viewports are free of cracks or scratches in accordance with ASME/PVHO 2.	Yes ❑ No ❑	
	d. Testing and certification documents for viewports are available for review.	Yes ❑ No ❑	
	e. All hollow and electrical penetrators are designed and fit for purpose.	Yes ❑ No ❑	
	f. Valves are labeled and free from rust and corrosion.	Yes ❑ No ❑	
	21. EES (Internal)		
	a. Paint work is free from rust and corrosion.	Yes ❑ No ❑	
	b. Seals on mating faces are clean and undamaged.	Yes ❑ No ❑	
	c. Valves are labeled and free from rust and corrosion.	Yes ❑ No ❑	
	d. Valve in EES are secured in the open or closed position.	Yes ❑ No ❑	
	e. All penetrators are labeled.	Yes ❑ No ❑	
	f. All hollow penetrators are fitted with devices to prevent loss of pressure.	Yes ❑ No ❑	

EMERGENCY EVACUATION SYSTEM³ *cont'd.* (HYPERBARIC RESCUE CHAMBER/SELF-PROPELLED HYPERBARIC LIFE BOAT)			
ITEM	REQUIREMENT	RESPONSE	REMARK
	g. All gas inlets are equipped with diffusers.	Yes ❑ No ❑	
	h. EES is equipped with overboard-dump type BIBS for each occupant, plus one spare.	Yes ❑ No ❑	
	i. Lighting is sufficient enough for reading of gauges and surveillance from the outside.	Yes ❑ No ❑	
	j. Toilet must be designed and fit for purpose, with safety interlock.	Yes ❑ No ❑	
	k. EES Doors/Hatches:		
	i. Are capable of being opened from either side.	Yes ❑ No ❑	
	ii. Are able to be secured in the open position.	Yes ❑ No ❑	
	iii. Are fitted with a means of pressure equalization.	Yes ❑ No ❑	
	l. EES is fitted with seating restraints for all occupants.	Yes ❑ No ❑	
	m. Fire-suppression system is available for easy access by EES occupants.	Yes ❑ No ❑	
	n. Testing and inspection documents for the EES fire-suppression system are available for review.	Yes ❑ No ❑	
	o. Minimum 1 gallon of drinking water is available for each EES occupant.	Yes ❑ No ❑	
	p. EES provisions are provided as outlined by IMO.	Yes ❑ No ❑	
	q. Procedures are in place for maintaining adequate temperature and atmosphere in the EES.	Yes ❑ No ❑	
	r. A suitable means is available to remove CO2 from the EES atmosphere for at least 72 hours.	Yes ❑ No ❑	
	s. ECU is fitted to the EES.		
	i. ECU is capable of providing heating, cooling, and CO2 scrubbing, humidity control.	Yes ❑ No ❑	
	t. EES is equipped with a depth gauge.	Yes ❑ No ❑	
	u. Calibration labels and documents for the EES depth gauge are available for review.	Yes ❑ No ❑	
	22. Launch and recovery systems (LARS) for EES:		
	a. Designed and fit for purpose, meeting SOLAS and class requirements.	Yes ❑ No ❑	
	b. Detailed and written procedures for the EES LARS are easily accessible and available for review.	Yes ❑ No ❑	
	c. LARS is rated and capable of handling the EES and its occupants.	Yes ❑ No ❑	
	d. Secondary backup LARS is available.	Yes ❑ No ❑	
	e. Testing, maintenance and inspection documents for LARS are available for review.	Yes ❑ No ❑	
	23. Connection of the EES to the saturation complex:		
	a. Safety interlock system is fitted to the clamping mechanism between the EES flange and the flange on the connection to the saturation chamber/complex.	Yes ❑ No ❑	
	b. Testing and maintenance documents of the safety interlock system are available for review.	Yes ❑ No ❑	

012981

PRE-DIVE SAFETY CHECKLIST

(Rev. 28 June 2007)

Please **print** all information.

Date: ______________________ Time: _________________ Job Number: _________________________________

Location: ____ Vessel/Platform: ______________________________

Person(s) Performing Safety Check:

Name____Title ____

Name____Title ____

Dive Team Members and Assignments:

Name____Title ____

Name____Title ____

Name____Title ____

Name____Title ____

(All personnel assigned to the dive team should have a valid ADCI Certification Card on record.)

Place a check next to each item and record all applicable information.

DIVE STATION REQUIRED DOCUMENTATION:

JHA: _______Tables/Schedules: _______ Dive Safety Manual: ___________ Emergency Contacts and information: _____________

DIVE STATION EQUIPMENT AND SYSTEMS

First Aid Kit/First Aid Procedures ________________ **Defibrillator/Bag Type Manual Resuscitator** _________________________
(Required by ADCI/USCG) (Required by ADCI/USCG)

012982

Primary Breathing Gas **Air** ______________________ **HeO_2** ____________ (%________)

Compressor(s) Fluids/Fuel/Filters: ______________________________

(Standby Air) Compressed Air Banks/Bottle

Pressure (PSI/Bar) ________________________ Check on Delivery and Activation of Gas _______________Valves______________

Gas Supply

HeO_2: Number of Banks/Bottles: ________________ Online Pressure (PSIG/Bar): ________________

50/50: Number of Banks/Bottles: ________________ Online Pressure (PSIG/Bar): ________________

O2: Number of Banks/Bottles: ________________ Online Pressure (PSIG/Bar): ________________

Air: Number of Banks/Bottles: ________________ Online Pressure (PSIG/Bar): ________________

Bailout: Air: ________________ HeO_2 _____ (%_____)

COMMUNICATIONS: ______________________________ (Ensure all communications are hooked up and tested.)

Two-way communications on site for emergencies: ______________________________ (Required by ADCI/USCG)

CHAMBER(S): ___________________________________

All gas is hooked up and delivery tested: _________________ O_2 online: _____ (PSIG/Bar: _____)

BIBS and backup BIBS: ___________________________ Backup gas supply ready for delivery: ______________________

GAUGES

Calibrated: _____
(Required by ADCI/USCG)

Verifying Documentation: _____
(Required by ADCI/USCG)

ALPHA FLAGS/DAY SHAPES/NIGHT LIGHTS: ____________________________ (Required by ADCI/USCG)

DIVE LADDER: ____________________________ (Ensure that it is secured to vessel/platform and in a safe location.)

BELL/STAGE: ___________________________________ (Ensure that all breathing gasses and delivery systems have been checked.)

Compressed Air (PSIG/Bar: ____________) HeO_2 (PSIG/Bar: ___________) 50/50 (PSIG/Bar: ______________)

012983

DIVE HOSES/UMBILICALS: ____________________ (Check all diving hoses for proper hook-up, staging and serviceability.)

HELMETS AND MASKS: ____________________ (Ensure that all helmets and masks have undergone pre-dive checks and are in compliance with manufacturer's inspection guidelines.)

HARNESSES: ____________________ (Check for serviceability.)

BAILOUTS/REGULATORS: ____________________ (Ensure that EGS has been activated at the bottle; bailout check and hose pressurization prior to water entry.)

HARNESSES: ____________________ (Check for serviceability.)

Note: Hardhats, safety glasses, steel-toed boots and personal floatation devices adequate for the project are required by ADCI/USCG.

COMMENTS: ____________________

____

____

Signature(s) of Person(s) Completing Safety Checklist: ____________________

____

Name of Designated Person-in-Charge/Supervisor: ____________________
(Required by ADCI/USCG) (PRINT)

DPIC / Supervisor's Signature: ____________________

012984

SECTION 11.0

REFERENCE MATERIALS

Association of Diving Contractors International, Inc.

012985

11.1 GLOSSARY OF TERMS

ACFM (acfm)

Actual cubic feet per minute. Refers to the actual volume of gas supplied to a diver, bell, etc., at ambient pressure.

ALST

Assistant Life Support Technician

Ambient Pressure

The surrounding pressure at depth (actual or simulated, in a hyperbaric chamber) to which the diver, bell, etc., is subjected.

Appropriate Breathing Mix

A breathing mixture that, having regard to the system and equipment used in the diving operations, the work undertaken in those operations, and the conditions in which and the depth at which they are to be carried out, is suitable in content and temperature and of adequate pressure.

Ascent Times

The time interval between leaving the bottom when the dive is terminated and reaching the surface.

ATA (ata)

Atmosphere absolute. Total pressure, including atmospheric, to which a diver, bell, etc., is subjected.

ATM (atm)

Atmospheric (atm) unit equivalent to 14.7 psi or 760 (mm) of mercury.

Bailout Bottle (EGS)

See **Diver-Worn or Carried Emergency Gas Supply.**

Bar

A unit of pressure equal to 1 atmosphere (atm).

Bell (Open Bell and Closed Bell)

An enclosed compartment, pressurized (closed bell) or un-pressurized (open bellm also known as Wet Bell), that allows the diver to be transported to and from the underwater work area and that may be used as a temporary refuge during diving operations.

Bends

See **Decompression Sickness**.

BIBS

Built-in breathing system. A breathing gas system built into all deck chambers and SDCs by which emergency breathing gas or a treatment gas can be supplied to the diver through an oral-nasal mask or hood.

Bottom Time

The total elapsed time, measured in minutes, from the time that the diver leaves the surface in descent to the time that the diver begins ascent.

Breathing System

Device or apparatus for delivering appropriate breathing mixture.

Bursting Pressure

The pressure at which a pressure containment device would fail structurally.

012986

Cleaned for Oxygen Service

Cleaning of equipment or system to ensure elimination of all hydrocarbons and other potentially dangerous contaminants when system is to be used in oxygen service. See also **Oxygen Cleaning.**

CNS

Central nervous system.

Commercial Diver

An individual who has applied for and been awarded a certification card or other document recognized to reflect the formal training, field experience, on-the-job performance and capabilities of the individual.

Compressor

A machine that raises air or other gasses to a pressure above 1 atmosphere.

CPR

Cardio-pulmonary resuscitation. A combination of artificial respiration and artificial circulation.

Cylinder

A pressure vessel for the storage of gasses.

DDC

Deck decompression chamber, PVHO (pressure vessel for human occupancy). A deck chamber capable of controlled pressurization and depressurization.

Decompression

Releasing from pressure or compression following a specific decompression table or procedure during ascent; ascending in the water or experiencing decreasing pressure in the chamber.

Deck Decompression Chamber

A hyperbaric chamber which is an integral part of a deep diving system, located on a surface platform from which diving is conducted.

Decompression Chamber

An enclosed space used to gradually decrease pressure to which a diver is exposed from ambient underwater pressure back to 1 atmosphere.

Decompression Schedule

A time-depth profile with a specific bottom time and depth, whose application is calculated to safely reduce the pressure on a diver.

Decompression Sickness (DCS or DCI)

A condition with a variety of symptoms that causes the formation of bubbles of gas in the blood or other tissues of the diver during or subsequent to ascent or other pressure reduction.

Decompression Table

A set of decompression schedules developed and available from a recognized source of expertise (such as the U.S. Navy) or developed by a recognized diving physiologist on behalf of a company. Such table must have been thoroughly field tested and evaluated before being used in operational practice.

Design Working Pressure of the System

The lowest pressure rating of any component of the system.

Differential Pressure (Delta P)

Occurs when there is suction of water, or where water moves from an area of high pressure to one of low pressure. This flow may be the result of the movement of water under its own weight or an active process involving powered machinery (e.g., pumps or thrusters).

Dive Location

The vessel or other structure from which dives are conducted and supported. More specifically, the point from which the actual dive is controlled.

Dive Station

The site from which diving operations are directly controlled. This site shall also include any auxiliary or peripheral equipment necessary to the conduct of the diving operation.

Dive Team

Tender/divers, divers and diver support personnel involved in a diving operation, including the diving supervisor.

Diver's Indicator Light

A light attached to a diver for the purpose of indicating the position of the diver when he or she is on the surface of the water.

Diver-Worn or Carried Emergency Gas Supply (Bailout)

The gas required to be worn/carried by the diver, while underwater.

Diving Bell

A tethered underwater underwater support system providing life-support services and used to transport divers.

Diving Harness

The combination of straps and fasteners used to attach equipment and umbilical to the diver that can be utilized as a lifting point to remove the diver from the water in the event of an emergency.

Diving Operations

Any work operation requiring some type of diving or work underwater that involves planned human exposure to increased pressures to perform the job.

Diving Operating Personnel

Any member of the dive team whose activities are regularly scheduled as necessary to conduct diving operations at or from the dive station.

Diving Superintendent

A superintendent or designated diving supervisor having complete responsibility for the safety of the diving operation, including responsibility for the safety and health of all diving personnel.

Diving Supervisor

An individual who, through training, experience, demonstrated competency, and certification, is appointed as the person responsible for executing the diving operation, ensuring the safety protocols are followed, and ensuring the overall safety of the diving operation.

DMT

Diver medical technician.

DPIC

Designated person in charge.

DPO

Dynamically position operator. The operator of a dynamically positioned vessel.

DP Vessel

Dynamically positioned vessel. A vessel that, through a computer controlled system, automatically maintains its position and heading by using its thrusters and propellers.

Dual-lock Chamber

Multi-lock deck decompression chamber.

Dry Suit

A diving suit designed to exclude water from the surface of the body.

DSV

Dive spport vessel.

Dynamic Positioning (DP)

A system that automatically controls a vessel's position and heading by means of thrusters. A typical DP system consists of a control system (including power management and position control), reference systems (such as position, heading, and environmental references) and power systems (including power generation, distribution and consumption. There are many different levels of redundancy for DP systems. DP 2 is the minimum required for diving operations.

EES

Emergency evacuation system (i.e., HRC or SPHL).

EGS

Emergency gas supply (bailout).

Embolism

See **Gas Embolism.**

Excursion Tables

Two tables for use with saturation excursion diving that limit upward and downward excursions and provide a zone in which the diver can move freely without regard to the number of excursions or their duration without incurring a decompression penalty.

Exhaust Valve

A valve controlling the venting of gas from any higher pressure source such as a DDC, diver's helmet, suit, buoyancy system, volume tank, etc.

FMEA

Failure modes and effect analysis. This is a methodology used to identify potential failure modes, determine their effects and identify actions to mitigate the failures.

FSW (fsw)

A foot of seawater. A unit of pressure at sea level generally defined as representing the pressure exerted by a foot of seawater having a specific gravity of 1.027, and is equal to approximately 0.445 pounds per square inch.

Gas Embolism

A condition caused by expanding gasses that have been taken into and retained in the lungs while breathing under pressure, being forced into the bloodstream or other tissues during ascent or decompression.

GFCI (GFI)

A ground fault circuit interrupter attached to the topside AC power source having receptacles, any of which may be attached to underwater cables supplying power to tools or lighting.

HAZID

Hazard identification

Helium Unscrambler — Unscrambler — Speech Unscrambler

An electronic device designed to render intelligible the words spoken in a helium hyperbaric environment.

High-pressure Nervous Syndrome (HPNS)

A group of symptoms, including a lack of coordination, tremors of the extremities, disorientation, nausea, dizziness, and brief lapses of consciousness occurring at depths of 500 feet or deeper.

HPU

Hydraulic power unit.

HIRA

Hazard identification and risk assessment

HRC

Hyperbaric rescue chamber.

HRV

Hyperbaric rescue vessel (SPHL)

Hyperbaric Conditions

Pressure conditions in excess of surface pressure.

Hyperbaric Reception Facility

A place to which evacuated saturation divers can be safely transported under pressure in either HRC or SPHL and transferred under pressure to other pressure vessels specifically intended to support the decompression of divers.

Hypothermia

Profound loss of body heat.

JHA (JHA, JHEA, SJA, TRA)

Job hazard analysis. Also called Job safety analysis, job hazard, evaluation analysis, and task risk assessment.

LARS

Launch and recovery system.

Liveboating

Liveboating is a diving technique where a single surface-supplied diver performs work underwater while his hose is being tended from the bow of a vessel and while the vessel is being manually operated by the vessel master and is underway using its main propulsion system.

Life-support Control System (LSCS, LSP)

Fly-away support package with gas and facilities for EES system's life support and/or decompression of saturation divers in an emergency. A system designed for the support of deployed Emergency evacuation systems (HRC or SPHL). Also known as Life support package (LSP).

LP

Low pressure (less than 500 PSI).

LSS

Life support supervisor

LST

Life-support technician/rack operator. Responsible for safe operation of hyperbaric system chambers; reports to diving supervisor.

MOC - Management of Change

A formal process by which changes to normal operations procedures and/or policies are managed.

Manifold

Panel for the distribution of diver breathing gas.

Manifold Operator

Individual, such as an LST, diving supervisor or mixed-gas diver, who is designated to perform the duties of gas distribution on a surface-supplied mixed gas (HeO_2) diving operation, who is experienced and trained in the operation of the manifold, and whose primary responsibility is to operate the manifold.

Master

Normally considered to be the person in charge of a marine asset.

MAWP

Maximum allowable working pressure. See **Maximum Working Pressure**.

Maximum Working Pressure

The maximum pressure to which a pressure containment device can be exposed under operating conditions.

Med-lock

A lock located in the inner lock of a hyperbaric chamber, to facilitate the transfer of medical supplies, food or other articles between the chamber occupants and personnel outside.

Mixed-Gas Diving (HeO_2)

A surface diving technique in which the diver is supplied with a bottom mix of helium and oxygen.

MSW

Meters of sea water.

NDT

Non-destructive testing

Nitrox (Enriched Air) Diving

A diving technique in which the diver is supplied a bottom mix of nitrogen, plus oxygen in excess of 21%.

No-decompression Diving

Diving that involves depths and times shallow and short enough so that the ascent can be made to the surface without water stops or subsequent chamber decompression.

Non-return Valve (Check Valve)

A one-way check valve installed in a fluid or gas system to permit flow in one direction only. All diving helmets must have a non-return valve at the gas supply inlet to prevent depressurization of the helmet and the resultant squeeze, should the gas supply be lost.

Oxygen Cleaning

Special cleaning process for equipment to be used in oxygen systems.

Oxygen Compatibility

The ability of a substance to come in contact with oxygen without reaction.

Oxygen Toxicity (CNS O_2)

A condition usually not encountered unless PPO_2 approaches or exceeds 1.6 ATA. However, could be encountered as low as 1.4 ATA.

Oxygen Toxicity (Pulmonary O_2)

A condition from long exposures to increased PPO_2, causing a direct pulmonary irritation. Can occur during treatment tables 4, 7, 8, and also through back–to-back administration of treatment table 6.

Partial Pressure

That portion of the total gas pressure exerted by a particular constituent of the breathing mixture.

Person in Charge (Barge Captain - Installation Manager)

In relation to the craft/barge/structure, includes the captain or any other person made responsible by the owner for the vessel or facility, its operation, and the safety, health and welfare of those on board.

Pneumofathometer (Kluge - Pneumo)

A depth-measuring device consisting of an open-end hose fixed to the diver, with the surface end connected to a gas supply and pressure gauge (usually marked in msw). Gauge measures pressure required to discharge water to depth of diver.

PSIA

Pounds per square inch absolute (pounds per square inch gauge plus 1 atmosphere (14.7).

PSI (psi)

Pounds per square inch. An expression of pressure; for example, 1 atmosphere equals 14.7 psi.

PSIG

Pounds per square inch gauge (pounds per square inch absolute minus 1 atmosphere.

PVHO

Pressure vessel for human occupancy.

Relief Valve

A pressure-relieving device that prevents pressure from rising above a preset level.

Risk Assessment

The process by which every perceived risk is identified, evaluated, and assessed, prior to commencement of operations. The findings and actions will be documented. A risk assessment is part of the risk management process.

ROV

Remotely operated vehicle.

Saturation Diving

Procedures in accordance with which a diver is continuously subjected to an ambient pressure greater than atmospheric pressure so that his or her body tissues and blood become saturated with the constituent elements of the breathing gas. Once the diver's body becomes saturated, he or she can remain within a specified zone for an unlimited time without incurring any additional decompression obligation.

Scuba

Acronym for self-contained underwater breathing apparatus. Used to describe apparatus in which the inspired air is delivered by demand regulator and exhaled into the surrounding water (open-circuit); the air supply is carried on the diver's back. Primarily used for relatively shallow, recreational-related diving.

SIMOPS

Simultaneous Operations

SPHL

Self-propelled hyperbaric lifeboat.

SWL

Safe working limit/load.

Squeeze

A lack of equalization between parts of the body or between the body and the equipment. Extreme cases can cause severe injury or death.

Standby Diver(s)

Another qualified diver at the dive location who is in a state of readiness to assist the diver in the water.

Surface-Supplied Diving

A diving mode in which the diver receives his or her breathing gas from a supply on the surface.

Tender

A term reserved for an apprentice diver or diver helper.

Transfer Under Pressure Lock/Chamber (TUP)

A lock or chamber that allows the transfer to and from of diving personnel between the worksite and living chambers (also called deck decompression chambers) without disturbing off-duty divers in the complex. Transfer under pressure locks/chambers are essential where being subjected to ambient pressure may be life-threatening.

Treatment Tables

A depth, time and breathing gas profile designed to treat a diver for gas embolism or decompression sickness.

Umbilical

A hose bundle between the dive location and the diver or bell that supplies a lifeline, breathing gas, communications, power and heat as appropriate to the diving mode or conditions. Underwater television cameras and cabling can also be carried as a component part of the umbilical or can be taped or banded to it on a temporary basis.

Valve

A device that starts, stops or regulates the flow of fluids or gas.

Volume Tank

A pressure vessel connected to the outlet of a gas supply and used as a gas reservoir.

Working Pressure

The pressure to which a pressure containment device is exposed under normal operating conditions.

11.2 PHYSICS AND FORMULAS

PSIG to PSIA

PSIA = PSIG + 14.7

Round up to the next whole number.

PSIA to PSIG

PSIG = PSIA – 14.7

Round up to the next whole number.

Depth (fsw) to PSIG

PSIG = Depth x .445

Round up to next whole number.

PSIG to Depth (fsw)

Depth = PSIG divided by .445

Round up to next whole number.

PSIG to Atmosphere Absolute (ATA)

$$\text{ATA} = \frac{(\text{PSIG} + 14.7)}{14.7}$$

Carry two decimal places.

Atmospheres Absolute (ATA) to PSIG

(ATA – 1) x 14.7 = PSIG

Depth (fsw) to Atmospheres Absolute (ATA)

$$\text{ATA} = \frac{\text{Depth} + 33}{33}$$

Carry two decimal places.

ATA to Depth (fsw)

ATA – 1 x 33 = Depth (fsw)

Round up to next whole number.

012994

Dalton's Law ("T" Formula)

PP

ATA | **% of Gas**

PP = Partial Pressure
% = Percent by Volume of the Identified Gas
ATA = Atmospheres Absolute

Gay-Lussac's Law

$$P2 = \frac{P1 \times T2}{T1}$$

Volume is constant.
T1 = Initial Temperature (absolute)
T2 = Final Temperature (absolute)
P1 = Initial Pressure (absolute)
P2 = Final Pressure (absolute)

Charles' Law

$$V2 = \frac{V1 \times T2}{T1}$$

Pressure is constant.
T1 = Initial Temperature (absolute)
T2 = Final Temperature (absolute)
V1 = Initial Volume (absolute)
V2 = Final Volume (absolute)

Boyles' Law (Pressure/Volume Relationship)

$$\frac{DL + 33}{DA + 33} \times OV = NV$$

DL= Depth Left
DA = Depth Arrived
OV = Original Volume
NV = New Volume

Henry's Law

(The Law of Gas Absorption and Solubility) EXPLANATION:

- "The amount of any given gas that will dissolve in a liquid at a given temperature is directly proportional to the partial pressure of that gas."
- Gas diffuses and dissolves in blood, because of the difference in partial pressure, between inhaled and exhaled air.
- The inert gas in the breathing media (nitrogen or helium) will be dissolved into the diver's body tissues as the diver is descending and during the time spent on bottom.
- Whatever gasses that have been dissolved in a diver's body tissues, at a given depth and pressure, will remain in the tissues, as long as the depth is maintained. As the diver starts to ascend, more and more of the dissolved gas will come out of his or her tissues. If his ascent is controlled, as through the use of the decompression table, the dissolved gas will be carried to the lungs and exhaled before it accumulates sufficiently to form significant bubbles in the blood or tissues.

General Gas Law (Pressure/Volume/Temperature Relationship)

(P1 x V1) ÷ T1 = (P2 x V2) ÷ T2

Degrees Fahrenheit to Rankine

R° = F° + 460°

Degrees Celsius to Absolute

C° + 273° = Degrees Kelvin

Degrees Fahrenheit to Celsius

5 x (F°– 32°) ÷9 = Celsius (carry 1 decimal place)

Degrees Celsius to Fahrenheit

(9 x C°) ÷ 5 = 32° = Fahrenheit (carry 1 decimal place)

Gas Volume Requirement Formula if Using an LP Compressor

SCFM = ATA x ACFM x N

Gas Volume Requirement Formula if Using an HP Gas Bank

SCF = ATA x ACFM x N x T

SCFM = Standard Cubic Feet per Minute
SCF = Standard Cubic Feet
ATA = Atmospheres Absolute
ACFM = Actual Cubic Feet per Minute
N = Number of Divers
T = Time (always expressed in minutes)

Minimum Manifold Pressure

MMP = D x .445 + Over Bottom Pressure
(OBP is established by company or a set standard used.)
Round up to next whole number.

Average Gas Consumption Based Upon Moderate

Free-flow Type Hat (Desco, MK V)	4.5 ACFM
Demand Type Hat (Superlite/Miller)	1.4 ACFM
Built-in Breathing System (BIBS)	0.3 ACFM

Treatment Gas Mixtures (O_2/HeO_2/N_2O_2)

Depth (fsw)	Gas Mixture	PPO_2
0 – 60 fsw	100 % O_2	1.00 – 2.81 ATA
61 – 165 fsw	50/50% HeO_2 or N_2O_2	1.42 – 3.00 ATA
166 – 225 fsw	64/36% HeO_2	2.17 – 2.80 ATA

Example of Calculating Surface Interval

Reached surface (RS) @ 2305 hrs.
Left surface (LS) @ 0317 hrs. (carry over 24-hr. clock)
0317 hrs. could be expressed, ONLY FOR THE PURPOSE OF CALCULATION, as 2717 hrs. 2717 minus (-) 2305 = 4:12
4 hrs. and 12 min.

Calculating In-water Travel Time

1. Depth left (ft/m) minus (-) depth arrived (ft/m) = distance traveled (ft/m).
2. Distance traveled divided (÷) by ascent/descent rate = minutes (and/or percentage of a minute in decimal.
3. Whole number is minute(s). Decimal is percentage of minute. Take decimal and multiply (x) by 60 (number of seconds in a minute). Decimal will then convert to actual seconds.

EXAMPLE:

215 fsw – 87 fsw = 128 fsw Ascent rate: 30 fpm
128 fsw ÷ 30 fpm = 4.26 (4 minutes and .26 or 26% of a minute)
26 x 60 = 15.6 seconds (round up to next whole second) = 16 seconds
4 minutes and 16 seconds is your travel time from 215’ to 87’

FORMULA DEFINITIONS

ACF	Actual Cubic Feet
ACFM	Actual Cubic Feet per Minute
ATA	Atmospheres Absolute
ATM	Atmospheres
CFM	Cubic Feet per Minute
D	Diameter
FFW	Feet of Fresh Water
FSW	Feet of Sea Water
FV	Floodable Volume
HP	High Pressure
LP	Low Pressure
MFW	Meters of Fresh Water
MSW	Meters of Sea Water
MWP	Maximum Working Pressure
PP	Partial Pressure
$PP0^2$	Partial Pressure of Oxygen
PPM	Parts Per Million
PSIG	Pounds per Square Inch Gauge
PSIA	Pounds per Square Inch Absolute
SCF	Standard Cubic Feet
SCFM	Standard Cubic Feet per Minute
V	Volume
W	Weight
WP	Working Pressure

11.3 ENGLISH METRIC EQUIVALENTS

PRESSURE EQUIVALENTS				
Atmosphere	**Bars**	**Pounds Per Square Inch (PSIG)**	**Columns of Mercury at 0˚C**	**Columns of Water at 15˚C**
1	1.01325	14.696	.76 meters / 29.92 inches	10.33 MSW / 33.06 FSW
0.986923	1	14.50	.75 meters / 29.59 inches	10.20 MSW / 32.63 FSW
0.967841	.98066	14.22	.73 meters / 28.95 inches	10.00 MSW / 32.00 FSW
.068046	.068947	1	.05 meters /2.03 inches	.70 MSW / 2.25 FSW
1.31579	1.33322	19.33	1 meters / 39.37 inches	13.60 MSW / 43.50 FSW
.0334211	.0338639	.4911	.0254 meters / 1 inch	.345 MSW / 1.10 FSW
.09674	.09798	1.421	.0735 meters / 2.89 inches	1 MSW / 3.19 FSW
.002456	.002489	.0360	.0018 meters / .0735 inches	.025 MSW / .0812 FSW
.029487	.029877	.4333	.0224 meters / .8822 inches	.304 MSW / .975 FSW
.030242	.03064271	.4444	.0229 meters / .9048 inches	.3126 MSW / 1 FSW

MASS EQUIVALENTS

Kilograms	Grams	Ounces	Pounds	Tons (short)	Tons (long)	Tons (metric)
1	1000	35.274	2.20462	1.1023×10^{-3}	9.942×10^{-4}	0.001
0.001	1	0.035274	2.2046×10^{-3}	1.1023×10^{-6}	9.842×10^{-7}	0.000001
6.479×10^{-5}	0.6047989	2.2857×10^{-3}	1.4286×10^{-4}	7.1429×10^{-8}	6.3776×10^{-8}	6.4799×10^{-8}
0.0283495	28.3495	1	0.0625	3.125×10^{-5}	2.790×10^{-5}	2.835×10^{-5}
0.453592	453.592	16	1	0.0005	4.4543×10^{-4}	4.5359×10^{-4}
907.185	907185	32000	2000	1	0.892857	0.907185
1016.05	1.016×10^{6}	35840	2240	1.12	1	1.01605
1000	10^{6}	35274	2204.62	1.10231	0.984206	1

LENGTH EQUIVALENTS

Centimeters	Meters	Kilometers	Inches	Feet	Yards	Fathom	Miles	Nautical Mi.
1	0.01	0.00001	.3937	.0328	.0109	.005468	6.21×10^{-5}	5.36×10^{-6}
2.54	0.025	2540×10^{-5}	1	.0833	.0277	.01388	1.57×10^{-5}	1.37×10^{-5}
30.48	0.3048	3048×10^{-4}	12	1	.3333	.16666	1.89×10^{-4}	1.64×10^{-4}
91.44	0.9144	9.14×10^{-4}	36	3	1	.5	5.68×10^{-4}	4.93×10^{-4}
100	1	0.001	39.37	3.28	1.093	.5468	6.21×10^{-4}	$5.39 \times 10-^{4}$
182.88	1.828	.000182	72	6	2	1	.00113	9.86×10^{-4}
100,000	1,000	1	39,370	3,280.83	1,093.61	546.8	.6213	.5395
160,935	1609.35	1.609	63,360	5,280	1,760	880	1	.8683
185,325	1853.25	1.853	72,962.4	6,080.4	2,026.73	1,013.36	1.1515	1

VOLUME AND CAPACITY EQUIVALENTS

Cubic Centimeters	Milliliter	Liter	Cubic Inches	Cubic Feet	Cubic Yards	Pint	Quart	Gallon
1	.99997	9.99×10^{-4}	.061023	3.53×10^{-5}	1.30×10^{-6}	2.113×10^{-3}	1.056×10^{-3}	2.641×10^{-4}
16.387	16.387	.016386	1	5.78x10-4	2.14x10-3	.034632	.017316	4.329×10^{-3}
28,317	28,316.2	28317	1728	1	.037037	59.84448	29.9221	7.48052
764,559	764,559	764.53	46,656	27	1	1615.79	807.896	201.974
1.00	1	.001	.061025	3.53×10^{-5}	1.308×10^{-6}	2.11×10^{-3}	1.056×10^{-3}	2.641×10^{-4}
1000.03	1,000	1	61.0251	.0353154	1.308×10^{-3}	2.11342	1.05671	.264178
473.179	473.166	.47316	28.875	.0167101	6.188×10^{-4}	1	0.5	.125
946.359	946.359	.9463	57.75	.0334201	1.237×10^{-3}	2	1	.25
3,785	3,785	3.785	231	.133681	49511×10^{-3}	8	4	1

11.4 BAILOUT CALCULATIONS (Cu. Ft.)

BAILOUT CALCULATIONS FOR 30 Cu. Ft. CYLINDERS									
Depth fsw	Depth psi	ATA	Rate cu.ft / min	Cylinder psi	Cylinder volume cu.ft	Delivery Pressure depth in psi + 150 psi reg press.	Usable Gas pressure	Usable Gas cu.ft / bottle	Duration Minutes at Depth
1000	445.00	31.30	1.5	3000	30	595.00	2405.00	24.05	0.51
975	433.88	30.55	1.5	3000	30	583.88	2416.13	24.16	0.53
950	422.75	29.79	1.5	3000	30	572.75	2427.25	24.27	0.54
925	411.63	29.03	1.5	3000	30	561.63	2438.38	24.38	0.56
900	400.50	28.27	1.5	3000	30	550.50	2449.50	24.50	0.58
875	389.38	27.52	1.5	3000	30	539.38	2460.63	24.61	0.60
850	378.25	26.76	1.5	3000	30	528.25	2471.75	24.72	0.62
825	367.13	26.00	1.5	3000	30	517.13	2482.88	24.83	0.64
800	356.00	25.24	1.5	3000	30	506.00	2494.00	24.94	0.66
775	344.88	24.48	1.5	3000	30	494.88	2505.13	25.05	0.68
750	333.75	23.73	1.5	3000	30	483.75	2516.25	25.16	0.71
725	322.63	22.97	1.5	3000	30	472.63	2527.38	25.27	0.73
700	311.50	22.21	1.5	3000	30	461.50	2538.50	25.39	0.76
675	300.38	21.45	1.5	3000	30	450.38	2549.63	25.50	0.79
650	289.25	20.70	1.5	3000	30	439.25	2560.75	25.61	0.82
625	278.13	19.94	1.5	3000	30	428.13	2571.88	25.72	0.86
600	267.00	19.18	1.5	3000	30	417.00	2583.00	25.83	0.90
575	255.88	18.42	1.5	3000	30	405.88	2594.13	25.94	0.94
550	244.75	17.67	1.5	3000	30	394.75	2605.25	26.05	0.98
525	233.63	16.91	1.5	3000	30	383.63	2616.38	26.16	1.03
500	222.50	16.15	1.5	3000	30	372.50	2627.50	26.28	1.08
475	211.38	15.39	1.5	3000	30	361.38	2638.63	26.39	1.14
450	200.25	14.64	1.5	3000	30	350.25	2649.75	26.50	1.21
425	189.13	13.88	1.5	3000	30	339.13	2660.88	26.61	1.28
400	178.00	13.12	1.5	3000	30	328.00	2672.00	26.72	1.36
375	166.88	12.36	1.5	3000	30	316.88	2683.13	26.83	1.45
350	155.75	11.61	1.5	3000	30	305.75	2694.25	26.94	1.55
325	144.63	10.85	1.5	3000	30	294.63	2705.38	27.05	1.66
300	133.50	10.09	1.5	3000	30	283.50	2716.50	27.17	1.79
275	122.38	9.33	1.5	3000	30	272.38	2727.63	27.28	1.95
250	111.25	8.58	1.5	3000	30	261.25	2738.75	27.39	2.13
225	100.13	7.82	1.5	3000	30	250.13	2749.88	27.50	2.34
200	89.00	7.06	1.5	3000	30	239.00	2761.00	27.61	2.61
175	77.88	6.30	1.5	3000	30	227.88	2772.13	27.72	2.93
150	66.75	5.55	1.5	3000	30	216.75	2783.25	27.83	3.35
125	55.63	4.79	1.5	3000	30	205.63	2794.38	27.94	3.89
100	44.50	4.03	1.5	3000	30	194.50	2805.50	28.06	4.64
75	33.38	3.27	1.5	3000	30	183.38	2816.63	28.17	5.74
50	22.25	2.52	1.5	3000	30	172.25	2827.75	28.28	7.50
25	11.13	1.76	1.5	3000	30	161.13	2838.88	28.39	10.77

BAILOUT CALCULATIONS FOR 50 Cu. Ft. CYLINDERS									
Depth fsw	Depth psi	ATA	Rate cu.ft / min	Cylinder psi	Cylinder volume cu.ft	Delivery Pressure depth in psi + 150 psi reg press.	Usable Gas pressure	Usable Gas cu.ft / bottle	Duration Minutes at Depth
1000	445.00	31.30	1.5	3000	50	595.00	2405.00	40.08	0.85
975	433.88	30.55	1.5	3000	50	583.88	2416.13	40.27	0.88
950	422.75	29.79	1.5	3000	50	572.75	2427.25	40.45	0.91
925	411.63	29.03	1.5	3000	50	561.63	2438.38	40.64	0.93
900	400.50	28.27	1.5	3000	50	550.50	2449.50	40.83	0.96
875	389.38	27.52	1.5	3000	50	539.38	2460.63	41.01	0.99
850	378.25	26.76	1.5	3000	50	528.25	2471.75	41.20	1.03
825	367.13	26.00	1.5	3000	50	517.13	2482.88	41.38	1.06
800	356.00	25.24	1.5	3000	50	506.00	2494.00	41.57	1.10
775	344.88	24.48	1.5	3000	50	494.88	2505.13	41.75	1.14
750	333.75	23.73	1.5	3000	50	483.75	2516.25	41.94	1.18
725	322.63	22.97	1.5	3000	50	472.63	2527.38	42.12	1.22
700	311.50	22.21	1.5	3000	50	461.50	2538.50	42.31	1.27
675	300.38	21.45	1.5	3000	50	450.38	2549.63	42.49	1.32
650	289.25	20.70	1.5	3000	50	439.25	2560.75	42.68	1.37
625	278.13	19.94	1.5	3000	50	428.13	2571.88	42.86	1.43
600	267.00	19.18	1.5	3000	50	417.00	2583.00	43.05	1.50
575	255.88	18.42	1.5	3000	50	405.88	2594.13	43.24	1.56
550	244.75	17.67	1.5	3000	50	394.75	2605.25	43.42	1.64
525	233.63	16.91	1.5	3000	50	383.63	2616.38	43.61	1.72
500	222.50	16.15	1.5	3000	50	372.50	2627.50	43.79	1.81
475	211.38	15.39	1.5	3000	50	361.38	2638.63	43.98	1.90
450	200.25	14.64	1.5	3000	50	350.25	2649.75	44.16	2.01
425	189.13	13.88	1.5	3000	50	339.13	2660.88	44.35	2.13
400	178.00	13.12	1.5	3000	50	328.00	2672.00	44.53	2.26
375	166.88	12.36	1.5	3000	50	316.88	2683.13	44.72	2.41
350	155.75	11.61	1.5	3000	50	305.75	2694.25	44.90	2.58
325	144.63	10.85	1.5	3000	50	294.63	2705.38	45.09	2.77
300	133.50	10.09	1.5	3000	50	283.50	2716.50	45.28	2.99
275	122.38	9.33	1.5	3000	50	272.38	2727.63	45.46	3.25
250	111.25	8.58	1.5	3000	50	261.25	2738.75	45.65	3.55
225	100.13	7.82	1.5	3000	50	250.13	2749.88	45.83	3.91
200	89.00	7.06	1.5	3000	50	239.00	2761.00	46.02	4.34
175	77.88	6.30	1.5	3000	50	227.88	2772.13	46.20	4.89
150	66.75	5.55	1.5	3000	50	216.75	2783.25	46.39	5.58
125	55.63	4.79	1.5	3000	50	205.63	2794.38	46.57	6.48
100	44.50	4.03	1.5	3000	50	194.50	2805.50	46.76	7.73
75	33.38	3.27	1.5	3000	50	183.38	2816.63	46.94	9.56
50	22.25	2.52	1.5	3000	50	172.25	2827.75	47.13	12.49
25	11.13	1.76	1.5	3000	50	161.13	2838.88	47.31	17.95

BAILOUT CALCULATIONS FOR 80 Cu. Ft. CYLINDERS									
Depth fsw	Depth psi	ATA	Rate cu.ft / min	Cylinder psi	Cylinder volume cu.ft	Delivery Pressure depth in psi + 150 psi reg press.	Usable Gas pressure	Usable Gas cu.ft / bottle	Duration Minutes at Depth
1000	445.00	31.30	1.5	3000	80	595.00	2405.00	64.13	1.37
975	433.88	30.55	1.5	3000	80	583.88	2416.13	64.43	1.41
950	422.75	29.79	1.5	3000	80	572.75	2427.25	64.73	1.45
925	411.63	29.03	1.5	3000	80	561.63	2438.38	65.02	1.49
900	400.50	28.27	1.5	3000	80	550.50	2449.50	65.32	1.54
875	389.38	27.52	1.5	3000	80	539.38	2460.63	65.62	1.59
850	378.25	26.76	1.5	3000	80	528.25	2471.75	65.91	1.64
825	367.13	26.00	1.5	3000	80	517.13	2482.88	66.21	1.70
800	356.00	25.24	1.5	3000	80	506.00	2494.00	66.51	1.76
775	344.88	24.48	1.5	3000	80	494.88	2505.13	66.80	1.82
750	333.75	23.73	1.5	3000	80	483.75	2516.25	67.10	1.89
725	322.63	22.97	1.5	3000	80	472.63	2527.38	67.40	1.96
700	311.50	22.21	1.5	3000	80	461.50	2538.50	67.69	2.03
675	300.38	21.45	1.5	3000	80	450.38	2549.63	67.99	2.11
650	289.25	20.70	1.5	3000	80	439.25	2560.75	68.29	2.20
625	278.13	19.94	1.5	3000	80	428.13	2571.88	68.58	2.29
600	267.00	19.18	1.5	3000	80	417.00	2583.00	68.88	2.39
575	255.88	18.42	1.5	3000	80	405.88	2594.13	69.18	2.50
550	244.75	17.67	1.5	3000	80	394.75	2605.25	69.47	2.62
525	233.63	16.91	1.5	3000	80	383.63	2616.38	69.77	2.75
500	222.50	16.15	1.5	3000	80	372.50	2627.50	70.07	2.89
475	211.38	15.39	1.5	3000	80	361.38	2638.63	70.36	3.05
450	200.25	14.64	1.5	3000	80	350.25	2649.75	70.66	3.22
425	189.13	13.88	1.5	3000	80	339.13	2660.88	70.96	3.41
400	178.00	13.12	1.5	3000	80	328.00	2672.00	71.25	3.62
375	166.88	12.36	1.5	3000	80	316.88	2683.13	71.55	3.86
350	155.75	11.61	1.5	3000	80	305.75	2694.25	71.85	4.13
325	144.63	10.85	1.5	3000	80	294.63	2705.38	72.14	4.43
300	133.50	10.09	1.5	3000	80	283.50	2716.50	72.44	4.79
275	122.38	9.33	1.5	3000	80	272.38	2727.63	72.74	5.20
250	111.25	8.58	1.5	3000	80	261.25	2738.75	73.03	5.68
225	100.13	7.82	1.5	3000	80	250.13	2749.88	73.33	6.25
200	89.00	7.06	1.5	3000	80	239.00	2761.00	73.63	6.95
175	77.88	6.30	1.5	3000	80	227.88	2772.13	73.92	7.82
150	66.75	5.55	1.5	3000	80	216.75	2783.25	74.22	8.92
125	55.63	4.79	1.5	3000	80	205.63	2794.38	74.52	10.38
100	44.50	4.03	1.5	3000	80	194.50	2805.50	74.81	12.38
75	33.38	3.27	1.5	3000	80	183.38	2816.63	75.11	15.30
50	22.25	2.52	1.5	3000	80	172.25	2827.75	75.41	19.99
25	11.13	1.76	1.5	3000	80	161.13	2838.88	75.70	28.72

BAILOUT CALCULATIONS FOR 120 Cu. Ft. CYLINDERS									
Depth fsw	Depth psi	ATA	Rate cu.ft / min	Cylinder psi	Cylinder volume cu.ft	Delivery Pressure depth in psi + 150 psi reg press.	Usable Gas pressure	Usable Gas cu.ft / bottle	Duration Minutes at Depth
1000	445.00	31.30	1.5	3500	120	595.00	2905.00	99.60	2.12
975	433.88	30.55	1.5	3500	120	583.88	2916.13	99.98	2.18
950	422.75	29.79	1.5	3500	120	572.75	2927.25	100.36	2.25
925	411.63	29.03	1.5	3500	120	561.63	2938.38	100.74	2.31
900	400.50	28.27	1.5	3500	120	550.50	2949.50	101.13	2.38
875	389.38	27.52	1.5	3500	120	539.38	2960.63	101.51	2.46
850	378.25	26.76	1.5	3500	120	528.25	2971.75	101.89	2.54
825	367.13	26.00	1.5	3500	120	517.13	2982.88	102.27	2.62
800	356.00	25.24	1.5	3500	120	506.00	2994.00	102.65	2.71
775	344.88	24.48	1.5	3500	120	494.88	3005.13	103.03	2.81
750	333.75	23.73	1.5	3500	120	483.75	3016.25	103.41	2.91
725	322.63	22.97	1.5	3500	120	472.63	3027.38	103.80	3.01
700	311.50	22.21	1.5	3500	120	461.50	3038.50	104.18	3.13
675	300.38	21.45	1.5	3500	120	450.38	3049.63	104.56	3.25
650	289.25	20.70	1.5	3500	120	439.25	3060.75	104.94	3.38
625	278.13	19.94	1.5	3500	120	428.13	3071.88	105.32	3.52
600	267.00	19.18	1.5	3500	120	417.00	3083.00	105.70	3.67
575	255.88	18.42	1.5	3500	120	405.88	3094.13	106.08	3.84
550	244.75	17.67	1.5	3500	120	394.75	3105.25	106.47	4.02
525	233.63	16.91	1.5	3500	120	383.63	3116.38	106.85	4.21
500	222.50	16.15	1.5	3500	120	372.50	3127.50	107.23	4.43
475	211.38	15.39	1.5	3500	120	361.38	3138.63	107.61	4.66
450	200.25	14.64	1.5	3500	120	350.25	3149.75	107.99	4.92
425	189.13	13.88	1.5	3500	120	339.13	3160.88	108.37	5.21
400	178.00	13.12	1.5	3500	120	328.00	3172.00	108.75	5.53
375	166.88	12.36	1.5	3500	120	316.88	3183.13	109.14	5.88
350	155.75	11.61	1.5	3500	120	305.75	3194.25	109.52	6.29
325	144.63	10.85	1.5	3500	120	294.63	3205.38	109.90	6.75
300	133.50	10.09	1.5	3500	120	283.50	3216.50	110.28	7.29
275	122.38	9.33	1.5	3500	120	272.38	3227.63	110.66	7.90
250	111.25	8.58	1.5	3500	120	261.25	3238.75	111.04	8.63
225	100.13	7.82	1.5	3500	120	250.13	3249.88	111.42	9.50
200	89.00	7.06	1.5	3500	120	239.00	3261.00	111.81	10.56
175	77.88	6.30	1.5	3500	120	227.88	3272.13	112.19	11.87
150	66.75	5.55	1.5	3500	120	216.75	3283.25	112.57	13.53
125	55.63	4.79	1.5	3500	120	205.63	3294.38	112.95	15.73
100	44.50	4.03	1.5	3500	120	194.50	3305.50	113.33	18.75
75	33.38	3.27	1.5	3500	120	183.38	3316.63	113.71	23.16
50	22.25	2.52	1.5	3500	120	172.25	3327.75	114.09	30.24
25	11.13	1.76	1.5	3500	120	161.13	3338.88	114.48	43.42

BAILOUT CALCULATIONS FOR 7L CYLINDERS (METRIC)

Depth msw	Depth Kg/cm²	Bar	Pressure absolute	Rate Ltrs/Min	Cylinder Bar Luxfer® S080	Cylinder Bar	Cylinder Kg/cm² Luxfer® S080	Cylinder Kg/cm²	Cylinder Ltrs FV Luxfer® S080	Cylinder Ltrs FV Luxfer® 106W	Cylinder Ltrs FV	Cylinder Ltrs at 300 bar Luxfer® S080	Cylinder Ltrs at 300 bar Luxfer® S106W	Cylinder Ltrs at 300 bar	Delivery Pressure depth in Kg/cm2 +10.54604 Kg/cm2 reg press.	Usable Gas Pressure Luxfer® S080	Usable Gas Pressure	Usable Gas Ltrs/Cyl Luxfer® S080	Usable Gas Ltrs/Cyl Luxfer® S106W	Usable Gas Ltrs/Cyl	Duration Minutes at Depth Luxfer® S080	Duration Minutes at Depth Luxfer® S106W	Duration Minutes at Depth
300	30.7692	30.1743	31.80	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	41.32	169.77	264.59	1997.80	3113.79	1816.38	1.48	2.30	1.34
290	29.7436	29.1685	30.77	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	40.29	170.79	259.71	2009.87	3056.32	1782.85	1.54	2.34	1.36
280	28.7179	28.1627	29.75	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	39.26	171.82	260.74	2021.94	3068.38	1789.89	1.60	2.43	1.42
270	27.6923	27.1569	28.72	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	38.24	172.84	261.76	2034.01	3080.45	1796.93	1.67	2.52	1.47
260	26.6667	26.1511	27.70	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	37.21	173.87	262.79	2046.08	3092.52	1803.97	1.74	2.63	1.53
250	25.641	25.1453	26.67	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	36.19	174.89	263.81	2058.15	3104.59	1811.01	1.82	2.74	1.60
240	24.6154	24.1394	25.65	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	35.16	175.92	264.84	2070.22	3116.66	1818.05	1.90	2.86	1.67
230	23.5897	23.1336	24.62	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	34.14	176.95	265.86	2082.29	3128.73	1825.10	1.99	2.99	1.74
220	22.5641	22.1278	23.59	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	33.11	177.97	266.89	2094.36	3140.80	1832.14	2.09	3.13	1.83
210	21.5385	21.122	22.57	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	32.08	179.00	267.92	2106.43	3152.87	1839.18	2.20	3.29	1.92
200	20.5128	20.1162	21.54	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	31.06	180.02	268.94	2118.50	3164.94	1846.22	2.31	3.46	2.02
190	19.4872	19.1104	20.52	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	30.03	181.05	269.97	2130.57	3177.01	1853.26	2.44	3.64	2.13
180	18.4615	18.1046	19.49	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	29.01	182.07	270.99	2142.64	3189.08	1860.30	2.59	3.85	2.25
170	17.4359	17.0988	18.47	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	27.98	183.10	272.02	2154.71	3201.15	1867.34	2.75	4.08	2.38
160	16.4103	16.093	17.44	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	26.96	184.12	273.04	2166.78	3213.22	1874.38	2.92	4.34	2.53
150	15.3846	15.0872	16.41	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	25.93	185.15	274.07	2178.85	3225.29	1881.42	3.12	4.62	2.70
140	14.359	14.0813	15.39	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	24.91	186.18	275.09	2190.92	3237.36	1888.46	3.35	4.95	2.89
130	13.3333	13.0755	14.36	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	23.88	187.20	276.12	2202.99	3249.43	1895.50	3.61	5.32	3.11
120	12.3077	12.0697	13.34	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	22.85	188.23	277.15	2215.06	3261.50	1902.54	3.91	5.75	3.36
110	11.2821	11.0639	12.31	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	21.83	189.25	278.17	2227.13	3273.57	1909.58	4.26	6.26	3.65
100	10.2564	10.0581	11.29	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	20.80	190.28	279.20	2239.20	3285.64	1916.63	4.67	6.85	4.00
90	9.23077	9.05229	10.26	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	19.78	191.30	280.22	2251.27	3297.71	1923.67	5.16	7.56	4.41
80	8.20513	8.04648	9.24	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	18.75	192.33	281.25	2263.34	3309.78	1930.71	5.77	8.43	4.92
70	7.17949	7.04067	8.21	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	17.73	193.36	282.27	2275.41	3321.85	1937.75	6.52	9.52	5.55
60	6.15385	6.03486	7.18	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	16.70	194.38	283.30	2287.48	3333.92	1944.79	7.49	10.92	6.37
50	5.12821	5.02905	6.16	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	15.67	195.41	284.33	2299.55	3345.99	1951.83	8.79	12.78	7.46
40	4.10256	4.02324	5.13	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	14.65	196.43	285.35	2311.62	3358.06	1958.87	10.60	15.39	8.98
30	3.07692	3.01743	4.11	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	13.62	197.46	286.38	2323.69	3370.13	1965.91	13.31	19.31	11.26
20	2.05128	2.01162	3.08	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	12.60	198.48	287.40	2335.75	3382.20	1972.95	17.84	25.83	15.07
10	1.02564	1.00581	2.06	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	11.57	199.51	288.43	2347.82	3394.27	1979.99	26.87	38.85	22.66
1	0.10256	0.10058	1.13	42.5	207	300	211.081	305.91	12	12	7	2484	3600	2100	10.65	200.43	289.35	2358.69	3405.14	1986.33	49.00	70.74	41.27

BAILOUT CALCULATIONS FOR 10L CYLINDERS (METRIC)												
Depth msw	Depth Kg/cm²	Bar	Pressure Absolute	Rate Ltrs/Min	Cylinder Bar	Cylinder Kg/cm²	Cylinder Ltrs FV	Cylinder Ltrs at 300 bar	Delivery Pressure depth in Kg/cm² +10.54604 Kg/cm² reg press.	Usable Gas Pressure	Usable Gas Ltrs/ Cyl	Duration Minutes at Depth
300	30.7692	30.1743	31.80	42.5	300	305.91	10	3000	41.32	264.59	2594.83	1.92
290	29.7436	29.1685	30.77	42.5	300	305.91	10	3000	40.29	259.71	2546.93	1.95
280	28.7179	28.1627	29.75	42.5	300	305.91	10	3000	39.26	260.74	2556.99	2.02
270	27.6923	27.1569	28.72	42.5	300	305.91	10	3000	38.24	261.76	2567.05	2.10
260	26.6667	26.1511	27.70	42.5	300	305.91	10	3000	37.21	262.79	2577.10	2.19
250	25.641	25.1453	26.67	42.5	300	305.91	10	3000	36.19	263.81	2587.16	2.28
240	24.6154	24.1394	25.65	42.5	300	305.91	10	3000	35.16	264.84	2597.22	2.38
230	23.5897	23.1336	24.62	42.5	300	305.91	10	3000	34.14	265.86	2607.28	2.49
220	22.5641	22.1278	23.59	42.5	300	305.91	10	3000	33.11	266.89	2617.34	2.61
210	21.5385	21.122	22.57	42.5	300	305.91	10	3000	32.08	267.92	2627.40	2.74
200	20.5128	20.1162	21.54	42.5	300	305.91	10	3000	31.06	268.94	2637.45	2.88
190	19.4872	19.1104	20.52	42.5	300	305.91	10	3000	30.03	269.97	2647.51	3.04
180	18.4615	18.1046	19.49	42.5	300	305.91	10	3000	29.01	270.99	2657.57	3.21
170	17.4359	17.0988	18.47	42.5	300	305.91	10	3000	27.98	272.02	2667.63	3.40
160	16.4103	16.093	17.44	42.5	300	305.91	10	3000	26.96	273.04	2677.69	3.61
150	15.3846	15.0872	16.41	42.5	300	305.91	10	3000	25.93	274.07	2687.74	3.85
140	14.359	14.0813	15.39	42.5	300	305.91	10	3000	24.91	275.09	2697.80	4.12
130	13.3333	13.0755	14.36	42.5	300	305.91	10	3000	23.88	276.12	2707.86	4.44
120	12.3077	12.0697	13.34	42.5	300	305.91	10	3000	22.85	277.15	2717.92	4.79
110	11.2821	11.0639	12.31	42.5	300	305.91	10	3000	21.83	278.17	2727.98	5.21
100	10.2564	10.0581	11.29	42.5	300	305.91	10	3000	20.80	279.20	2738.04	5.71
90	9.23077	9.05229	10.26	42.5	300	305.91	10	3000	19.78	280.22	2748.09	6.30
80	8.20513	8.04648	9.24	42.5	300	305.91	10	3000	18.75	281.25	2758.15	7.03
70	7.17949	7.04067	8.21	42.5	300	305.91	10	3000	17.73	282.27	2768.21	7.93
60	6.15385	6.03486	7.18	42.5	300	305.91	10	3000	16.70	283.30	2778.27	9.10
50	5.12821	5.02905	6.16	42.5	300	305.91	10	3000	15.67	284.33	2788.33	10.65
40	4.10256	4.02324	5.13	42.5	300	305.91	10	3000	14.65	285.35	2798.39	12.83
30	3.07692	3.01743	4.11	42.5	300	305.91	10	3000	13.62	286.38	2808.44	16.09
20	2.05128	2.01162	3.08	42.5	300	305.91	10	3000	12.60	287.40	2818.50	21.52
10	1.02564	1.00581	2.06	42.5	300	305.91	10	3000	11.57	288.43	2828.56	32.38
1	0.10256	0.10058	1.13	42.5	300	305.91	10	3000	10.65	289.35	2837.61	58.95

11.5 MEDICAL CONDITION REFERENCE CHART

MEDICAL CONDITION	CAUSE	PREVENTION	SYMPTOMS	TREATMENT
SQUEEZE Damage done to tissues that do not pressurize with the ambient pressure	G - Gas-filled space R - Rigid walls A - Ambient press. change V - Vascular penetration E - Enclosed space	Stay ahead of the pressure	Dependent upon type of squeeze.	Dependent upon type of squeeze.
HYPOXIA An O_2 deficiency in the body's tissues	- Air supply failure - Diver loses mouthpiece - Airway obstruction or restriction - Insufficient O_2 in the diver's breathing media - Inadequate vent in chamber - O_2 falls below .16 ATA	- Gas analysis. - Cylinder line-ups. - Pre dive check-outs procedures. - Monitor O_2 sensors throughout the dive.	C - Cyanosis (bluing of skin) I - Increased pulse rate L - Lack of muscle control L - Lack of concentration I - Inability to perform delicate tasks W- Weakness L - Loss of consciousness D - Drowsiness	In water: Perform emergency procedure for rig/helmet. Surface: 100% O_2 by mask. CPR if necessary. Transport to medical facility.
HYPERCAPNIA (CO_2 Toxicity) An excess of CO_2 built up in the blood	- Skip breathing - Excessive working at depth - Over breathing rig/ helmet - Inadequate lung ventilation - Rig malfunction	- Follow pre dive. - Moderate work pace. - Avoid skip breathing. - Avoid over-breathing diving Apparatus.	I - Increased respiration C - Confusion H - Headache I - Inability to concentrate L - Loss of consciousness D - Drowsiness	In water: - Notify topside. - Decrease work rate. - Breathe normally. - Follow EPs - Abort dive (if necessary). - Seek medical Attention. Surface: - Remove diving Apparatus. - Neuro to rule out AGE. - 100% O_2 by mask. - Transport to medical facility.
NITROGEN NARCOSIS A narcotic feeling caused by the effects of inert gasses on the nervous system; usually starts around 4 ATA	Primarily because of O_2 toxicity; nitrogen is an inert gas that the body does not use or metabolize	Avoidance of excessive partial pressure of nitrogen. Limit depth. Work up dives.	C - Confusion L - Lack of concern for job or safety A - Apparent stupidity S - Sense of well being I - Impaired judgment	- Ascend above depth of onset - Will normally resolve in :01.
INNER EAR BAROTRAUMA (IEB) Inner ear contains no gas and is not subject to barotraumas. However, it is located next to the middle ear and affected by the same conditions that produce MIDDLE EAR BAROTRAUMA	- Common cold - Abnormal anatomy - Dysfunctional Eustachian tube - Running nose, head cold or congestion - TYPES: round window rupture, oval window rupture, violent shift in fluid in the inner ear, hemorrhage into inner ear	- Do not perform forceful valsalva maneuver. - No diving with a cold. - Stay ahead of the pressure. - Proper training.	- Vertigo - Hearing loss - Nystagmus - Nausea/ vomiting - Imbalance - Roaring tinnitus - Symptoms of MEB will be Present.	- May be the result of AGE. - Avoid straining. - Transport to medical facility.

MEDICAL CONDITION	CAUSE	PREVENTION	SYMPTOMS	TREATMENT
MIDDLE EAR BAROTRAUMA Most common type of barotrauma (MEB)	- Common cold - Abnormal anatomy - Dysfunctional Eustachian tube - Running nose, head cold, or congestion	- No diving with a cold. - Stay ahead of the pressure. - Proper training.	- Fullness or pain in ear - Slight bloody drip from oral/nasal via cavityEustachian tube - Mild hearing loss	- Notify topside. - Stop travel, ascend/ descend a few feet. - Attempt to clear. - Abort dive if Necessary.
EXTERNAL EAR BAROTRAUMA Occurs if external auditory canal is blocked	- Wax impaction - Tight wet suit hood - Ear infection	- Pull wet suit hood from face to allow water in and pressurize. - Do not dive with ear infection. - Do not use ear Plugs.	- Canal swelling - Possible hemorrhaging - Considerable pain in the canal	- Transport to medical facility.
CARBON MONOXIDE (CO) TOXICITY Produced as a result of incomplete combustion of Hydrocarbons	- Compressor intake down-wind of exhaust - Improper compressor oils - Faulty air compressor system	- Do proper pre-dive checks. - Compressor intake located away from engine exhausts. - Proper maintenance of compressors.	- Tightness across forehead - Headache - Nausea - Confusion - Vomiting	- Remove patient from CO exposure. - Neuro to rule out AGE. - 100% O_2. - Transport to medical facility
CNS O_2 TOXICITY Central nervous system oxygen toxicity	- Excessive partial pressure usually not encountered unless PPO_2 approaches or exceeds 1.6 ATA. However, could be encountered as low as 1.4 ATA.		VENTID - C V - Visual disturbance E - Ears ringing or roaring N - Nausea T- Tingling/twitching I - Irritability D - Dizziness C - Convulsions	- Off O_2. - Wait for symptoms to subside. - Wait :15. - Back on O_2 at point of interruption. - Further incidents consult CDP.
AGE The most serious diving injury; alveolar rupture with air bubbles entering capillaries of the lungs and traveling to the heart and then distributed throughout the body	- Lungs over-inflate, alveolar rupture occurs, and air is forced into the capillaries of the arterial system. These bubbles are carried to the left side of the heart and pumped out the arteries. Bubbles that accumulate in narrow areas create an obstruction of blood flow. All tissue beyond is deprived of blood and turns hypoxic. Damage and symptoms depend on location of blockage. Brain is most significant site for bubbles	- Breath normally. - Never hold your breath on ascent. - If out of air, exhale during ascent.	- Unconsciousness - Weakness - Paralysis - Numbness - Ringing/roaring in ears - Blurred vision - Dizziness - Fatigue - Tingling/twitching Any neurological symptom that presents itself within the first :10 after surfacing from a dive is to be a sign of AGE by non-medical personnel.	- Immediate Recompression. - Complete neuro exam. - 100% O_2. - Transport to medical facility below 1,000 ft. above sea level - If patient has relief upon entering chamber, treat original disorder. - Contact certified dive physician.
PULMONARY O_2 TOXICITY	Occurs during long exposures to increased PPO_2, causing a direct pulmonary irritant; can occur during treatment tables 4,7,8 and back-to-back TT6		C - Coughing, severe B - Breath; shortness of S - Substernal chest pain	- Discontinue O_2 Use. - Consult certified diving physician.

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MEDICAL CONDITION	CAUSE	PREVENTION	SYMPTOMS	TREATMENT
SUBCUTANEOUS EMPHYSEMA	Results of expansion of gas that is leaked from the mediastinum into the subcutaneous tissues of the neck		- "Rice Krispies" feeling in neck - Voice change - Symptoms of mediastinal may be present - Feeling of fullness - Difficulty swallowing	- Neuro exam to rule out AGE. - 100% O_2. - Consult certified diving physician. - Transport to medical facility.
MEDIASTINAL EMPHYSEMA	Gas expands and forces gas into the loose mediastinal tissue in the middle of the chest		- Chest pain behind sternum - Pain may worsen with deep inspiration, coughing or swallowing - Tightness to dull ache from mild to moderate	- Neuro exam to rule out AGE. - 100% O_2. - Consult certified diving physician. - Transport to medical facility.
TYPE II DCS	- Individual variations - Excessive exercise while working - Previous injury - Cold, during decompression - CO_2 intoxication - AGE - Alcohol - Dehydration - Fatigue	- Individual variations - Excessive exercise while working - Previous injury - Cold, during decompression - CO_2 intoxication - AGE - Dehydration - Fatigue - Ensure proper fitness to dive - Proper training of dive personnel	- Unconsciousness - Weakness - Paralysis - Numbness - Ringing/Roaring in ears - Blurred vision - Dizziness - Fatigue - Tingling/twitching	- Complete Neuro to rule out AGE - Immediate recompression - 100% O_2 - Contact certified diving physician - Transport to medical facility below 1000 ft. above sea level.
TYPE I DCS	- Individual variations - Excessive exercise while working - Previous injury - Cold, during decompression - CO_2 intoxication - AGE - Alcohol - Dehydration - Fatigue	- Individual variations - Excessive exercise while working - Previous injury - Cold, during decompression - CO_2 intoxication - AGE - Alcohol - Dehydration - Fatigue - Ensure proper fitness to dive - Proper training of dive personnel	- Pain - Marbling - Swelling of lymph nodes	- Complete Neuro to rule out AGE or TYPE II. - Immediate recompression. - 100% O_2. - Consult certified diving physician - Some forms of TYPE I D.C.S do not require Immediate recompression.
PNEUMOTHORAX Over–inflation, causing air to enter space between lung and covering and chest wall	- Not exhaling on ascent	- Breathe normally. - Never hold your breath on ascent - Evaluate diver's physical. - Proper training of divers/proper medical screening & functioning equipment.	- Chest pain, lateral or top of shoulder suddenly or sharp - May have rapid or shallow breathing - Diver may guard affected side - Diver may be pale	- Neuro to rule out AGE. - 100% O_2. - Contact certified diving physician. - Transport to medical facility.

11.6 ADCI CHECKLIST FOR EQUIPMENT SCHEDULED TESTING AND INSPECTION

TYPE OF EQUIPMENT	REQUIRED TESTING	RECOMMENDED TESTING	REQUIRED INSPECTION	RECOMMENDED INSPECTION	COMMENTS/NOTES
Wetsuits	N/A	N/A	N/A	Periodic	
Drysuits	N/A	N/A	N/A	Prior to each use	
Hot water Suits	N/A	N/A	N/A	Prior to each use	
Diving Harnesses	Tested by manufacturer prior to initial use	N/A	N/A	Prior to each use	
Weight Belts	N/A	N/A	N/A	Prior to each use	
Bailouts	Hydrostatic Test every 5 years	N/A	Annually (by a qualified technician)	N/A	
Helmets and Masks	Function Test Annually	Function Test prior to conducting diving operations	Annually (Internal and external)	Inspection prior to conducting diving operations	
Breathing Gas Hoses (i.e. Deck Whips and all other LP hoses associated with the breathing gas system)	Pressure Test Annually (Pressure test after initial construction or any modification or repair)	N/A	Annually	Inspection prior to conducting diving operations	
Umbilicals	Pressure Test Annually (After initial construction or after any modification or repair)	N/A	Annually	Inspection prior to conducting diving operations	
Oxygen Hoses for Life Support	Pressure Test Annually (Pressure test after initial construction or any modification or repair)	N/A	Annually	Inspection prior to conducting diving operations	
Compressor Systems	Air Purity Test every 6 months	N/A	N/A	Inspection prior to conducting diving operations	
Volume Tanks	Pneumatic Test Annually and Hydrostatic Test every 5 years	N/A	Annually (Internal and external)	Inspection prior to conducting diving operations	
Filters	N/A	N/A	N/A	Inspection prior to conducting diving operations	
Diving Ladder	N/A	N/A	N/A	Inspection prior to conducting diving operations	

TYPE OF EQUIPMENT	REQUIRED TESTING	RECOMMENDED TESTING	REQUIRED INSPECTION	RECOMMENDED INSPECTION	COMMENTS/NOTES
Stage	N/A	N/A	N/A	Inspection prior to conducting diving operations	
PVHO / Chamber	Pressure Leak Test Annually	N/A	Annually (modification or deterioration)	Inspection prior to conducting diving operations	
Depth Gauges / Master test Gauges	Calibration every 6 months	N/A	N/A	N/A	
Relief Valves	Relief valve pressure setting to be tested annually	N/A	N/A	Periodic	
Gas Storage Cylinders / Tubes	Hydrostatic Test every 5 years	N/A	Annually (External and Internal for cylinders used underwater by a qualified technician)	Periodic	
Handling Systems	Function Test (When installed, repaired, or modified)	N/A	Visually inspected every 6 months (Damage, deterioration, deformation)	Prior to each job	
First Aid Kits	N/A	N/A	Monthly	Prior to each job	

11.7 EMERGENCY RESPONSE DRILLS

NOTE: The ADCI recommends that companies develop and perform the necessary emergency response drills (ERDs) applicable to their operations. The following drills are examples that can be utilized and/or modified.

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: ABV/Dizzy on Ascent	
Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	FIRST DIVE AFTER LUNCH. Diver 2 has two holds on descent, with a descent time of 1 minute and 30 seconds. At about 10 feet on ascent, Diver 2 will halt ascent and take about 3 rapid turns around the down line. He/she will report vertigo and will be OK in about 20 seconds at 10 feet. When asked, Diver 2 will state that he/she has just gotten over a cold and took two red Sudafed pills at 0730 that morning in order to be able to dive. The rest of the dive, if controlled, is uneventful.
Table/Schedule: N/A	
RS:	
SI:	
Current Dive	
Table/Schedule: Actual	
RS:	
Time of Onset: Actual	
Project:	

Casualty Drill Will Continue Until: Diver is recovered and cause is determined.

Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		YES	NO

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013011

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Launch and Recovery of Emergency Evacuation System (EES)

Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	**Catastrophic fire has caused the captain to order the emergency evacuation of all personnel from the vessel. Diving personnel in the saturation complex must be transferred to the EES. Launch and recovery of the EES must be initiated.**
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013012

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Bell-to-Bell Transfer

Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	During the course of diving operations, the diving bell suffers damage, preventing the transfer lock/TUP from mechanically sealing. A bell-to-bell transfer must be initiated.
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:			
Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		YES	NO

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013013

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: CO_2 Buildup (In Demand-type Breathing Rig)

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Communications/Log Keeper, Diving Supervisor, Standby Diver (if deployed), Tenders.

DIVE PROFILE	SCENARIO
Previous Dive	**Diver has CO_2 buildup approximately 15 minutes into the dive. Symptoms are light-headedness, breathing hard and irritability, and eventually, diver passes out if proper action is not taken. Once diver is ventilated, the dive continues normal.**
Table/Schedule: None	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Diver is ventilated.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. **Poor/Wrong Procedures/Major Safety Violations**
2. **Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor**
3. **Average/No Safety Violations/Required Some Prompting by Supervisor**
4. **Above Average/No Safety Violations/Required Minimal Prompting by Supervisor**
5. **Outstanding/No Safety Violations/Required No Prompting by Supervisor**

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013014

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ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Contaminated Breathing Gas Supply

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Diving supervisor, communications/logs operator, tender, standby diver (if deployed).

DIVE PROFILE	SCENARIO
Previous Dive	**Approximately 10 minutes into the dive, the diver says the air tastes funny. If no action is taken, within 3 minutes the diver will pass out. If or when the diver shifted to EGS or a backup breathing gas source, the taste goes away. The diving supervisor *MUST* send someone to inspect the primary breathing source of problems.**
Table/Schedule: NONE	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Breathing gas source is shifted.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. **Poor/Wrong Procedures/Major Safety Violations**
2. **Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor**
3. **Average/No Safety Violations/Required Some Prompting by Supervisor**
4. **Above Average/No Safety Violations/Required Minimal Prompting by Supervisor**
5. **Outstanding/No Safety Violations/Required No Prompting by Supervisor**

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013015

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: DCS/Type I/Pain in Right Elbow

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

DIVE PROFILE	SCENARIO
Previous Dive	During the last dive of the day, Diver 2 from the previous dive informs a fellow member of the dive team that his/her right elbow is very sore. When asked, he/she will state that it started at about 30 minutes after surfacing. It is not aggravated with movement and not a result of any mechanical injury. It is about a 7 on a 1 to 10 scale, up from about a 4 when first noticed. There are no other symptoms. Symptoms will completely resolve on descent in the chamber.
Table/Schedule: 60'/55 minutes	
RS:	
SI: 45 minutes	
Current Dive	
Table/Schedule: Actual	
RS:	
Time of Onset: @ 30 minutes SI	
Project:	

Casualty Drill Will Continue Until: At 60 feet in, the chamber and correct TT determined.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013016

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: DCS/Type II/Pain Left Forearm, Numbness Left Hand

Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	**During the last dive of the day, Diver 2 from the previous dive reports to a fellow member of the dive team that his/her left forearm hurts somewhat. When asked, he/she will state that it started about 15 minutes surface interval (SI) while he/she was in the shower. The pain will be hard to pinpoint and is not made worse by movement. It is at a 6 on a 1 to 10 scale and has gotten a little worse since first noticed. During a neuro, numbness is found on the back of the left hand. Diver will be asymptomatic at 11 minutes into the first O_2 period.**
Table/Schedule: 70’/50 minutes	
RS:	
SI: 30 minutes	
Current Dive	
Table/Schedule: Actual	
RS:	
Time of Onset: @15 minutes SI	
Project:	

Casualty Drill Will Continue Until: 11 minutes @ 60’ and the Proper TT is determined.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. **Poor/Wrong Procedures/Major Safety Violations**
2. **Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor**
3. **Average/No Safety Violations/Required Some Prompting by Supervisor**
4. **Above Average/No Safety Violations/Required Minimal Prompting by Supervisor**
5. **Outstanding/No Safety Violations/Required No Prompting by Supervisor**

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor’s Debrief:

Participants’ Remarks:

013017

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Diver Shocked While Underwater Welding

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Communications/logs operator, diving supervisor, tenders, switch operator, standby diver (if deployed).

DIVE PROFILE	SCENARIO
Previous Dive	**While welding underwater, the diver reports being shocked. The topside personnel should disconnect the knife switch. If power is not secured in a timely manner, the diver will become unconscious (not answering communications or line-pull signals).**
Table/Schedule: NONE	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Power to the welding equipment is secured

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013018

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Fouled Diver, Hose Change

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Standby Diver, Tenders, Phone Talker, Dive Supervisor

DIVE PROFILE	SCENARIO
Previous Dive	Diver fouled on bottom and is unable to become free. When asked, the diver states he/she is wrapped around the downline several times and cannot tell which way to move to become free. Standby will be deployed but is unable to clear the diver and will state that the umbilical needs to be changed out with another umbilical from the surface. Standby will acquire another umbilical and change out umbilicals on the primary diver.
Table/Schedule: N/A	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Umbilical is changed out in the water.

Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013019

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Mechanical, Badly Sprained Right Ankle

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

DIVE PROFILE	SCENARIO
Previous Dive	While returning to the down line, Diver 1's right foot gets fouled in debris on the bottom. He/she does not report this. The tenders will continue to take up slack until Diver 1 lets out a yell to stop. Diver 1 reports that his/her foot is clear but got severely twisted in the process. When asked, Diver 1 will state that he/she can make it to the down line but will require assistance up the ladder.
Table/Schedule: N/A	
RS:	
SI:	
Current Dive	
Table/Schedule: Actual	
RS:	
Time of Onset: Bottom	
Project:	

Casualty Drill Will Continue Until: Injured diver is on deck and recommendation made.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013020

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: POIS/AGE/Pneumothorax, Weakness

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

DIVE PROFILE	SCENARIO
Previous Dive	**LAST DIVE OF THE DAY. During cleanup, Diver 1 from the last set complains of a moderate pain on the left lateral side of his/her chest that started about 11 minutes after surfacing from the dive. It hurts more when inhaling but is not getting worse. Reports a 6 on a 1 to 10 scale. Neuro reveals notable weakness in the diver's left shoulder, when he/she is asked to shrug shoulders. There are no other symptoms. Diver will be asymptomatic 5 minutes after reaching treatment depth.**
Table/Schedule: N/A	
RS:	
SI:	
Current Dive	
Table/Schedule: Actual	
RS:	
Time of Onset: @ 15 minutes SI	
Project:	

Casualty Drill Will Continue Until: Diagnosis, treatment depth and TT determined.

Start Time:		**Stop Time:**	
Symptoms presented as briefed? (If not, explain in remarks.)		**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013021

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: POIS/Mediastinal/Pain, Cough

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

DIVE PROFILE	SCENARIO
Previous Dive	LAST DIVE BEFORE LUNCH. Upon reaching surface, Diver 1 starts to cough. When unhatted, he/she will complain of a burning sensation and pain in the center of his/her chest that is worse when taking a deep breath. The cough gets slightly worse and persists. A neuro reveals no other symptoms.
Table/Schedule: N/A	
RS:	
SI:	
Current Dive	
Table/Schedule: Actual	
RS:	
Time of Onset: @ RS	
Project:	

Casualty Drill Will Continue Until: Neuro and proper diagnosis and treatment are made.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013022

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Tender Collapses Due to Heat Exhaustion

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Dive supervisor, tenders, extra personnel on the side.

DIVE PROFILE	SCENARIO
Previous Dive	**Shortly after the diver enters the water (approximately 10 minutes), the No. 1 tender will pass out. Upon further investigation, it is discovered that this tender is suffering from heat exhaustion.**
Table/Schedule: NONE	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Tender is given appropriate first aid.

Start Time:		**Stop Time:**	
Symptoms presented as briefed? (If not, explain in remarks.)		**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. **Poor/Wrong Procedures/Major Safety Violations**
2. **Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor**
3. **Average/No Safety Violations/Required Some Prompting by Supervisor**
4. **Above Average/No Safety Violations/Required Minimal Prompting by Supervisor**
5. **Outstanding/No Safety Violations/Required No Prompting by Supervisor**

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013023

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Unconscious Penetration Diver

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Dive supervisor, communications/logs operator, standby diver, tenders.

DIVE PROFILE	SCENARIO
Previous Dive	**Shortly after entering the penetration area (at least 10 feet but not more than 15 feet), the diver stops and does not answer communications or line-pull signals. Standby has to rescue diver.**
Table/Schedule: NONE	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Unconscious Diver is on the dive platform.

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. **Poor/Wrong Procedures/Major Safety Violations**
2. **Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor**
3. **Average/No Safety Violations/Required Some Prompting by Supervisor**
4. **Above Average/No Safety Violations/Required Minimal Prompting by Supervisor**
5. **Outstanding/No Safety Violations/Required No Prompting by Supervisor**

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013024

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Unconscious Tender

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

Diving supervisor, tenders, extra personnel on the side.

DIVE PROFILE	SCENARIO
Previous Dive	**Shortly after the diver enters the water (approximately 10 minutes), the No. 1 tender will pass out. Upon further investigation, it is discovered that this tender made the *previous* dive.**
Table/Schedule: NONE	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until: Tender is at correct treatment depth.

Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013025

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Unconscious Bell Diver (in the Bell)

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

DIVE PROFILE	SCENARIO
Previous Dive	After repeated attempts by diving control to contact the bell, the diver was directed to return to the bell, to discover the bell man unconscious. Unconscious bell siver (in the bell) response procedure initiated.
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	YES	NO

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013026

ADCI

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Unconscious Bell Diver (Out of the Bell)

Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	After failing to respond to radio communications from dive control, the bell, and line pulls from the bell, the Bell Standby was sent to the location of the diver. Initiate unconscious bell diver response procedure.
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:

Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		**YES**	**NO**

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013027

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Loss of Breathing Media to Diver	
Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	While diver was working on the bottom, delivery of diver's primary breathing gas was interrupted. Supervisor needs to initiate emergency gas to diver and resolve primary gas failure.
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:			
Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		YES	NO

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013028

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Hydrocarbons in the Bell

Supervisor:	**Job No.**
Subject:	**Date:**
Key Participants/Remarks:	

DIVE PROFILE	SCENARIO
Previous Dive	Hydrocarbon alarm in the bell has gone off. Hydrocarbons response procedure initiated.
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:			
Start Time:	**Stop Time:**		
Symptoms presented as briefed? (If not, explain in remarks.)		YES	NO

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013029

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL, INC.

EMERGENCY RESPONSE DRILLS

Category/Type/Symptom: Recovery of Unconscious Surface Diver

Supervisor:	**Job No.**
Subject:	**Date:**

Key Participants/Remarks:

DIVE PROFILE	SCENARIO
Previous Dive	After no response from the diver via radio communication or line pulls, the standby was sent down to the diver's location. Standby diver reports the diver unconscious. Unconscious diver response procedure to be initiated.
Table/Schedule:	
RS:	
SI:	
Current Dive	
Table/Schedule:	
RS:	
Time of Onset:	
Project:	

Casualty Drill Will Continue Until:

Start Time:	**Stop Time:**

Symptoms presented as briefed? (If not, explain in remarks.)	YES	NO

Grade Casualty Drill with 1-5 or N/A as follows:

1. Poor/Wrong Procedures/Major Safety Violations
2. Below Average/Minor Safety Violations/Required Frequent Prompting by Supervisor
3. Average/No Safety Violations/Required Some Prompting by Supervisor
4. Above Average/No Safety Violations/Required Minimal Prompting by Supervisor
5. Outstanding/No Safety Violations/Required No Prompting by Supervisor

ITEM / AREA	GRADE	ITEM / AREA	GRADE
• Recognized Initial Problem		• Questions Asked	
• Notified the Company Office		• Dive Profile Checked	
• Notified Emergency Services		• Dive Partner Checked	
• Dive Stations Covered		• Surface O_2 – Stretcher on Scene	
• Emergency Assignments		• Correct Diagnosis of Symptom	
• Dive Team Efforts		• Correct Treatment Table	
• Standby Diver Deployed		• Correct Depth	
• Control of Injured Personnel		• Travel Rate	
• Neurological Exam		• Post Treatment	
• Affected Area Checked		• Other	

Supervisor's Debrief:

Participants' Remarks:

013030

11.8 JOB HAZARD ANALYSIS

JOB HAZARD ANALYSIS

Company:	Location:	Date:	Page_____of_____	New ❒ Revised ❒
Job or Task:				
No.	Basic Job Steps	Potential Hazards	Recommended Safe Procedures/Protection	Responsibilty
Prepared By:		Reviewed By:		Approved By:
Distribution:				

11.9 ANSI/ACDE-01-2009 STANDARDS

ANSI (AMERICAN NATIONAL STANDARD INSTITUTE) AND
ACDE (ASSOCIATION OF COMMERCIAL DIVING EDUCATORS) STANDARDS

The Association of Diving Contractors International, Inc. (ADCI), hereby recognizes and endorses this standard as one being acceptable for an entry-level commercial diver trainee.

Introduction

The American National Standards Institute (ANSI) Standard for Commercial Diver Training requires that a diver at work must have received adequate training to safely undertake the work involved in the diving operation. As part of this requirement, each diver must possess a valid certificate of training. This may be:

a. A certificate of training issued by an Association of Commercial Diving Educators (ACDE) accredited school; or

b. Commercial diving experience or combination of both commercial experience and training; or

c. The equivalent of the training requirements as outlined in the ANSI standard.

Competence Assessment

During 1993, in its endeavor to foster better vocational training and education, the Association of Commercial Diving Educators (ACDE) encouraged the development of standards-based qualifications that focused on essential competence at the workplace and that were assessable, as well as understood, by employers, trainees and trainers.

With the agreement of the industry, ACDE decided in 1995 that such an approach was appropriate to diver qualification and that certificates should be issued on the basis of competence rather than merely the completion of a training course. ACDE subsequently developed the competence standard and related assessment requirements as set out in this document.

Competence is determined through written tests, instructor evaluation, log book records and the trainee's performance, attitude and ability to conduct in-water diving-related work tasks. In conjunction with a diver training course, divers will be assessed by schools that have been accredited for this purpose. Theoretical competence forms the foundation for the application and is required when practical ability and skills depend on some element of knowledge and understanding. Where both theory and practice are indicated, divers will be assessed both ways. Assessment records on each trainee will be maintained by individual training sites.

Although not spelled out as a specific competence, all divers recommended for a certificate shall have achieved specified in-water times during training and assessment. Those times for training are set out in the published Commercial Diver Training Minimum Standard and are further clarified in the standard where needed to avoid ambiguity.

To obtain a certificate of training, a student shall achieve a minimum of 625 hours of formal instruction.

Competence Standard

This new standard was derived from the 1993 American National Standard for commercial diver training. This revised standard is more defined and specifies minimum requirements.

The competence standard represents abilities that a diver must demonstrate under testing before he or she can be issued a commercial diving certificate. This standard pertains whether the certificate is the result of training or experience, or both.

The competence standard is divided into sections that represent important aspects of a diver's ability and can be identified as such by employers. These include, for example, practical diving — the ability of the diver to leave the surface, remain at the underwater work site until the job is finished or his or her time is up, and return safely to the surface. Each section is further divided into main headings and subheadings. The latter provides the essential details on which the diver will be assessed.

Statement

The aim of the standard is to:

- Improve the quality of training, with both theoretical and practical applications, for entrants to commercial diving.
- Reduce the risk of diving accidents attributable to inadequate training.
- Establish consistent minimum training requirements to insure continuity of training within the ACDE.
- Require that graduates be qualified and competent to dive and perform underwater work assignments before receiving a certificate.

This standard was developed to establish what is to be taught, the minimum length of training required for each section, the minimum qualifications for instructors, and the minimum facilities and equipment required to support that training as outlined in Section 1. In developing this standard, subject matter that is similar, or closely related, is grouped together. Subject matter has been further subdivided into topics of manageable size for instructional purposes and detailed lesson planning. Such grouping is not intended as a training schedule.

After the effective date of the standard, the (ACDE) hereby recognizes and endorses this standard as the acceptable minimum training standard for the entry level commercial diver trainee. All commercial divers who can document an equivalent level of training through a combination of field experience and/or formal diver training prior to the original issue date (1993) are specifically exempt from its application.

ACDE provides accreditation to all of its member schools and ensures that a national system of commercial diver training is maintained. Diver training institutions wishing to become a member of ACDE are inspected and evaluated to ensure their training standards provide training for commercial diving at the level of this standard.

Questions regarding this standard and/or applications for membership in ACDE should be addressed to:

ACDE Inc.
c/o Santa Barbara City College
721 Cliff Drive
Santa Barbara, CA 93109
Telephone: 805-965-0581 x2426
Fax: 805-560-6059

Deviation from the standard may be made only to exceed or supplement the required training.

The order of sections presented by ACDE for training requirements is not restricted to the section sequence contained herein. Differences in facilities, equipment, local administrative requirements, state and federal laws and/or similar conditions may warrant modification of any established sequence. It is the responsibility of each school to provide for the efficient implementation and administration of this standard and to ensure that each topic presented herein is presented in a way that provides a maximum gain in knowledge and skill for each trainee. The minimum standard will be reviewed periodically to reflect changes in technology, techniques and other developments that are likely to occur in the commercial diving industry.

COMMERCIAL DIVER TRAINING MINIMUM STANDARDS

1.0 GENERAL REQUIREMENTS

1.1 Facility
Training facilities shall meet all federal, state and local requirements and laws. They should possess adequate space, equipment and safety regulations to offer safe and competent training. Aside from federal, state and local requirements, at a minimum, facilities will include classrooms with adequate lighting, tables, desks, seating, blackboards/whiteboards, audio-visual equipment, technical library, texts and training materials to support the student learning environment. Training facilities must be available to support practical, in-water training as well as rigging, welding, chamber operations, etc.

1.2 Staff
Each training facility should have adequate support staff to maintain high-quality teaching standards, facility, equipment, records and emergency procedures. Staff members should be selected for their competency in performing their assigned tasks.

1.3 Instructors
Schools should employ instructors with a minimum of two years of full-time working experience in the field of commercial surface-supplied diving, or area of instruction taught, and should meet state educational requirements for vocational instructors. If required, instructors must meet state and/or city codes. All instructors should have current first aid and CPR certificates and be trained in emergency policies and procedures.

1.4 Equipment
All diving and support equipment will be properly maintained in accordance with manufacturer's specifications.

Practical training (hands-on) should be conducted with equipment that the trainee will use in the industry. Knowledge of newly developed equipment should be taught. Manufacturer's operational manuals must be available, as well as instruction manuals, equipment and tools for hands-on helmet and mask repair and maintenance. This must be in addition to equipment used for working dives.

All commercial diver training facilities will provide, at a minimum, at least two different types of diving helmets common to the industry, including a "demand" and a "freeflow" type helmet.

Other diving and support equipment that must be provided on site includes, but is not limited to, the following: diving air compressors (hp and Ip), surface-supplied diving systems, bail-out bottles, recompression chambers, air and mixed-gas supply manifolds, diver's hot water supply systems, gas racks, welding machines, underwater cutting and welding equipment, hydraulic/pneumatic tools, air lift, water jet, topside and underwater rigging and mechanical projects, equipment for teaching the operation and maintenance of marine engines and compressors, lifting devices and other rigging equipment common to the diving industry, properly constructed umbilicals, and first aid and CPR training equipment.

1.5 Training Aids
Books and training aids should contain current information and be appropriate for individual courses and modules. Up-to-date audiovisual aids should be used with all applicable instruction. Students should be supplied with an ACDE/ADC commercial diving log book, which must be maintained and updated on a regular basis.

1.6 Physical Examinations
Each entrant should pass a medical examination before being accepted into a training program. The medical examination should be current within the last year from the class finish date. Limits and standards for physical condition of the entrant should be spelled out in the medical examination form according to the current ADCI medical requirements for commercial divers. The examining physician should be instructed in writing exactly what qualities to look for in a potential entrant, and the recommended tests and techniques to be employed should be listed.

1.7 Physical Fitness
The importance of physical fitness will be emphasized to students throughout the training program.

1.8 Industry Input
Close liaison with the safety, education and medical committees of the ADCI should be maintained to ensure that training meets industry requirements and needs. Contact with commercial diving companies and equipment manufacturers should be maintained to ensure awareness of changes and improvements in equipment, procedures, safety requirements, etc.

1.9 Employment
Students shall be informed about employers' hiring policies regarding drugs and alcohol. Responsibilities of tenders, tender/divers and divers shall be included in the training. Rules and regulations for the United States Coast Guard, Association of Diving Contractors (ADC) Consensus Standards and OSHA shall be an integral part of the training.

1.10 Safety
Safety and compliance with federal, state and ADC standards should be emphasized throughout the training program. Students will be instructed that the basic responsibility for both personal and operational safety lies with each individual.

1.11 Documentation
Documentation of all training successfully completed must be available to the student, including transcripts, diplomas and certificates. Students will be issued and required to maintain an official ADCI/ACDE log book. Upon completion of training, an official ACDE certification card will be issued to each graduating student.

1.12 Drug Policy
Safety is of paramount importance. ACDE is committed to maintaining a safe, healthy work and training environment and is dedicated to providing a drug- and alcohol-free workplace.

A substance abuse policy should be strictly enforced. This will provide a means to minimize the use of intoxicants by personnel, staff, employees and trainees, and will enhance safe conduct of operations. The goals should be to attain the highest work and training standards possible and to promote a safe work environment, free of drugs and alcohol.

The goals and objectives of maintaining safety in a drug-free work environment are attainable through cooperation at every level and by explicitly and forcefully prohibiting the use, manufacture, distribution, dispensation and possession of illicit drugs, drug paraphernalia and alcohol at all training locations and diving operations.

2.0 PRINCIPLES OF DIVING PHYSICS
Required Hours: 12.5

2.1 Objectives:
To provide the trainee with an understanding of the physics of air and water pressure applicable to diving.

2.2 Outline of Instruction:

a) Normal air
- 1) Definition
- 2) Composition
- 3) Properties
- 4) Characteristics
- 5) Gas laws affecting air

b) Water
- 1) Composition, salt and fresh water
- 2) Characteristics
- 3) Weight/salt and fresh water

c) Terminology and values used in pressure (partial, barometric, atmospheric, gauge and absolute)
- 1) Mechanical pressure
- 2) Other ambient pressures related to diving

d) Buoyancy in water
- 1) Archimedes' principle
- 2) Example and application

e) Definitions
- 1) Buoyancy
- 2) Density
- 3) Area
- 4) Volume

f) Gas laws
- 1) Boyle's
- 2) Charles'
- 3) Henry's
- 4) General gas law
- 5) Guy Lusac's
- 6) Daltons'

g) Summary
- 1) Characteristics of air and water
- 2) Laws governing gasses
- 3) Pressure: absolute and relative
- 4) Computation of pressure at various atmospheres
- 5) Buoyancy in water
- 6) Effect of pressure on gas absorption
- 7) Effect of temperature on pressure

3.0 FORMULA APPLICATION
Required Hours: 12.5

3.1 Objectives:
a) To familiarize the trainee with diving physics formulas.
b) To provide practical experience in using diving physics formulas.

3.2 Outline of Instruction:
a) Gauge and absolute pressure at various depths
b) Volume of cylinders
c) Time duration of air supply from air flasks
d) Air supplies required by divers
e) Flow requirements for masks and hats
f) Required capacity of air compressor
g) Hose test formula
h) Application of physics formulas

4.0 AIR DECOMPRESSION TABLES AND DECOMPRESSION PROCEDURES
Required Hours: 30

4.1 Objectives:
a) To familiarize the trainee with the various methods of decompression.
b) To provide the trainee experience in the practical application of decompression tables.

4.2 Outline of Instruction:
a) History of decompression
b) Decompression
  1) Definition
  2) Types
c) U.S. Navy Standard Air Decompression tables
d) Surface decompression tables (O_2 and Air)
e) Practical application of decompression tables in theoretical dives
f) Altitude diving tables and computation
  1) Barometric
  2) Tables
  3) 4% Rule

5.0 ANATOMY AND PHYSIOLOGY RELATED TO DIVING
Required Hours: 18

5.1 Objectives:
a) To describe the anatomy and physiology of the circulatory and respiratory systems of the human body.
b) To educate the trainee on the effects of pressure and changes of pressure on the human body.
c) To provide the trainee a better understanding of the process and what happens when ambient pressure is increased or decreased.

5.2 Outline of Instruction:
a) Anatomy and physiology: the study of various organs and parts of the body — their functions and activities
  1) Anatomy of the circulatory system
  2) Physiology of the circulatory system
  3) Anatomy of the respiratory system
  4) Physiology of the respiratory system
  5) Body cavities containing air

- b) Primary effects of pressure
  - 1) Effects of pressure applied equally to the body
  - 2) Effects of pressure applied unequally to the body
- c) Secondary effects of pressure (the disturbances in gas equilibrium, i.e., of gasses in the body)
  - 1) Toxic effects of oxygen
  - 2) Narcotic effect of nitrogen
  - 3) Toxic effects of carbon dioxide and carbon monoxide
  - 4) Nitrogen absorption and elimination
  - 5) Effects of pressure in excess of 1 atmosphere on body tissue
  - 6) Principles involving prevention of decompression sickness

6.0 DIVING DISEASES, INJURIES AND PSYCHOLOGICAL ASPECTS
Required Hours: 12

6.1 Objectives:
To familiarize the trainee with the various types of diseases and injuries that occur in diving.

6.2 Outline of Instruction:

- a) Anoxia/hypoxia
  - 1) Definition
  - 2) Symptoms
  - 3) Causes
  - 4) Prevention and treatment
- b) Hypercapnia/asphyxia
  - 1) Definition
  - 2) Symptoms
  - 3) Causes
  - 4) Prevention and treatment
- c) Squeeze
  - 1) Definition
  - 2) Symptoms
  - 3) Causes
  - 4) Prevention and treatment
- d) Decompression sickness
  - 1) Definition and types
  - 2) Symptoms
  - 3) Causes
  - 4) Prevention and Treatment
- e) Arterial gas embolism (AGE)
  - 1) Definition
  - 2) Symptoms
  - 3) Causes
  - 4) Prevention and treatment
- f) High-pressure nervous syndrome (HPNS)
  - 1) Definition
  - 2) Symptoms
  - 3) Causes
  - 4) Prevention and treatment

g) Nitrogen narcosis
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
h) Oxygen toxicity (CNS/pulmonary)
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
i) Pneumothorax
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
j) Mediastinal and subcutaneous emphysema
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
k) Carbon monoxide poisoning
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
l) Drowning (near drowning)
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
m) Lipoid pneumonia
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
n) Bone necrosis
   1) Definition
   2) Symptoms
   3) Causes
   4) Prevention and treatment
o) Psychological aspects of diving
   1) Screening for phobias
   2) Rationale of physics versus mental abilities of divers
   3) Water skills and their psychological implications
   4) Specific adaptations (breathing through the nose, use of mechanical equipment, etc.)

5) Emotional and physical stability
6) Diver stress
7) Effects of stress
8) Comparison of panic and mental controls
9) Diving philosophies
10) Dive planning
11) Breathing and diving (relate to stress stimulus)
12) Rules for reacting to all unusual feelings, control of stress, stimulus
13) Green diver syndrome

7.0 TREATMENT OF DIVER'S ILLNESS AND INJURIES
Required Hours: 30

7.1 Objectives:

a) To educate the trainee in the use of tables for treatment of arterial gas embolism, decompression sickness and omitted decompression.

b) To impress upon the trainee the importance of selection of the proper treatment table.

c) To provide the trainee practical experience in the selection and use of the treatment tables.

7.2 Outline of Instruction:

a) Treatment Table 1A
b) Treatment Table 2A
c) Treatment Table 3
d) Treatment Table 4
e) Treatment Table 5
f) Treatment Table 6
g) Treatment Table 6A
h) Treatment Table 7
i) Treatment Table 8
j) Review case histories with cases that illustrate both proper and improper selection and use of treatment tables
k) Practical use of table with hypothetical cases and various symptoms
l) Examination of injured diver
   1) Vital signs
   2) Mental condition
   3) Cranial nerves
   4) Sensory nerves
   5) Motor nerves
   6) Coordination
   7) Reflexes

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8.0 FIRST AID FOR DIVERS AND CPR
Required Hours: 16

8.1 Objectives:

a) To provide the trainee with a basic understanding of the first aid measures appropriate to common diving and industrial accidents/illnesses.

b) To meet or exceed the minimum standards as set forth by the American Red Cross or equivalent first aid and CPR training requirements.

8.2 Outline of Instruction:

a) Shock
  1) Electric
  2) Traumatic
  3) Emotional

b) Artificial respiration (CPR)
  1) Drowning
  2) CO_2 poisoning
  3) CO poisoning
  4) Mouth-to-mouth method

c) Use of mechanical resuscitation

d) Hemorrhage (bleeding)
  1) Venous
  2) Arterial
  3) Capillary
  4) Internal
    - Lungs
    - Stomach

e) Fracture
  1) Simple
  2) Compound

f) Burns
  1) Classification
  2) Chemical
  3) Thermal
  4) Treatment

g) Wounds

h) Communication with medical personnel (terminology)

i) Assist in treatment of diving-related illness and accidents

j) Cardiac arrest
  1) Definition
  2) Symptoms
  3) Causes
  4) Prevention and treatment

9.0 NOXIOUS GASSES IN ENCLOSED SPACES
Required Hours: 2

9.1 Objectives:

a) To provide the trainee with knowledge of the noxious gasses encountered in diving operations.

b) To introduce the trainee to various instruments used to detect noxious gasses.

c) To familiarize the trainee with precautions necessary to avoid accidents from noxious gasses.

9.2 Outline of Instruction:

a) Noxious gasses
b) Closed spaces
c) Carbon monoxide
    1) Origin, description and identification
    2) Affinity toward hemoglobin; comparative attraction ratios versus oxygen
    3) Symptoms of carbon monoxide poisoning
    4) Treatment of carbon monoxide poisoning cases
d) Carbon dioxide
    1) Sources and description
    2) Effects upon respiration
    3) Symptoms of carbon dioxide poisoning
    4) Treatment of carbon dioxide poisoning cases
e) Explosive gasses
    1) Types
    2) Generation process
f) Instruments used in detecting gasses
    1) Hydrogen sulfide detector
    2) Carbon monoxide detector
g) Elimination and prevention of gas hazards
h) Means of avoiding accidents from gas hazards
i) Rules for mask or helmet removal

10.0 ENVIRONMENTAL HAZARDS OF DIVING
Required Hours: 12

10.1 Objectives:
To provide the trainee knowledge of the environmental hazards the diver may encounter.

10.2 Outline of Instruction:

a) Marine life
    1) Wound-inflicting species
    2) Animals that inject venom
    3) Treatment of wounds
    4) Divers' evasive action
b) Exposure/weather patterns
    1) Climate
        - Air temperature
        - Water temperature
        - Body protection (hyperthermia and hypothermia)
            • Exposure suits
            • Underwear
            • Sunburn

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c) Wave motion — seasickness
d) Surf, surge, currents and tides
e) Bottom conditions/visibility
f) Polluted water/hazards
g) Identification of underwater hazards
h) Oxygen-deficient environments
i) Underwater explosions
j) Underwater suctions and discharges

11.0 THE HYPERBARIC CHAMBER AND ASSOCIATED EQUIPMENT
Required Hours: 16

11.1 Objectives:
To provide the trainee with a knowledge of the characteristics of the chamber and the procedures for operating the chamber.

11.2 Outline of Instruction:
a) Gas supply for chambers
1) Capacity
2) Ventilation
3) Supply valves
4) Exhaust valves
5) Gauges
6) Relief and gag valve
7) Primary and secondary gas supply
8) Atmosphere sensors (O_2, CO_2, temp)
9) Life-support systems (CO_2 scrubbers, heater/chiller)
10) Plumbing
11) O_2 system
b) Precautions in chamber use
1) Lighting
2) Door
3) Seals, openings and penetrations
4) Oxygen fires
5) Testing and maintenance of chamber
6) Operational considerations
- Oxygen safety
- Personal requirements
- Chamber safety considerations
- Smoking
- General fire hazard
7) Equipment
8) Communication system

12.0 TRAINEE PARTICIPATION IN CHAMBER OPERATIONS
Required Hours: 44

12.1 Objectives:
a) To provide the trainee with practice in the operational procedures of a hyperbaric chamber and simulating the treatment of diving injuries.
b) To develop trainee's skills in proper decompression and recompression operations.

12.2 Outline of Instruction:

a) Review operating procedures for the chamber

b) Practice maintaining steady rate of ascent/descent

c) Conduct simulated treatments

d) Use of man lock and treatment lock, and the purpose of medical locks

e) Conduct simulated treatment using oxygen and/or nitrox

f) Practice maintaining required pressure while ventilating

g) Safety precautions

h) Decompression operations

1) Surface decompression using oxygen and/or nitrox

2) Surface decompression using air

i) Lock in/lock out procedures

j) Pressure test

13.0 SEAMANSHIP AND RIGGING FUNDAMENTALS
Required Hours: 25

13.1 Objectives:

a) To provide the trainee with a knowledge of the construction, use and care of fiber, synthetic and wire rope.

b) To familiarize the trainee with the purpose and use of splices in fiber and wire rope.

c) To instruct the trainee in the purpose and use of terminal fittings on wire rope.

d) To introduce the trainee to the applicable sections of the American Petroleum Institute.

13.2 Outline of Instruction:

a) Fiber rope

1) Types

2) Sizes — how measured

3) Care and maintenance

b) Wire rope

1) Types

2) Sizes — how measured

3) Care and maintenance

c) Synthetic rope

1) Nylon

2) Polyester (Dacron)

3) Polypropylene

d) Splices
    1) Types
    2) Application of various splices
    3) Strength of splices
    4) Safety factors
e) Wire rope clips
    1) Use
    2) Method of application
    3) Strength
f) Terminal fittings
    1) Types
    2) Strength
    3) Methods of application
g) Blocks and tackles and mechanical advantage
h) Come-alongs, chain hoists, shackles and grip hoist
i) Winches and air tuggers
j) Hand signals for controlling crane operations
k) Calculation of problems for safe working load and braking strain for fiber and wire rope
l) Slings
m) Performance of underwater projects for practical application of rigging

14.0 PRACTICAL APPLICATION OF SEAMANSHIP AND RIGGING
Required Hours: 60

14.1 Objectives:
To provide the trainee practice in the application of seamanship and rigging.

14.2 Outline of Instruction:
a) Splices, fiber rope
    1) Eye
    2) Short
    3) Long
b) Splices, wire rope
    1) Flemish eye (Molly Hogan)
    2) Eye splice 3-strand line
    3) Back splice 3-strand line
    4) Short splice
c) Knots and hitches
    1) Square knot
    2) Clove hitch
    3) Rolling hitch
    4) Timber hitch
    5) Telegraph hitch
    6) Two half hitches
    7) Round turn and two half-hitches
    8) Fisherman's bend
    9) Single-sheet bend
    10) Double-sheet bend

11) Catspaw in center of line
12) Prussic knot
13) Single bowline
14) Running bowline
15) Stopper
16) French bowline
17) Double bowline
18) Baker bowline
19) Girth hitch
20) Double carrick

d) Practical application in knot tying and splicing
e) Reeving of block and tackles
f) Practical underwater projects requiring rigging
g) Hooks
h) Mechanical advantage
i) Chain

15.0 LIGHTWEIGHT DIVING EQUIPMENT FUNCTION AND NOMENCLATURE
Required Hours: 24

15.1 Objectives:

a) To familiarize the trainee with the nomenclature, function and operation of lightweight diving equipment, masks and helmets.
b) To instruct the trainee in the proper procedures for checking, testing and maintaining lightweight diving equipment.
c) To instill in the trainee a sense of confidence and trust in the equipment.
d) To instruct the trainee in the use of bailout systems and other safety procedures.

15.2 Outline of Instruction:

a) History and development
  1) Diving equipment
  2) Advantages and disadvantages — deep-sea gear versus lightweight gear
b) Use of lightweight diving equipment
c) Nomenclature and function
  1) Masks and helmets
  2) Dress
  3) Belt (weight)
  4) Air hose
  5) Lifeline
  6) Communications wire
  7) Harness
  8) Diver's radio
  8) Gas manifolds
d) Disassemble/assemble mask and helmets
  1) Use of drawings/schematics and tech manuals

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16.0 LIGHTWEIGHT DIVING PROCEDURES AND TECHNIQUES
Required Hours: 40

16.1 Objectives:

a) To instruct the trainee in the operational use of lightweight diving equipment, procedures and safety consideration.

b) To develop the trainee's confidence in lightweight equipment and in lightweight diving.

c) To develop the trainee's skill in the proper way of entering the water, using hose signals and other means of communication, and accomplishing different tasks, using lightweight diving equipment.

d) To instruct trainees in the proper use of procedural manuals and emergency procedures.

16.2 Outline of Instruction:

a) Safety precautions
- 1) Ascending procedures
- 2) Reasons for not removing lifeline
- 3) Last resort of ditching mask

b) Orientation dives using lightweight diving gear, helmets and weighted belt
- 1) Instruction before entering water
  - -Proper method of dressing
  - -Location of air-control valve
  - -Location of exhaust valve
  - -Proper use of weighted belt
  - -Proper method of securing lifeline to diver
  - -Location and use of EGS valve and bottle
- 2) Dress diver and commence dive
  - -Proper water entry
  - -Observe hand signals
  - -Proper ditching of weights
- 3) Water entries
- 4) Orientation dives
- 5) Use of a minimum of one demand and one free flow mask
- 6) Bailout procedures

c) Proper tending procedures

d) Proper use of communications

e) Time keeping/chart procedures

f) Use of diver's log book
- 1) Organization and content
- 2) Official documentation
- 3) Recording of dives

g) Commercial diving standards

h) Requirements for training

i) Diver classification, qualification and certification

j) Diving accident reports

17.0 MAINTENANCE OF DIVER'S UMBILICAL
Required Hours: 12

17.1 Objectives:

a) To instruct the trainee in the proper method for making, maintaining, and testing dive hose.

b) To provide practice to the trainee in making and testing dive hose.

17.2 Outline of Instruction:

a) Lifelines
   1) Make-up
   2) Maintenance
   3) Minimum strength requirement
   4) Testing
   5) Snap shackle types/sizes

b) Airhose
   1) Make-up
   2) Maintenance
   3) Testing
   4) Marking

c) Air hose connection

d) Checking for safety

e) Communications line: care and maintenance

f) Practical application

18.0 UNDERWATER WORK USING LIGHTWEIGHT DIVING EQUIPMENT
Required Hours: 65

18.1 Objectives:

a) To provide the trainee with practical experience in diving and lightweight equipment.

b) To provide the trainee experience in some of the more difficult underwater tasks encountered in commercial diving.

c) To familiarize the trainee with safety issues surrounding using lightweight diving gear and hazards encountered (e.g. liveboating).

18.2 Outline of Instruction:

a) Safety precautions

b) Emergency procedures for loss of gas
   1) Bailout bottle procedures
   2) Pneumo hose procedures
   3) Standby diver procedures

c) Bottom search project (lost object recovery)

d) Single flange ups

e) Blank flange removal

f) Multiple bolts and flange projects

g) Penetration (outfalls and intakes)

h) Overhead patches, sea chests

i) Angle descending line

j) Hogging line project

k) Excavating and dredging
   1) Air lifts
   2) Hand jetting

18.3 Liveboating

a) Operational considerations

1) Sunset rule
2) Visibility
3) Sea state
4) Vessel
5) Tending considerations

b) Safety considerations

1) Depth maximum
2) Standby boat
3) Propeller shutdown
4) Propeller guards
5) Standby diver
6) Bailout supply
7) Bottom time limits

19.0 OPERATIONS PLANNING
Required Hours: 12

19.1 Objectives:

a) To expose the trainee to the successful relationship of diving jobs and operational planning.

b) To demonstrate to the trainee that while the nature of each operation will determine the scope of the planning effort, certain considerations apply to every operation.

c) Trainees will be made aware of the current Association of Diving Contractors InternationalConsensus Standard, OSHA and U.S. Coast Guard diving operational regulations.

19.2 Outline of Instruction:

a) The proper sequence of the planning process is as follows:

1) Define objectives
2) Collect and analyze data (underwater surveys/inspections)
3) Establish operational tasks
4) Select diving technique
5) Select equipment and supplies
6) Select and assemble the diving team
7) Written job description
8) Equipment list
9) Make final preparations; check all safety precautions
10) Start operation
11) Maintain safety requirements/considerations

20.0 DIVING LOGS, RECORDS AND STANDARDS FOR COMMERCIAL DIVING OPERATIONS
Required Hours: 12

20.1 Objectives:

a) To compare and contrast the types and uses of dive logs, records and reports.

b) To define the differences in standards for commercial diving operations as set forth by the Association of Diving Contractors International Consensus Standards, the U.S. Coast Guard. and OSHA.

20.2 Outline of Instruction:

a) Use of log books
  1) Organization and content
  2) Official documentation
  3) Recording of dives

b) Commercial diving standards

c) Diving accident reports

21.0 UNDERWATER TOOLS
Required Hours: 24

21.1 Objectives:

a) To provide the trainee with a knowledge of the care and use of tools and equipment used underwater.

b) To familiarize the trainee with safety precautions required to safely use tools and equipment underwater.

21.2 Outline of Instruction:

a) Nomenclature and use of tools
  1) Hand tools
  2) Pneumatic and hydraulic tools
  3) Special tools
  4) Dredges and air lifts
  5) Lift bags

b) Underwater use of tools

c) Inspection/maintenance of tools

d) Safety precautions

e) Practical application in the use of tools

22.0 DRAWINGS, BLUEPRINT READING, REPORT WRITING
Required Hours: 8

22.1 Objectives:

a) To instruct the trainee in how to read and understand blueprints and properly prepare drawings for reporting purposes.

b) To familiarize the trainee with the preparation of formal reports for submittal to the employer and customer.

22.2 Outline of Instruction:

a) Introduction to blueprint reading

b) Scale drawing and schematics

c) Report-writing

23.0 HOT-WATER SYSTEMS
Required Hours: 2

23.1 Objectives:

a) To list the terms associated with diver's hot-water systems and the problems associated with the effects of cold.

b) To provide practical experience in the setup, operation, shutdown and maintenance of diver's hot-water systems.

23.2 Outline of Instruction:

a) System description

b) Operation procedures

c) Hot-water suits and umbilical

d) Maintenance and troubleshooting

e) Safety procedures

f) Practical experience in operation and maintenance of diver's hot-water system.

24.0 INTRODUCTION TO TOPSIDE WELDING
Required Hours: 26

24.1 Objectives:
To provide proper training so the trainee can understand the applications of topside welding; explain the limitations of topside welding in regard to size of project, position and condition of metals being welded. Trainees should be able to describe the techniques for topside welding in the flat, vertical and overhead positions.

24.2 Outline of Instruction:

a) Application of topside welding

b) Limitations of topside welding

c) Topside welding techniques

25.0 TOPSIDE WELDING EQUIPMENT
Required Hours: 12

25.1 Objectives:
To assist the trainee to name and describe the functions of the components of topside welding equipment and to describe the safety precautions prescribed for topside welding.

25.2 Outline of Instruction:

a) Welding machines

b) Welding cables

c) Electrode holders

d) Electrodes

e) Welding glass and faceplate

f) Safety precautions

26.0 OXYGEN-ACETYLENE CUTTING TECHNIQUES
Required Hours: 10

26.1 Objectives:
To describe the basic techniques of oxygen-acetylene cutting. At the conclusion, the trainee will be able to name and describe the function of each component of oxy-acetylene cutting equipment and the necessary safety precautions.

26.2 Outline of Instruction:

a) History of oxy-acetylene cutting

b) The torch

c) Oxygen cylinders/care in handling

d) Gauges for oxygen cylinders/care in handling

e) Safety precautions in oxy-acetylene cutting

f) Technique for oxy-acetylene cutting

27.0 PRACTICAL APPLICATION OF OXYGEN-ACETYLENE METHOD OF CUTTING
Required Hours: 12

27.1 Objectives:
To instruct the trainee on techniques for cutting various thickness of plate, pipe and structures employing the oxy-acetylene method.

27.2 Outline of Instruction:
a) Construction and nomenclature of cutting equipment
b) Setting up equipment
c) Techniques
d) Accomplish projects
e) Safety precautions

28.0 INTRODUCTION TO UNDERWATER BURNING AND WELDING
Required Hours: 24

NOTE: Because of commonalties between topside welding and underwater welding, including basic theory, equipment and techniques, many hours in the topside welding courses are applicable or supplemental to the "Introduction to Underwater Burning and Welding" course.

28.1 Objectives
a) To list and describe the basic equipment used in oxygen-arc burning. At the conclusion, the trainee will be able to name and describe the function of each component of oxy-arc underwater burning equipment and the necessary safety precautions.
b) To describe the techniques for oxy-arc underwater burning using at least two different types of electrodes (Broco, Arcair, Thermal, Arc Lance or Kerie Cable).
c) To provide a practical introduction to the techniques for burning various thicknesses of plate, pipe and structures underwater, employing the oxy-arc method using at least two different types of electrodes.
d) To list and describe the function of the components of underwater welding equipment and describe the necessary safety precautions prescribed for welding underwater.
e) To provide practical introduction to welding underwater so the trainee can understand the applications of underwater welding AND explain the limitations of underwater welding in regards to size of the project, position and condition of metals being welded. Trainees should be able to describe the techniques for underwater welding in the flat, vertical and overhead positions.

28.2 Outline of Instruction:
a) History of oxy-arc underwater cutting
b) Construction and nomenclature of underwater burning equipment
c) The torch-holder for electrodes
d) Electrodes
e) Welding generators
f) Welding cables
g) Safety switch
h) Oxygen cylinders/care in handling
i) Oxygen hose/size/care in handling
j) Gauges for oxygen cylinders/care in handling
k) Safety precautions in oxy-arc underwater cutting
I) Technique for oxy-arc underwater cutting
m) Setting up equipment
n) Accomplish projects using at least two different manufacturers of oxy-arc cutting rod (would vary on availability of materials)
o) Techniques
p) Safety precautions
q) Welding machines
r) Welding cables

s) Electrode holders
t) Electrodes
u) Welding glass and faceplate
v) Waterproofing materials
w) Application of underwater welding
x) Limitations of underwater welding
y) Underwater welding techniques
z) Safety precautions

29.0 MIXED-GAS DIVING
Required Hours: 30

29.1 Objectives
To provide the trainee with a basic understanding of mixed-gas diving techniques and procedures.

29.2 Outline of Instruction:
a) History and medical aspects of mixed-gas diving
b) Formulas
c) Decompression procedures
d) Diving and emergency procedures
e) Operator safety considerations
f) Treatments
g) Practical applications

30.0 MARINE ENGINES AND COMPRESSORS
Required Hours: 16

30.1 Objectives
To provide the trainee with fundamental knowledge of the operation, maintenance and field troubleshooting of diesel engines and low-pressure compressors.

30.2 Outline of Instruction:
a) Application of diesel engines in diving
  1) Air compressors
  2) Generators
  3) Cranes
  4) Boats
  5) Trucks
  6) Forklifts
  7) Hydraulic power units
b) Seven systems common to all diesel engines
  1) Fuel system
  2) Fuel filters
  3) Injectors
  4) Lubrication system
  5) Cooling system
  6) Intake system
  7) Exhaust system
c) Power take-offs and clutches
d) Diesel operation (practical)
e) Maintenance (practical)

f) Troubleshooting (practical)
g) Types of compressors used in diving
h) Compressor systems
  1) Intake
  2) Compression stage
  3) Intercooler
  4) Lubrication system
    - Compressor oil for breathing air compressors
  5) Variable differential unloader
  6) Hydraulic unloader
  7) Filters
  8) Volume tanks
  9) Supply valve/manifold
i) Compressor calculations
  1) Capacity (CFM/SCFM)
  2) Depth limit (over bottom pressure)
j) Set up compressors used in diving/chamber operations
k) Compressor operation (practical)
l) Compressor maintenance (practical)
m) Troubleshooting (practical)
n) Air purity testing
o) Valves and fittings
p) Air system schematic

31.0 INDUSTRIAL AND OFFSHORE SAFETY
Required Hours: 6

31.1 Objectives

a) To familiarize the trainee with federal, state and ADCI requirements for diving operations.
b) To provide the trainee with instruction in industrial and offshore safety.
c) To provide the trainee with basic crane-safety training.

31.2 Outline of Instruction:

a) U.S. Coast Guard regulations
b) OSHA regulations
c) ADCI standards
d) General industrial safety
  1) Drugs and alcohol
  2) Hazard identification
  3) Work zone safety
  4) Lock-out and tag-out
  5) Personal protective equipment
  6) Working in confined spaces
  7) Hazardous materials
  8) Fire safety
e) Offshore safety
  1) H2S safety
  2) Helicopter orientation

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3) Personnel safety basket
4) Life jackets
5) Life rafts/boats
6) Visual location aids
7) Audio location aids

f) Basic crane safety
1) Rules and regulations
2) Slings
3) Rigging hardware
4) Proper rigging techniques
5) Signaling
6) Chain slings
7) Hoists
8) Knots

32.0 ELECTIVES

32.1 Objectives

To provide the trainee with additional skills based on individual institution needs. These needs are determined by industry needs, which are generally defined by demands of geographic location.

32.2 Outline of Instruction:

a) The standards for the courses listed as elective are maintained and monitored by the parent associations of each specific discipline.

b) The elective coursework is not limited to the list below. The list below is a result of direct industry input:
1) Non-destructive testing
2) Hazardous worker (HAZWOPER)
3) Offshore survival and safety
4) Underwater Imaging
5) Diving in contaminated environments
6) Noxious gasses in enclosed spaces
7) Dry hyperbaric welding

Total Training Hours: 625

11.10 U.S. FEDERAL REGULATIONS REGARDING COMMERCIAL DIVING OPERATIONS

U.S. FEDERAL REGULATIONS REGARDING COMMERCIAL DIVING OPERATIONS

INTRODUCTION

The following information on U.S. government regulations is provided for reference only. The Association of Diving Contractors International (ADCI) is an international organization and, therefore, each contractor will need to have knowledge of the applicable governmental regulations that apply to the diving operations in his or her specific area of operations.

Nothing herein contained is intended to replace or supplant regulations, codes or standards applied by flag state or national bodies. The ADCI recognizes the validity of codes and standards developed by other recognized international organizations, such as, but not limited to, ship classification societies, IMCA, IMO, standards institutes, etc. Member companies of this association operating outside U.S. jurisdiction may have a need to follow such codes and standards prepared by others. However, if required to also comply with other standards or codes, member companies remain pledged to comply with not less than the minimum requirements of these standards in addition to any other requirements that may apply.

SUBCHAPTER V—MARINE OCCUPATIONAL SAFETY AND HEALTH STANDARDS

PART 197—GENERAL PROVISIONS

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Subpart A [Reserved]

Subpart B—Commercial Diving Operations

GENERAL

§ 197.200 Purpose of subpart.

This subpart prescribes rules for the design, construction, and use of equipment, and inspection, operation, and safety and health standards for commercial diving operations taking place from vessels and facilities under Coast Guard jurisdiction.

§ 197.202 Applicability.

(a) This subpart applies to commercial diving operations taking place at any deepwater port or the safety zone thereof as defined in 33 CFR part 150; from any artificial island, installation, or other device on the Outer Continental Shelf and the waters adjacent thereto as defined in 33 CFR part 147 or otherwise related to activities on the Outer Continental Shelf; and from all vessels required to have a certificate of inspection issued by the Coast Guard including mobile offshore drilling units regardless of their geographic location, or from any vessel connected with a deepwater port or within the deepwater port safety zone, or from any vessel engaged in activities related to the Outer Continental Shelf; except that this subpart does not apply to any diving operation—

(1) Performed solely for marine scientific research and development purposes by educational institutions;

(2) Performed solely for research and development for the advancement of diving equipment and technology; or

(3) Performed solely for search and rescue or related public safety purposes by or under the control of a governmental agency.

(b) Diving operations may deviate from the requirements of this subpart to the extent necessary to prevent or minimize a situation which is likely to cause death, injury, or major environmental damage. The circumstances leading to the situation, the deviations made, and the corrective action taken, if appropriate, to reduce the possibility of recurrence shall be recorded by the diving supervisor in the logbook as required by § 197.482(c).

§ 197.203 Right of appeal.

Any person directly affected by a decision or action taken under this subchapter, by or on behalf of the Coast Guard, may appeal therefrom in accordance with subpart 1.03 of this chapter.

[CGD 88–033, 54 FR 50382, Dec. 6, 1989]

§ 197.204 Definitions.

As used in this subpart:

ACFM means actual cubic feet per minute.

ANSI Code1 means the B31.1 American National Standards Institute "Code for Pressure Piping, Power Piping."

ASME Code means the American Society of Mechanical Engineers "Boiler and Pressure Vessel Code."

ASME PVHO–1 means the ANSI/ ASME standard "Safety Standard for Pressure Vessels for Human Occupancy."

ATA means a measure of pressure expressed in terms of atmosphere absolute (includes barometric pressure).

Bell means a compartment either at ambient pressure (open bell) or pressurized (closed bell) that allows the diver to be transported to and from the underwater work site, allows the diver access to the surrounding environment, and is capable of being used as a refuge during diving operations.

Bottom time means the total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time to the next whole minute that the diver begins ascent.

Breathing gas/breathing mixture means the mixed-gas, oxygen, or air as appropriate supplied to the diver for breathing.

Bursting pressure means the pressure at which a pressure containment device would fail structurally.

Commercial diver means a diver engaged in underwater work for hire excluding sport and recreational diving and the instruction thereof.

Commercial diving operation means all activities in support of a commercial diver.

Cylinder means a pressure vessel for the storage of gases under pressure.

Decompression chamber means a pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system especially equipped to recompress, decompress, and treat divers.

Decompression sickness means a condition caused by the formation of gas or gas bubbles in the blood or body tissue as a result of pressure reduction.

Decompression table means a profile or set of profiles of ascent rates and breathing mixtures designed to reduce the pressure on a diver safely to atmospheric pressure after the diver has been exposed to a specific depth and bottom time.

Depth means the maximum pressure expressed in feet of seawater attained by a diver and is used to express the depth of a dive.

Dive location means that portion of a vessel or facility from which a diving operation is conducted.

Dive team means the divers and diver support personnel involved in a diving operation, including the diving supervisor.

Diver means a person working beneath the surface, exposed to hyperbaric conditions, and using underwater breathing apparatus.

Diver-carried reserve breathing gas means a supply of air or mixed-gas, as appropriate, carried by the diver in addition to the primary or secondary breathing gas supplied to the diver.

Diving installation means all of the equipment used in support of a commercial diving operation.

Diving mode means a type of diving requiring SCUBA, surface-supplied air, or surface-supplied mixed-gas equipment, with related procedures and techniques.

Diving stage means a suspended platform constructed to carry one or more divers and used for putting divers into the water and bringing them to the surface when in-water decompression or a heavy-weight diving outfit is used.

Diving supervisor means the person having complete responsibility for the safety of a commercial diving operation including the responsibility for the safety and health of all diving personnel in accordance with this subpart.

Facility means a deepwater port, or an artificial island, installation, or other device on the Outer Continental Shelf subject to Coast Guard jurisdiction.

Fsw means feet of seawater (or equivalent static pressure head).

Gas embolism means a condition caused by expanding gases, which have been taken into and retained in the lungs while breathing under pressure, being forced into the bloodstream or other tissues during ascent or decompression.

Heavy-weight diving outfit means diver-worn surface-supplied deep-sea dress.

Hyperbaric conditions means pressure conditions in excess of surface atmospheric pressure.

Injurious corrosion means an advanced state of corrosion which may impair the structural integrity or safe operation of the equipment.

Liveboating means the support of a surfaced-supplied diver from a vessel underway.

Maximum working pressure means the maximum pressure to which a pressure containment device can be exposed under operating conditions (usually the pressure setting of the pressure relief device).

No-decompression limits means the air depth and bottom time limits of appendix A.

Pressure vessel means a container capable of withstanding an internal maximum working pressure over 15 psig.

Psi(g) means pounds per square inch (gage).

PVHO means pressure vessel for human occupancy but does not include pressure vessels for human occupancy that may be subjected to external pressures in excess of 15 psig but can only be subjected to maximum internal pressures of 15 psig or less (i.e., submersibles, or one atmosphere observation bells).

Saturation diving means saturating a diver's tissues with the inert gas in the breathing mixture to allow an extension of bottom time without additional decompression.

SCUBA diving means a diving mode in which the diver is supplied with a compressed breathing mixture from diver carried equipment.

Standby diver means a diver at the dive location available to assist a diver in the water.

Surface-supplied air diving means a diving mode in which the diver is supplied from the dive location or bell with compressed breathing air including oxygen or oxygen enriched air if supplied for treatment.

Surface-supplied mixed-gas diving means a diving mode in which the diver is supplied from the dive location or bell with a compressed breathing mixture other than air.

Timekeeping device means a device for measuring the time of a dive in minutes.

Treatment table means a depth, time, and breathing gas profile designed to treat a diver for decompression sickness.

Umbilical means the hose bundle between a dive location and a diver or bell, or between a diver and a bell, that supplies the diver or bell with a lifeline, breathing gas, communications, power, and heat as appropriate to the diving mode or conditions.

Vessel means any waterborne craft including mobile offshore drilling units required to have a Certificate of Inspection issued by the Coast Guard or any waterborne craft connected with a deepwater port or within the deepwater port safety zone, or any waterborne craft engaged in activities related to the Outer Continental Shelf.

Volume tank means a pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working pressure means the pressure to which a pressure containment device is exposed at any particular instant during normal operating conditions.

§ 197.205 Availability of standards.

(a) Several standards have been incorporated by reference in this subchapter. The incorporation by reference has been approved by the Director of the Federal Register under the provisions of 1 CFR part 51.

(b) The standards are available from the appropriate organizations whose addresses are listed below:

(1) American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

(2) American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

[CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 96–041, 61 FR 50735, Sept. 27, 1996]

§ 197.206 Substitutes for required equipment, materials, apparatus, arrangements, procedures, or tests.

(a) The Coast Guard may accept substitutes for equipment, materials, apparatus, arrangements, procedures, or tests required in this subpart if the substitute provides an equivalent level of safety.

(b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, material, apparatus, arrangement, procedure, or test is unreasonable or impracticable, the Commandant may permit the use of alternate equipment, material, apparatus, arrangement, procedure, or test to such an extent and upon such condition as will insure, to his satisfaction, a degree of safety consistent with the minimum standards set forth in this subpart.

§ 197.208 Designation of person-in-charge.

(a) The owner or agent of a vessel or facility without a designated master shall designate, in writing, an individual to be the person-in-charge of the vessel or facility.

(b) Where a master is designated, the master is the person-in-charge.

§ 197.210 Designation of diving supervisor.

The name of the diving supervisor for each commercial diving operation shall be—

(a) Designated in writing; and

(b) Given to the person-in-charge prior to the commencement of any commercial diving operation.

EQUIPMENT

§ 197.300 Applicability.

(a) Each diving installation used on each vessel or facility subject to this subpart must meet the requirements of this subpart.

(b) In addition to the requirements of this subpart, equipment which is permanently installed on vessels and is part of the diving installation must meet Subchapters F and J of this chapter.

(c) All repairs and modifications to pressure vessels used for commercial diving operations must be made in accordance with the requirements of section VIII, division 1 or division 2 of the ASME Code, ASME PVHO–1, part 54 of this chapter, or 49 CFR 173.34, as applicable.

(d) All repairs and modifications to pressure piping used for commercial diving operations must be made in accordance with the requirements of the ANSI Code or part 56 of this chapter, as applicable.

§ 197.310 Air compressor system.

A compressor used to supply breathing air to a diver must have—

(a) A volume tank that is—

(1) Built and stamped in accordance with section VIII, division 1 of the ASME Code with—

(i) A check valve on the inlet side;

(ii) A pressure gage;

(iii) A relief valve; and

(iv) A drain valve; and

(2) Tested after every repair, modification, or alteration to the pressure boundaries as required by § 197.462;

(b) Intakes that are located away from areas containing exhaust fumes of internal combustion engines or other hazardous contaminants;

(c) An efficient filtration system; and

(d) Slow-opening shut-off valves when the maximum allowable working pressure of the system exceeds 500 psig.

§ 197.312 Breathing supply hoses.

(a) Each breathing supply hose must—

(1) Have a maximum working pressure that is equal to or exceeds—

(i) The maximum working pressure of the section of the breathing supply system in which used; and

(ii) The pressure equivalent of the maximum depth of the dive relative to the supply source plus 100 psig;

(2) Have a bursting pressure of four times its maximum working pressure;

(3) Have connectors that—

(i) Are made of corrosion-resistant material;

(ii) Are resistant to accidental disengagement; and

(iii) Have a maximum working pressure that is at least equal to the maximum working pressure of the hose to which they are attached; and

(4) Resist kinking by—

(i) Being made of kink-resistant materials; or

(ii) Having exterior support.

(b) Each umbilical must—

(1) Meet the requirements of paragraph (a) of this section; and

(2) Be marked from the diver or open bell end in 10-foot intervals to 100 feet and in 50-foot intervals thereafter.

§ 197.314 First aid and treatment equipment.

(a) Each dive location must have—

(1) A medical kit approved by a physician that consists of—

(i) Basic first aid supplies; and

(ii) Any additional supplies necessary to treat minor trauma and illnesses resulting from hyperbaric exposure;

(2) A copy of an American Red Cross Standard First Aid handbook;

(3) A bag-type manual resuscitator with transparent mask and tubing; and

(4) A capability to remove an injured diver from the water.

(b) Each diving installation must have a two-way communications system to obtain emergency assistance except when the vessel or facility ship-toshore, two-way communications system is readily available.

(c) Each dive location supporting mixed-gas dives, dives deeper than 130 fsw, or dives outside the no-decompression limits must meet the requirements of paragraph (a) of this section and have—

(1) A decompression chamber;

(2) Decompression and treatment tables;

(3) A supply of breathing gases sufficient to treat for decompression sickness;

(4) The medical kit required by paragraph (a)(1) of this section that is—

(i) Capable of being carried into the decompression chamber; and

(ii) Suitable for use under hyperbaric conditions; and(5) A capability to assist an injured diver into the decompression chamber.

§ 197.318 Gages and timekeeping devices.

(a) A gage indicating diver depth must be at each dive location for surface- supplied dives.

(b) A timekeeping device must be at each dive location.

§ 197.320 Diving ladder and stage.

(a) Each diving ladder must—

(1) Be capable of supporting the weight of at least two divers;

(2) Extend 3 feet below the water surface;

(3) Be firmly in place;

(4) Be available at the dive location for a diver to enter or exit the water unless a diving stage or bell is provided; and

(5) Be—

(i) Made of corrosion-resistant material; or

(ii) Protected against and maintained free from injurious corrosion.

(b) Each diving stage must—

(1) Be capable of supporting the weight of at least two divers;

(2) Have an open-grating platform;

(3) Be available for a diver to enter or exit the water from the dive location and for in-water decompression if the diver is—

(i) Wearing a heavy-weight diving outfit; or

(ii) Diving outside the no-decompression limits, except when a bell is provided; and

(4) Be—

(i) Made of corrosion-resistant material; or

(ii) Protected against and maintained free from injurious corrosion.

§ 197.322 Surface-supplied helmets and masks.

(a) Each surface-supplied helmet or mask must have—

(1) A nonreturn valve at the attachment point between helmet or mask and umbilical that closes readily and positively;

(2) An exhaust valve; and

(3) A two-way voice communication system between the diver and the dive location or bell.

(b) Each surface-supplied air helmet or mask must—

(1) Ventilate at least 4.5 ACFM at any depth at which it is operated; or

(2) Be able to maintain the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

§ 197.324 Diver's safety harness.

Each safety harness used in surface supplied diving must have—

(a) A positive buckling device; and

(b) An attachment point for the umbilical life line that—

(1) Distributes the pulling force of the umbilical over the diver's body; and

(2) Prevents strain on the mask or helmet.

§ 197.326 Oxygen safety.

(a) Equipment used with oxygen or oxygen mixtures greater than 40 percent by volume must be designed for such use.

(b) Oxygen systems with pressures greater than 125 psig must have slow opening shut-off valves except pressure boundary shut-off valves may be ball valves.

§ 197.328 PVHO—General.

(a) Each PVHO, contracted for or purchased after February 1, 1979, must be built and stamped in accordance with ASME PVHO–1.

(b) Each PVHO, contracted for or constructed before February 1, 1979, and not Coast Guard approved, must be submitted to the Coast Guard for approval prior to February 1, 1984.

(c) To be approved under paragraph (b), a PVHO must be—

(1) Constructed in accordance with part 54 of this chapter; or—

(2) Be built in accordance with section VIII, division 1 or division 2 of the ASME Code; and—

(i) Have the plans approved in accordance with § 54.01–18 of this chapter;

(ii) Pass the radiographic and other survey tests of welded joints required by section VIII, division 1 or division 2, as appropriate, of the ASME Code; and

(iii) Pass—

(A) The hydrostatic test described in § 54.10–10 of this chapter; or

(B) The pneumatic test described in § 54.10–15 of this chapter and such additional tests as the Officer-in-Charge, Marine Inspection (OCMI) may require.

(d) Each PVHO must—

(1) Have a shut-off valve located within 1 foot of the pressure boundary on all piping penetrating the pressure boundary;

(2) Have a check valve located within 1 foot of the pressure boundary on all piping exclusively carrying fluids into the PVHO;

(3) Have the pressure relief device required by ASME PVHO–1;

(4) Have a built-in breathing system with at least one mask per occupant stored inside each separately pressurized compartment;

(5) Have a two-way voice communications system allowing communications between an occupant in one pressurized compartment of the PVHO and—

(i) The diving supervisor at the dive location;

(ii) Any divers being supported from the same PVHO; and

(iii) Occupants of other separately pressurized compartments of the same PVHO;

(6) If designed to mechanically couple to another PVHO, have a two-way communications system allowing communications between occupants of each PVHO when mechanically coupled;

(7) Have a pressure gage in the interior of each compartment that is—

(i) Designed for human occupancy; and

(ii) Capable of having the compartment pressure controlled from inside the PVHO;

(8) Have viewports that allow observation of occupants from the outside;

(9) Have viewports that meet the requirements of ASME PVHO–1 except those PVHO's approved under paragraph

(b) of this section which have nonacrylic viewports;

(10) Have means of illumination sufficient to allow an occupant to—

(i) Read gages; and

(ii) Operate the installed systems within each compartment;

(11) Be designed and equipped to minimize sources of combustible materials and ignition;

(12) Have a protective device on the inlet side of PVHO exhaust lines;

(13) Have a means of extinguishing a fire in the interior;

(14) Have a means of maintaining the oxygen content of the interior atmosphere below 25 percent surface equivalent by volume when pressurized with air as the breathing mixture;

(15) Have a means of maintaining the interior atmosphere below 2 percent surface equivalent carbon dioxide by volume;

(16) Have a means of overriding and controlling from the exterior all interior breathing and pressure supply controls;

(17) Have a speech unscrambler when used with mixed-gas;

(18) Have interior electrical systems that are designed for the environment in which they will operate to minimize the risk of fire, electrical shock to personnel, and galvanic action of the PVHO; and

(19) Be tested after every repair, modification, or alteration to the pressure boundaries as required by § 197.462.

§ 197.330 PVHO—Closed bells.

(a) Except as provided in paragraph

(b) of this section, each closed bell must meet the requirements of § 197.328 and—

(1) Have underwater breathing apparatus for each occupant stored inside each separately pressurized compartment;

(2) Have an umbilical;

(3) Have lifting equipment attached to the closed bell capable of returning the occupied closed bell when fully flooded to the dive location;

(4) Be capable of recompressing on the surface to the maximum design diving depth;

(5) Be constructed and equipped as required by § 197.332;

(6) Have an emergency locating device designed to assist personnel on the surface in acquiring and maintaining contact with the submerged PVHO if the umbilical to the surface is severed;

(7) Have a capability to remove an injured diver from the water; and

(8) Have a life support capability for the intact closed bell and its occupants for—

(i) Twelve hours after an accident severing the umbilical to the surface when the umbilical to the surface is the only installed means of retrieving the closed bell; or

(ii) A period of time, at least equal to 1 hour plus twice the time required to retrieve the bell from its designed operating depth and attach an auxiliary lifesupport system, after an accident severing the umbilical to the surface when the umbilical is one of the two independent installed means of retrieving the closed bell, each meeting the requirements of paragraph (a)(3) of this section.

(c) A closed bell that does not meet the requirements of paragraphs (a)(3), (a)(4), and (a)(5) of this section, must be capable of attachment to another PVHO that—

(1) Allows the transfer of personnel and diver's equipment under pressure from the closed bell to the PVHO;

(2) Meets the requirements of paragraph (a)(3) of this section;

(3) Is capable of attachment to a decompression chamber meeting the requirements of paragraphs (a)(4) and (a)(5) of this section; and

(4) Allows the transfer of personnel and diver's equipment under pressure from the PVHO to the decompression chamber.

§ 197.332 PVHO—Decompression chambers.

Each decompression chamber must—

(a) Meet the requirements of § 197.328;

(b) Have internal dimensions sufficient to accommodate a diver lying in a horizontal position and another person tending the diver;

(c) Have a capability for ingress and egress of personnel and equipment while the occupants are under pressure;

(d) Have a means of operating all installed man-way locking devices, except disabled shipping dogs, from both sides of a closed hatch;

(e) Have interior illumination sufficient to allow visual observation, diagnosis, and medical treatment of an occupant.

(f) Have one bunk for each two occupants;

(g) Have a capability that allows bunks to be seen over their entire lengths from the exterior;

(h) Have a minimum pressure capability of—

(1) 6 ATA, when used for diving to 300 fsw; or

(2) The maximum depth of the dive, when used for diving operations deeper than 300 fsw, unless a closed bell meeting the requirements of § 197.330(a) (3), (4), and (5) is used;

(i) Have a minimum pressurization rate of 2 ATA per minute to 60 fsw and at least 1 ATA per minute thereafter;

(j) Have a decompression rate of 1 ATA per minute to 33 fsw;

(k) Have an external pressure gage for each pressurized compartment;

(l) Have a capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work; and

(m) Have a sound-powered headset or telephone as a backup to the communications system required by § 197.328(c) (5) and (6), except when that communications system is a sound-powered system.

§ 197.334 Open diving bells.

Each open diving bell must—

(a) Have an upper section that provides an envelope capable of maintaining a bubble of breathing mixture available to a diver standing on the lower section of the platform with his body through the open bottom and his head in the bubble;

(b) Have lifting equipment capable of returning the occupied open bell to the dive location;

(c) Have an umbilical; and

(d) Be—

(1) Made of corrosion-resisting material; or

(2) Protected against and maintained free from injurious corrosion.

§ 197.336 Pressure piping.

Piping systems that are not an integral part of the vessel or facility, carrying fluids under pressures exceeding 15 psig must—

(a) Meet the ANSI Code;

(b) Have the point of connection to the integral piping system of the vessel or facility clearly marked; and

(c) Be tested after every repair, modification, or alteration to the pressure boundaries as set forth in § 197.462.

§ 197.338 Compressed gas cylinders.

Each compressed gas cylinder must—

(a) Be stored in a ventilated area;

(b) Be protected from excessive heat;

(c) Be prevented from falling;

(d) Be tested after any repair, modification, or alteration to the pressure boundaries as set forth in § 197.462; and

(e) Meet the requirements of—

(1) Part 54 of this chapter; or

(2) 49 CFR 173.34 and 49 CFR part 178, subpart C.

§ 197.340 Breathing gas supply.

(a) A primary breathing gas supply for surface-supplied diving must be sufficient to support the following for the duration of the planned dive:

(1) The diver.

(2) The standby diver.

(3) The decompression chamber, when required by §197.432(e)(2) or by § 197.434(a) for the duration of the dive and for one hour after completion of the planned dive.

(4) A decompression chamber when provided but not required by this subpart.

(5) A closed bell when provided or required by § 197.434(d).

(6) An open bell when provided or required by § 197.432(e) (4) or by § 197.434(c).

(b) A secondary breathing gas supply for surface-supplied diving must be sufficient to support the following:

(1) The diver while returning to the surface.

(2) The diver during decompression.

(3) The standby diver.

(4) The decompression chamber when required by §197.432(e)(2) or by § 197.434(a) for the duration of the dive and one hour after the completion of the planned dive.

(5) The closed bell while returning the diver to the surface.

(6) The open bell while returning the diver to the surface.

(c) A diver-carried reserve breathing gas supply for surface-supplied diving must be sufficient to allow the diver to—

(1) Reach the surface.

(2) Reach another source of breathing gas; or

(3) Be reached by a standby diver equipped with another source of breathing gas for the diver.

(d) A primary breathing gas supply for SCUBA diving must be sufficient to support the diver for the duration of the planned dive through his return to the dive location or planned pick-up point.

(e) A diver-carried reserve breathing gas supply for SCUBA diving must be sufficient to allow the diver to return to the dive location or planned pick-up point from the greatest depth of the planned dive.

(f) Oxygen used for breathing mixtures must—

(1) Meet the requirements of Federal Specification BB-0–925a; and

(2) Be type 1 (gaseous) grade A or B.

(g) Nitrogen used for breathing mixtures must—

(1) Meet the requirements of Federal Specification BB-N–411c;

(2) Be type 1 (gaseous);

(3) Be class 1 (oil free); and

(4) Be grade A, B, or C.

(h) Helium used for breathing mixtures must be grades A, B, or C produced by the Federal Government, or equivalent.

(i) Compressed air used for breathing mixtures must—

(1) Be 20 to 22 percent oxygen by volume;

(2) Have no objectionable odor; and

(3) Have no more than—

(i) 1,000 parts per million of carbon dioxide;

(ii) 20 parts per million carbon monoxide;

(iii) 5 milligrams per cubic meter of solid and liquid particulates including oil; and

(iv) 25 parts per million of hydrocarbons (includes methane and all other hydrocarbons expressed as methane).

§ 197.342 Buoyancy-changing devices.

(a) A dry suit or other buoyancychanging device not directly connected to the exhaust valve of the helmet or mask must have an independent exhaust valve.

(b) When used for SCUBA diving, a buoyancy-changing device must have an inflation source separate from the breathing gas supply.

§ 197.344 Inflatable floatation devices.

An inflatable floatation device for SCUBA diving must—

(a) Be capable of maintaining the diver at the surface in a faceup position;

(b) Have a manually activated inflation device;

(c) Have an oral inflation device;

(d) Have an over-pressure relief device; and

(e) Have a manually operated exhaust valve.

§ 197.346 Diver's equipment.

(a) Each diver using SCUBA must have—

(1) Self-contained underwater breathing equipment including—

(i) A primary breathing gas supply with a cylinder pressure gage readable by the diver during the dive; and

(ii) A diver-carried reserve breathing gas supply provided by—

(A) A manual reserve (J valve); or

(B) An independent reserve cylinder connected and ready for use;

(2) A face mask;

(3) An inflatable floatation device;

(4) A weight belt capable of quick release;

(5) A knife;

(6) Swim fins or shoes;

(7) A diving wristwatch; and

(8) A depth gage.

(b) Each diver using a heavyweight diving outfit must—

(1) Have a helmet group consisting of helmet, breastplate, and associated valves and connections;

(2) Have a diving dress group consisting of a basic dress that encloses the body (except for head and hands) in a tough, waterproof cover, gloves, shoes, weight assembly, and knife;

3) Have a hose group consisting of the breathing gas hose and fittings, the control valve, the lifeline, communications cable, and a pneumofathometer; and

(4) Be provided with a helmet cushion and weighted shoes.

(c) Each surface-supplied dive operation using a heavyweight diving outfit must have an extra breathing gas hose with attaching tools available to the standby diver.

(d) Each diver using a lightweight diving outfit must have—

(1) A safety harness;

(2) A weight assembly capable of quick release;

(3) A mask group consisting of a lightweight mask and associated valves and connections;

(4) A diving dress group consisting of wet or dry diving dress, gloves, shoes or fins, and knife; and

(5) A hose group consisting of the breathing gas hose and fittings, the control valve, the lifeline, communications cable, and a pneumofathometer (if the breaking strength of the communications cable is at least equal to that required for the lifeline, the communications cable can serve as the lifeline).

(e) Each surface-supplied air dive operation within the no-decompression limits and to depths of 130 fsw or less must have a primary breathing gas supply at the dive location.

(f) Each surface-supplied dive operation outside the no-compression limits, deeper than 130 fsw, or using mixed-gas as a breathing mixture must have at the dive location—

(1) A primary breathing gas supply; and

(2) A secondary breathing gas supply.

(g) Each diver diving outside the nodecompression limits, deeper than 130 fsw, or using mixed-gas must have a diver-carried reserve breathing gas supply except when using a heavyweight diving outfit or when diving in a physically confining area.

OPERATIONS

§ 197.400 Applicability.

Diving operations may only be conducted from a vessel or facility subject to the subpart if the regulations in this subpart are met.

§ 197.402 Responsibilities of the person-in-charge.

(a) The person-in-charge shall—

(1) Be fully cognizant of the provisions of this subpart;

(2) Prior to permitting any commercial diving operation to commence, have—

(i) The designation of the diving supervisor for each diving operation as required by § 197.210;

(ii) A report on—

(A) The nature and planned times of the planned diving operation; and

(B) The planned involvement of the vessel or facility, its equipment, and its personnel in the diving operation.

(b) Prior to permitting any commerical diving operation involving liveboating to commence, the person in charge shall insure that—

(1) A means of rapid communications with the diving supervisor while the diver is entering, in, or leaving the water is established; and

(2) A boat and crew for diver pickup in the event of an emergency is provided.

(c) The person-in-charge shall insure that a boat and crew for SCUBA diver pickup is provided when SCUBA divers are not line-tended from the dive location.

(d) The person-in-charge shall coordinate the activities on and of the vessel or facility with the diving supervisor.

(e) The person-in-charge shall insure that the vessel or facility equipment and personnel are kept clear of the dive location except after coordinating with the diving supervisor.

§ 197.404 Responsibilities of the diving supervisor.

(a) The diving supervisor shall—

(1) Be fully cognizant of the provisions of this subpart;

(2) Be fully cognizant of the provisions of the operations manual required by § 197.420;

(3) Insure that diving operations conducted from a vessel or facility subject to this subpart meet the regulations in this subpart;

(4) Prior to the commencement of any commercial diving operation, provide the report required by § 197.402 to the person-in-charge;

(5) Coordinate with the person-incharge any changes that are made to the report required by § 197.402; and

(6) Promptly notify the person-incharge of any diving related casualty, accident, or injury.

(b) The diving supervisor is in charge of the planning and execution of the diving operation including the responsibility for the safety and health of the dive team.

§ 197.410 Dive procedures.

(a) The diving supervisor shall insure that—

(1) Before commencing diving operations, dive team members are briefed on—

(i) The tasks to be undertaken;

(ii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iii) Any modifications to the operations manual or procedures including safety procedures necessitated by the specific diving operation;

(2) The breathing gas supply systems, masks, helmets, thermal protection, when provided, and bell lifting equipment, when a bell is provided or required, are inspected prior to each diving operation;

(3) Each diver is instructed to report any physical problems or physiological effects including aches, pains, current illnesses, or symptoms of decompression sickness prior to each dive;

(4) A depth, bottom time profile, including any breathing mixture changes, is maintained at the dive location for each diver during the dive, except that SCUBA divers shall maintain their own profiles;

(5) A two-way voice communication system is used between—

(i) Each surface-supplied diver and a dive team member at the dive location or bell (when provided); and

(ii) The bell (when provided) and the dive location;

(6) A two-way communication system is available at the dive location to obtain emergency assistance;

(7) After the completion of each dive—

(i) The physical condition of the diver is checked by—

(A) Visual observation; and

(B) Questioning the diver about his physical well-being;

(ii) The diver is instructed to report any physical problems or adverse physiological effects including aches, pains, current illnesses, or symptoms of decompression sickness or gas embolism;

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(iii) The diver is advised of the location of an operational decompression chamber; and

(iv) The diver is alerted to the potential hazards of flying after diving;

(8) For any dive outside the no-decompression limits, deeper than 130 fsw, or using mixed-gas as a breathing mixture—

(i) A depth, time, decompression profile including breathing mixture changes is maintained for each diver at the dive location;

(ii) The diver is instructed to remain awake and in the vicinity of the dive location decompression chamber for at least one hour after the completion of a dive, decompression, or treatment; and

(iii) A dive team member, other than the diver, is trained and available to operate the decompression chamber; and

(9) When decompression sickness or gas embolism is suspected or symptoms are evident, a report is completed containing—

(i) The investigation for each incident including—

(A) The dive and decompression profiles;

(B) The composition, depth, and time of breathing mixture changes;

(C) A description of the symptoms including depth and time of onset; and

(D) A description and results of the treatment;

(ii) The evaluation for each incident based on—

(A) The investigation;

(B) Consideration of the past performance of the decompression table used; and

(C) Individual susceptibility; and

(iii) The corrective action taken, if necessary, to reduce the probability of recurrence.

(b) The diving supervisor shall ensure that the working interval of a dive is terminated when he so directs or when—

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly reestablished between—

(i) The diver and a dive team member at the dive location; or

(ii) The person-in-charge and the diving supervisor during liveboating operations; or

(4) A diver begins to use his divercarried reserve breathing gas supply.

§ 197.420 Operations manual.

(a) The diving supervisor shall—

(1) Provide an operations manual to the person-in-charge prior to commencement of any diving operation; and

(2) Make an operations manual available at the dive location to all members of the dive team.

(b) The operations manual must be modified in writing when adaptation is required because of—

(1) The configuration or operation of the vessel or facility; or

(2) The specific diving operation as planned.

(c) The operations manual must provide for the safety and health of the divers.

(d) The operations manual must contain the following:

(1) Safety procedures and checklists for each diving mode used.

(2) Assignments and responsibilities of each dive team member for each diving mode used.

(3) Equipment procedures and checklists for each diving mode used.

(4) Emergency procedures for—

(i) Fire;

(ii) Equipment failure;

(iii) Adverse environmental conditions including, but not limited to, weather and sea state;

(iv) Medical illness; and

(v) Treatment of injury.

(5) Procedures dealing with the use of—

(i) Hand-held power tools;

(ii) Welding and burning equipment; and

(iii) Explosives.

SPECIFIC DIVING MODE PROCEDURES

§ 197.430 SCUBA diving.

The diving supervisor shall insure that—

(a) SCUBA diving is not conducted—

(1) Outside the no-decompression limits;

(2) At depths greater than 130 fsw;

(3) Against currents greater than one (1) knot unless line-tended; and

(4) If a diver cannot directly ascend to the surface unless line-tended;

(b) The SCUBA diver has the equipment required by § 197.346(a);

(c) A standby diver is available while a diver is in the water;

(d) A diver is line-tended from the surface or accompanied by another diver in the water in continuous visual contact during the diving operation;

(e) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line-tending the diver; and

(f) A boat is available for diver pickup when the divers are not line-tended from the dive location.

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§ 197.432 Surface-supplied air diving.

The diving supervisor shall insure that—

(a) Surface-supplied air diving is conducted at depths less than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(b) Each diving operation has a primary breathing gas supply;

(c) Each diver is continuously tended while in the water;

(d) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line-tending the diver;

(e) For dives deeper than 130 fsw or outside the no-decompression limits—

(1) Each diving operation has a secondary breathing gas supply;

(2) A decompression chamber is ready for use at the dive location;

(3) A diving stage is used except when a bell is provided;

(4) A bell is used for dives with an inwater decompression time greater than 120 minutes, except when the diver is using a heavy-weight diving outfit or is diving in a physically confining space;

(5) A separate dive team member tends each diver in the water;

(6) A standby diver is available while a diver is in the water; and

(7) Each diver has a diver-carried reserve breathing gas supply except when using a heavy-weight diving outfit or when diving in a physically confining space; and

(f) The surface-supplied air diver has the equipment required by § 197.346 (b) or (d).

§ 197.434 Surface-supplied mixed-gas diving.

The diving supervisor shall insure that—

(a) When mixed-gas diving is conducted, a decompression chamber or a closed bell meeting the requirements of § 197.332 is ready for use at the dive location;

(b) A diving stage is used except when a bell is provided;

(c) A bell is used for dives deeper than 220 fsw or when the dive involves in-water decompression times greater than 120 minutes, except when the diver is using a heavy-weight diving outfit or is diving in a physically confining space;

(d) A closed bell is used for dives at depths greater than 300 fsw, except when diving is conducted in a physically confining space;

(e) A separate dive team member tends each diver in the water;

(f) A standby diver is available during all nonsaturation dives;

(g) When saturation diving is conducted—

(1) A standby diver is available when the closed bell leaves the dive location until the divers are in saturation; and

(2) A member of the dive team at the dive location is a diver able to assist in the recovery of the closed bell or its occupants, if required;

(h) When closed bell operations are conducted, a diver is available in the closed bell to assist a diver in the water;

(i) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line-tending the diver;

(j) Each diving operation has a primary and secondary breathing gas supply meeting the requirements of § 197.340; and

(k) The surface-supplied mixed-gas diver has the equipment required by § 197.346 (b) or (d).

§ 197.436 Liveboating.

(a) During liveboating operations, the person-in-charge shall insure that—

(1) Diving is not conducted in seas that impede station-keeping ability of the vessel;

(2) Liveboating operations are not conducted— (i) From 1 hour after sunset to 1 hour before sunrise; or

(ii) During periods of restricted visibility;

(3) The propellers of the vessel are stopped before the diver enters or exits the water; and

(4) A boat is ready to be launched with crew in the event of an emergency.

(b) As used in paragraph (a)(2)(ii) of this section, restricted visibility means any condition in which vessel navigational visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.

(c) During liveboating operations, the diving supervisor shall insure that—

(1) Diving is not conducted at depths greater than 220 fsw;

(2) Diving is not conducted in seas that impede diver mobility or work function;

(3) A means is used to prevent the diver's hose from entangling in the propellers of the vessel;

(4) Each diver carries a reserve breathing gas supply;

(5) A standby diver is available while a diver is in the water;

(6) Diving is not conducted with inwater decompression times greater than 120 minutes; and

(7) The person-in-charge is notified before a diver enters or exits the water.

PERIODIC TESTS AND INSPECTIONS
OF DIVING EQUIPMENT

§ 197.450 Breathing gas tests.

The diving supervisor shall insure that—

(a) The output of each air compressor is tested and meets the requirements of § 197.340 for quality and quantity by means of samples taken at the connection point to the distribution system—

(1) Every 6 months; and

(2) After every repair or modification.

(b) Purchased supplies of breathing mixtures supplied to a diver are checked before being placed on line for—

(1) Certification that the supply meets the requirements of § 197.340; and

(2) Noxious or offensive odor and oxygen percentage;

(c) Each breathing supply system is checked, prior to commencement of diving operations, at the umbilical or underwater breathing apparatus connection point for the diver, for noxious or offensive odor and presence of oil mist; and

(d) Each breathing supply system, supplying mixed-gas to a diver, is checked, prior to commencement of diving operations, at the umbilical or underwater breathing apparatus connection point for the diver, for percentage of oxygen.

§ 197.452 Oxygen cleaning.

The diving supervisor shall ensure that equipment used with oxygen or oxygen mixtures greater than 40 percent by volume is cleaned of flammable materials—

(a) Before being placed into service; and

(b) After any repair, alteration, modification, or suspected contamination.

§ 197.454 First aid and treatment equipment.

The diving supervisor shall ensure that medical kits are checked monthly to insure that all required supplies are present.

§ 197.456 Breathing supply hoses.

(a) The diving supervisor shall insure that—

(1) Each breathing supply hose is pressure tested prior to being placed into initial service and every 24 months thereafter to 1.5 times its maximum working pressure;

(2) Each breathing supply hose assembly, prior to being placed into initial service and after any repair, modification, or alteration, is tensile tested by—

(i) Subjecting each hose-to-fitting connection to a 200 pound axial load; and

(ii) Passing a visual examination for evidence of separation, slippage, or other damage to the assembly;

(3) Each breathing supply hose is periodically checked for—

(i) Damage which is likely to affect pressure integrity; and

(ii) Contamination which is likely to affect the purity of the breathing mixture delivered to the diver; and

(4) The open ends of each breathing supply hose are taped, capped, or plugged when not in use.

(b) To meet the requirements of paragraph (a)(3) of this section, each breathing supply hose must be—

(1) Carefully inspected before being shipped to the dive location;

(2) Visually checked during daily operation; and

(3) Checked for noxious or offensive odor before each diving operation.

§ 197.458 Gages and timekeeping devices.

The diving supervisor shall insure that—

(a) Each depth gage and timekeeping device is tested or calibrated against a master reference gage or time-keeping device every 6 months;

(b) A depth gage is tested when a discrepancy exists in a depth gage reading greater than 2 percent of full scale between any two gages of similar range and calibration;

(c) A timekeeping device is tested when a discrepancy exists in a timekeeping device reading greater than one-quarter of a minute in a 4-hour period between any two timekeeping devices; and

(d) Each depth gage and timekeeping device is inspected before diving operations are begun.

§ 197.460 Diving equipment.

The diving supervisor shall insure that the diving equipment designated for use in a dive under § 197.346 is inspected before each dive.

§ 197.462 Pressure vessels and pressure piping.

(a) The diving supervisor shall ensure that each pressure vessel, including each volume tank, cylinder and PVHO, and each pressure piping system is examined and tested as required by this section and after any repair, modification or alteration to determine that they are in satisfactory condition and fit for the service intended.

(b) Pressure vessels and pressure piping shall be examined annually for mechanical damage or deterioration. Any defect that may impair the safety of the pressure vessel or piping shall be repaired and pressure tested to the satisfaction of the Officer in Charge, Marine Inspection.

(c) The following tests shall be conducted at least every three years:

(1) All piping permanently installed on a PVHO shall be pressure tested.

(2) PVHOs subject to internal pressure shall be leak tested at the maximum allowable working pressure using the breathing mixture normally used in service.

(3) Equivalent nondestructive testing may be conducted in lieu of pressure testing. Proposals to use nondestructive testing in lieu of pressure testing shall be submitted to the Officer in Charge, Marine Inspection.

(d) Unless otherwise noted, pressure tests conducted in accordance with this section shall be either hydrostatic tests or pneumatic tests.

(1) When a hydrostatic test is conducted on a pressure vessel, the test pressure shall be no less than 1.25 times the maximum allowable working pressure.

(2) When a pneumatic test is conducted on a pressure vessel, the test pressure shall be the maximum allowable working pressure stamped on the nameplate.

(3) When a pneumatic test is conducted on piping, the test pressure shall be no less than 90 percent of the setting of the relief device.

(4) Pressure tests shall be conducted only after suitable precautions are taken to protect personnel and equipment.

(5) When pressure tests are conducted on pressure vessels or pressure piping, the test pressure shall be maintained for a period of time sufficient to allow examination of all joints, connections and high stress areas.

[CGD 95–028, 62 FR 51220, Sept. 30, 1997]

RECORDS

§ 197.480 Logbooks.

(a) The person-in-charge of a vessel or facility, that is required by 46 U.S.C. 11301 to have an official logbook, shall maintain the logbook on form CG–706.

(b) The person-in-charge of a vessel or facility not required by 46 U.S.C. 11301 to have an official logbook, shall maintain, on board, a logbook for making the entries required by this subpart.

(c) The diving supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart.

[CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 95–028, 62 FR 51220, Sept. 30, 1997]

§ 197.482 Logbook entries.

(a) The person-in-charge shall insure that the following information is recorded in the logbook for each commercial diving operation:

(1) Date, time, and location at the start and completion of dive operations.

(2) Approximate underwater and surface conditions (weather, visibility, temperatures, and currents).

(3) Name of the diving supervisor.

(4) General nature of work performed.

(b) The diving supervisor shall insure that the following information is recorded in the logbook for each commercial diving operation:

(1) Date, time, and location at the start and completion of each dive operation.

(2) Approximate underwater and surface conditions (weather, visibility, temperatures, and currents).

(3) Names of dive team members including diving supervisor.

(4) General nature of work performed.

(5) Repetitive dive designation or elapsed time since last hyperbaric exposure if less than 24 hours for each diver.

(6) Diving modes used.

(7) Maximum depth and bottom time for each diver.

(8) Name of person-in-charge.

(9) For each dive outside the no-decompression limits, deeper than 130 fsw, or using mixed-gas, the breathing gases and decompression table designations used.

(10) When decompression sickness or gas embolism is suspected or symptoms are evident—

(i) The name of the diver; and

(ii) A description and results of treatment.

(11) For each fatality or any diving related injury or illness that results in incapacitation of more than 72 hours or requires any dive team member to be hospitalized for more than 24 hours—

(i) The date;

(ii) Time;

(iii) Circumstances; and

(iv) Extent of any injury or illness.

(c) The diving supervisor shall insure that the following is recorded in the logbook for each diving operation deviating from the requirements of this subpart:

(1) A description of the circumstances leading to the situation.

(2) The deviations made.

(3) The corrective action taken, if appropriate, to reduce the possibility of recurrence.

(d) The diving supervisor shall insure that a record of the following is maintained:

(1) The date and results of each check of the medical kits.

(2) The date and results of each test of the air compressor.

(3) The date and results of each check of breathing mixtures.

(4) The date and results of each check of each breathing supply system.

(5) The date, equipment cleaned, general cleaning procedure, and names of persons cleaning the diving equipment for oxygen service.

(6) The date and results of each test of the breathing supply hoses and system.

(7) The date and results of each inspection of the breathing gas supply system.

(8) The date and results of each test of depth gages and timekeeping devices.

(9) The date and results of each test and inspection of each PVHO.

(10) The date and results of each inspection of the diving equipment.

(11) The date and results of each test and inspection of pressure piping.

(12) The date and results of each test and inspection of volume tanks and cylinders.

(e) The diving supervisor shall insure that a notation concerning the location of the information required under paragraph (d) is made in the logbook.
NOTE: 46 U.S.C. 11301 requires that certain entries be made in an official logbook in addition to the entries required by this section; and 46 U.S.C. 11302 prescribes the manner of making those entries.

[CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by USCG–1999–6216, 64 FR 53229, Oct. 1, 1999]

§ 197.484 Notice of casualty.

(a) In addition to the requirements of subpart 4.05 of this chapter and 33 CFR 146.30, the person-in-charge shall notify the Officer-in-Charge, Marine Inspection, as soon as possible after a diving casualty occurs, if the casualty involves any of the following:
  (1) Loss of life.
  (2) Diving-related injury to any person causing incapacitation for more than 72 hours.
  (3) Diving-related injury to any person requiring hospitalization for more than 24 hours.

(b) The notice required by this section must contain the following:
  (1) Name and official number (if applicable) of the vessel or facility.
  (2) Name of the owner or agent of the vessel or facility.
  (3) Name of the person-in-charge.
  (4) Name of the diving supervisor.
  (5) Description of the casualty including presumed cause.
  (6) Nature and extent of the injury to persons.

(c) The notice required by this section is not required if the written report required by § 197.486 is submitted within 5 days of the casualty.

[CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 95–072, 60 FR 50469, Sept. 29, 1995]

§ 197.486 Written report of casualty.

The person-in-charge of a vessel or facility for which a notice of casualty was made under § 197.484 shall submit a report to the Officer-in-Charge, Marine Inspection, as soon as possible after the casualty occurs, as follows:

(a) On Form CG–2692, when the diving installation is on a vessel.

(b) Using a written report, in narrative form, when the diving installation is on a facility. The written report must contain the information required by § 197.484.

(c) The report required by this section must be accompanied by a copy of the report required by § 197.410(a)(9) when decompression sickness is involved.

(d) The report required by this section must include information relating to alcohol or drug involvement as required by § 4.05–12 of this chapter.

(The reporting requirement in paragraph (a) was approved by OMB under control number 1625–0001)

[CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 82–023, 47 FR 35748, Aug. 16, 1982; 48 FR 43328, Sept. 23, 1983; CGD 84–099, 52 FR 47536, Dec. 14, 1987; USCG–2006–25697, 71 FR 55747, Sept. 25, 2006]

§ 197.488 Retention of records after casualty.

(a) The owner, agent, or person-incharge of a vessel or facility for which a report of casualty is made under § 197.484 shall retain all records onboard that are maintained on the vessel or facility and those records required by this subpart for 6 months after the report of a casualty is made or until advised by the Officer-in-Charge, Marine Inspection, that records need not be retained onboard.

(b) The records required by paragraph (a) of this section to be retained on board include, but are not limited to, the following:
  (1) All logbooks required by § 197.480.
  (2) All reports required by §197.402(a)(2)(ii), §197.404(a)(4), § 197.410(a)(9).

(c) The owner, agent, person-incharge, or diving supervisor shall, upon request, make the records described in this section available for examination by any Coast Guard official authorized to investigate the casualty.

DEPARTMENT OF LABOR OSHA

TEXT OF THE REGULATION-OSHA

PART 1910 - OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Subpart T - Commercial Diving Operations

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APPENDIX A

Examples of conditions that may restrict or limit exposure to Hyperbaric conditions.

APPENDIX B

Guidelines for scientific diving.

In addition to this Standard, the 2006 OSHA Directive is available for reference.

Subpart T - Commercial Diving Operations

Authority: Sections 4, 6, and 8, of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); sec. 107, Contract Work Hours and Safety Standards Act (the Construction Safety Act) (40 U.S.C. 333); sec. 41, Long shore and Harbor Workers' Compensation Act (33 U.S.C. 941); Secretary of Labor's Order No. 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable; 29 CFR part 1911.

General

§ 1910.401 Scope and application.

(a) Scope.

(1) This subpart (standard) applies to every place of employment within the waters of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, Wake Island, Johnston Island, the Canal Zone, or within the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462, 43 U.S.C. 1331), where diving and related support operations are performed.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, ship breaking and longshoring. However, this standard does not apply to any diving operation:

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(ii) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(iii) Governed by 45 CFR part 46 (Protection of Human Subjects, U.S. Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(iv) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(B) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) Alternative requirements for recreational diving instructors and diving guides. Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by paragraphs (b)(2) and (c)(3)(iii) of §1910.423 and paragraph (b)(1) of §1910.426 when they meet all of the following conditions:

(i) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(ii) The instructor or guide is diving within the no-decompression limits in these operations;

(iii) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(iv) The instructor or guide is using an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(v) The employer of the instructor or guide is complying with all requirements of Appendix C of this subpart.

(b) Application in emergencies.

An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(1) Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(2) Upon request from the Area Director, submits such information in writing.

(c) Employer obligation. The employer shall be responsible for compliance with:

(1) All provisions of this standard of general applicability; and

(2) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 58 FR 35310, June 30, 1993; 69 FR 7363, Feb. 17, 2004]

§ 1910.402 Definitions.

As used in this standard, the listed terms are defined as follows:

ACFM: Actual cubic feet per minute.

ASME Code or equivalent: ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA: Atmosphere absolute.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

Bottom time: The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

Bursting pressure: The pressure at which a pressure containment device would fail structurally.

Cylinder: A pressure vessel for the storage of gasses.

Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

Decompression table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive-guiding operations means leading groups of sports divers, who use an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, to local undersea diving locations for recreational purposes.

Dive location: A surface or vessel from which a diving operation is conducted.

Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

Dive team: Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver: An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-carried reserve breathing gas: A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.

Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

FSW: Feet of seawater (or equivalent static pressure head).

Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.

Hyperbaric conditions: Pressure conditions in excess of surface pressure.

In water stage: A suspended underwater platform which supports a diver in the water.

Liveboating: The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

Mixed-gas diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No-decompression limits: The depth-time limits of the “no-decompression limits and repetitive dive group designation table for no-decompression air dives”, U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Psig: Pounds per square inch (gage).

Recreational diving instruction means training diving students in the use of recreational diving procedures and the safe operation of diving equipment, including an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, during dives.

Scientific diving means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA diving: A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby diver: A diver at the dive location available to assist a diver in the water.

Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

Treatment table: A depth-time and breathing gas profile designed to treat decompression sickness.

Umbilical: The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir. **Working pressure:** The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 69 FR 7363, Feb. 17, 2004]

Personnel Requirements

§ 1910.410 Qualifications of dive team.

(a) *General.*

(1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(2) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode: and

(iii) Diving operations and emergency procedures.

(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(4) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(b) *Assignments.*

(1) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(2) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(3) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(c) *Designated person-in-charge.*

(1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

General Operations Procedures

§ 1910.420 Safe practices manual.

(a) *General.*

The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(b) *Contents.*

(1) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(2) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

(a) *General.*

The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(b) *Emergency aid.*

A list shall be kept at the dive location of the telephone or call numbers of the following:

(1) An operational decompression chamber (if not at the dive location);

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

(5) The nearest U.S. Coast Guard Rescue Coordination Center.

(c) *First aid supplies.*

(1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions.

(3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(d) *Planning and assessment.*

Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(1) Diving mode;

(2) Surface and underwater conditions and hazards;

(3) Breathing gas supply (including reserves);

(4) Thermal protection;

(5) Diving equipment and systems;

(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

(7) Repetitive dive designation or residual inert gas status of dive team members;

(8) Decompression and treatment procedures (including altitude corrections); and

(9) Emergency procedures.

(e) *Hazardous activities*.

To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(f) *Employee briefing.*

(1) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(2) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(g) *Equipment inspection.*

The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(h) *Warning signal.*

When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982; 54 FR 24334, June 7, 1989]

§ 1910.422 Procedures during dive.

(a) *General.*

The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(b) *Water entry and exit.*

(1) A means capable of supporting the diver shall be provided for entering and exiting the water.

(2) The means provided for exiting the water shall extend below the water surface.

(3) A means shall be provided to assist an injured diver from the water or into a bell.

(c) *Communications.*

(1) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(d) *Decompression tables.*

Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(e) *Dive profiles.*

A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(f) *Hand-held power tools and equipment.*

(1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(g) *Welding and burning.*

(1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(2) The welding machine frame shall be grounded.

(3) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(4) Insulated gloves shall be provided to divers performing welding and burning operations.

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(5) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gasses which will not support combustion.

(h) *Explosives.*

(1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of §1910.109 and §1926.912 of Title 29 of the Code of Federal Regulations.

(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(3) Explosives shall not be detonated while the diver is in the water.

(i) Termination of dive.

The working interval of a dive shall be terminated when:

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly re-established between the diver and a dive team member at the dive location, and between the designated Person in Charge and the person controlling the vessel in liveboating operations; or

(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423 Post-dive procedures.

(a) *General.*

The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(b) *Precautions.*

(1) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(c) *Recompression capability.*

(1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(3) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within 5 minutes of the dive location.

(4) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(6) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(d) *Record of dive.*

(1) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(e) *Decompression procedure assessment.*

The employer shall:

(1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

Specific Operations Procedures

§ 1910.424 SCUBA diving.

(a) *General.*

Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.*

SCUBA diving shall not be conducted:

(1) At depths deeper than 130 fsw;

(2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(3) Against currents exceeding one (1) knot unless line-tended; or

(4) In enclosed or physically confining spaces unless line-tended.

(c) *Procedures.*

(1) A standby diver shall be available while a diver is in the water.

(2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(5) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

§ 1910.425 Surface-supplied air diving.

(a) *General.*

Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.*

(1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(3) A bell shall be used for dives with an in-water decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(c) *Procedures.*

(1) Each diver shall be continuously tended while in the water.

(2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(3) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(4) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(5) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An in water stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving.

(a) *General.*

Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.*

Mixed-gas diving shall be conducted only when:

(1) A decompression chamber is ready for use at the dive location; and

(i) A bell is used at depths greater than 220 fsw or when the dive involves in water decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(c) *Procedures.*

(1) A separate dive team member shall tend each diver in the water.

(2) A standby diver shall be available while a diver is in the water.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(5) Each diving operation shall have a dive-location reserve breathing gas supply.

(6) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An in water stage shall be provided to divers in the water.

(7) An in water stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(8) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

§ 1910.427 Liveboating.

(a) *General.*

Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(b) *Limits.*

Diving operations involving liveboating shall not be conducted:

(1) With an in-water decompression time of greater than 120 minutes;

(2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(3) Using mixed gas at depths greater than 220 fsw;

(4) In rough seas which significantly impede diver mobility or work function; or

(5) In other than daylight hours.

(c) Procedures.

(1) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(2) A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

(3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(4) A standby diver shall be available while a diver is in the water.

(5) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

Equipment Procedures and Requirements

§ 1910.430 Equipment

(a) *General.*

(1) All employers shall comply with the following requirements, unless otherwise specified.

(2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(b) *Air compressor system.*

(1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

(3) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (CO_2) greater than 1,000 p/m;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

(c) *Breathing gas supply hoses.*

(1) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(2) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(3) Umbilicals shall:

(i) Be marked in 10-ft. increments to 100 feet beginning at the diver's end, and in 50 ft. increments thereafter;

(ii) Be made of kink-resistant materials; and

(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(d) *Buoyancy control.*

(1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(e) *Compressed gas cylinders.*

Compressed gas cylinders shall:

(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.

(2) Be stored in a ventilated area and protected from excessive heat;

(3) Be secured from falling; and

(4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(f) *Decompression chambers.*

(1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(3) Each decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(g) *Gauges and timekeeping devices.*

(1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(2) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.

(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(4) A timekeeping device shall be available at each dive location.

(h) *Masks and helmets.*

(1) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) *Oxygen safety*.

(1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) *Weights and harnesses.*

(1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.

[39 FR 23502, June 27, 1974, as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]

Recordkeeping

§ 1910.440 Recordkeeping requirements.

(a)

(1) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(b) *Availability of records.*

(1) Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)–(e) and (g)–(i). Safe practices manuals (§1910.420), depth-time profiles (§1910.422), recordings of dives (§1910.423), decompression procedure assessment evaluations (§1910.423), and records of hospitalizations (§1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (§1910.430) shall also be provided upon request to employees and their designated representatives.

(3) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (§1910.411)—5 years;

(ii) Safe practices manual (§1910.420)—current document only;

(iii) Depth-time profile (§1910.422)—until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording of dive (§1910.423)—1 year, except 5 years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (§1910.423)—5 years;

(vi) Equipment inspections and testing records (§1910.430)—current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§1910.440)—5 years.

(4) After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

(5) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or

(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986; 61 FR 9242, Mar. 7, 1996; 71 FR 16672, Apr. 3, 2006]

§ 1910.441 Effective date.

This standard shall be effective on October 20, 1977, except that for provisions where decompression chambers or bells are required and such equipment is not yet available, employers shall comply as soon as possible thereafter but in no case later than 6 months after the effective date of the standard.

Appendix A – Examples of Conditions Which May Restrict or Limit Exposure to Hyperbaric Conditions

The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode or degree and duration of isolation:

- History of seizure disorder other than early febrile convulsions.
- Malignancies (active) unless treated and without recurrence for 5 years.
- Chronic inability to equalize sinus and/or middle ear pressure.
- Cystic or cavitary disease of the lungs.
- Impaired organ function caused by alcohol or drug use.
- Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood-altering drugs or insulin).
- Meniere's disease.
- Hemoglobinopathies.
- Obstructive or restrictive lung disease.
- Vestibular end organ destruction.
- Pneumothorax.
- Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).
- Juxta-articular osteonecrosis.

Appendix B – Guidelines for Scientific Diving

This appendix contains guidelines that will be used in conjunction with §1910.401(a)(2)(iv) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.
2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and troubleshooting tasks traditionally associated with commercial diving are not included within scientific diving.
4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[50 FR 1050, Jan. 9, 1985]

Volume Tank Test Procedure

All volume tanks and associated piping shall be pneumatically tested annually to the MAWP of the system. A hydrostatic test to 1.3 MAWP is to be done everyfzfth year or after any repair, modification or alterations to the pressure vessel.

Ensure you fully read and understand all directions before starting

1. Visually inspect the entire exterior of the volume tank to be tested for any noticeable damage or corrosion, pay close attention to the areas around the fittings for cracks.

2. Check last hydro date and ensure that hydro test is current (every fifth year).

3. Remove, inspect and test the non-return valve for proper operation. Blow air one way, no flow the other way. Reinstall non-return valve, ensuring proper flow direction.

4. Remove and inspect pressure relief valve (See Pressure Relief Valve Test Procedures). Depending on the pop off setting of this valve, removal and plugging may be necessary for pneumatic test. All pressure relief valves must be set and "crack" at no more than 10% ABOVE MA WP.

5. Inspect pressure gauge for any defects and replace/recalibrate as needed.

6. Inspect drain valve and ensure proper function.

7. Remove inspection plug and inspect tank interior for dirt, oil and corrosion.

8. Clean tank interior of debris, oil and rust with simple green and fresh water. Once interior has been cleaned and dried reinstall inspection plugs.

9. If significant corrosion or defects are found bring this to the attention of a supervisor.

10. Pressurize the system, tanks and piping to MA WP stamped on plate.

11. Check the system for leaks at all connections, penetrations, valves, and gauges using a mixture of soapy water.

12. Depressurize the system.

13. Document any tests (pass or fail) and or repairs made in the equipment log file.

14. Make sure the test records form is properly filled out and turned into the equipment log.

Volume Tank 5-Year Hydrostatic Test Procedure

All volume tanks and associated piping shall be pneumatically tested annually to the MAWP of the system. A hydrostatic test to 1.3 MAWP is to be done every fifth year or after any repair, modification or alterations to the pressure vessel.

Ensure you fully read and understand all directions before starting

1. Visually inspect the entire exterior of the volume tank to be tested for any noticeable damage or corrosion, pay close attention to the areas around the fittings for cracks.
2. Check last hydro date. This test is only required every five years.
3. Remove all plumbing and plug all holes except one on top.
4. Remove inspection plug and inspect the volume tank interior for dirt, oil and corrosion.
5. Clean the volume tank interior of debris, oil and rust with simple green and fresh water. Once interior has been cleaned, reinstall inspection plugs.
6. If significant corrosion or defects are found bring this to the attention of a supervisor.
7. Plug the volume tank and fill “completely” with water.
8. Pressurize the volume tank to 1.3 times MAWP stamped on plate. Hold for 10 minutes. Decrease pressure to MAWP.
9. Check the volume tank for leaks at all penetrations.
10. Depressurize the volume tank.
11. Drain and Dry the volume tank and re-install all hardware.
12. Pressurize with air to MAWP and check for leaks.
13. Document any tests (pass or fail) and or repairs made in the equipment log file.
14. Make sure the test records form is properly filled out and turned into the equipment log.

Air Hose Pressure Test Procedure

*All air hoses shall be subjected to an annual pressure test to 1.5 times the **designed working pressure ofthe system.** The pressure should be maintained without loss of pressure (when corrected for temperature) for 10 minutes. Additionally any time the air hose has been repaired and/or replacedfitting the Pull/Pressure test procedure applies.*

Ensure you fully read and understand all directions before starting

1. Visually inspect the entire hose to be tested for any noticeable damage, pay close attention to the areas around the fittings.

2. Attach plug end with eyelet to one end of the hose.

3. Attach the opposite end of hose to plug end with eyelet and ball valve.

4. Be sure the ball valve is open and pressurize the hose to_ psi (1.5 x the "Design Working Pressure of the System" **not MAWP**). Close the ball valve once the pressure is reached.

5. Leave the hose pressurized for 10 minutes.

6. If there is pressure loss, spray the entire length of the hose with snoop to detect the area in which the hose is leaking. Make sure any pressure loss is recorded on the test record form.

7. If any leaks are found bring this to the attention of a supervisor.

8. After 10 minutes, if no leaks are visible then slowly bleed off the air pressure.

9. Pressure test the pneumo hose for leaks at 50 psi, Plug end ofpneumo hose with a temporary reusable fitting or with vise grips.

10. Ihhere is pressure loss, spray the entire length of the hose with snoop to detect the area in which the hose is leaking. Make sure any pressure loss is recorded on the test record form and brought to the attention of a Supervisor.

11. Document any tests (pass or fail) and or repairs made in the equipment log file.

12. Once the test is complete, cap the ends of the hose or reinstall it in its proper location. If necessary pressurize the system the hose belongs in and snoop for leaks to ensure system is ready for use.

13. Make sure the test records form is properly filled out and turned into the equipment log.

Dive Umbilical Checkslist & Preventative Maintenance

Dive Umbilical Checklist

Equipment No.: ___________________ **Date Work Performed:_________________**

A	Initials	HSE ADVISORY	PPE
A1		Use whip checks, be aware of fish hooks in comm wire, rip hazard, back train while coililng	
B	Initials	**PPE REQUIRED KEY**	
B1		Safety Glasses (S), Gloves (G), Heariog Protection (P) Hard Hat (H), Face Shield {F) Welding Hood (W), Fire Extinguisher (E), Respirator(R) **See PPE on right side of sheet required for task**	
C	Initials	**EQUIPMENT CHECK-IN**	**PPE**
C1		Hand over hand visually inspect umbilical mark **(inform supervisor of ANY defects)**	G, S
C2		Inspect fittings for damage or corrosion before pressure test	G, S
C3		Test air hose to 300 PSI for 15 minutes as per EPC-LWI-620	G, S
C4		Vise grip the diver side of pneumo, hook up to HP air bottle and regulator pressure up to 150 PSI for 15 minutes as per ADCI	G, S
C5		Verify that there is at least 10” of tightly coiled come wire around dive hose	G, S
C6		Test comms using diver radio and test speaker to confirm you have good comms	G, S
C7		Test video and ensure connections are good and water tight	G, S
C8		Put hose caps in both ends of dive hose and shack end of pneumo	G, S
C9		Ensure all length taping is intact and correct per ADCI	G, S
C10		Yellow tag umbilical with date tested your intitials and umbilical info {length and number}	G, S
D	Initials	**EQUIPMENT LOADOUT**	**PPE**
D1		Check resupply or loadout form to ensure proper size and type of umbilical is selected	G, S
D2		Visually inspect imbilical for damage.	G, S
		Ensure both ends of Comm cable are in good condition	
D3		Ensure hose caps are in both ends of dive hose	G, S
D4		Ensure RFID tag and Asset tag are affixed	**G, S**
D5		Ensure umbilical is securely tied up with 1/2” poly for transit	

Pressure Relief Valve Test Procedure

All Pressure Relief Valves (PRV) shall be tested annually to the MAWP of the system or after any repair, modification, alterations to the PRV or before original installation.

Ensure you fully read and understand all directions before starting

1. Remove Pressure Relief Valve (PRV) from the piece of equipment it was on. Visually inspect. Record the setting stamped on the PRV.
2. Connect PRV to the output side of PRV testing apparatus.
3. Connect the input side of the PRV to a regulated high pressure air source iwth a 3/8 inch deck whip.
4. Slowly increase air pressure from zero up to the PRV pop-off setting or as needed PRV should release. Make note of the release pressure.
5. Bleed off air pressure until PRV resets. Repeat to verify release pressure.
6. If PRV fails, replace with a new PRV and report to supervisor. **All pressure relief valves should be set at no more than 10% above MAWP.**
7. If no replacement is necessary, place the PRV back onto the piece of equipment it was on, being sure to you use Teflon tape.
8. Document any tests (pass or fail) and or repairs made in the euipment log file.
9. Make sure the test records form is properly filled out and turned into the equipment log
10. Apply sticker or tag to body of relief valve depicting test date, due date, cracking pressure and technician's initials.

Decompression Chamber Pressure Test Procedure

Pressure testing is to be performed on the Recompression Chamber when it is newly installed, when repairs are made and on an annual basis.

Tests and test results are recorded on a standard Double Lock Recompression Chamber Air Pressure and Leak Test form (see attached).

Ensure you fully read and understand all directions before starting

1. Pressurize the inner lock to 135 PSI (MA WP). Check for leaks at all points of penetration: fittings, view-ports, dog seals, valve connections, pipe joints, and shell weldments, with either soapy water or an evaluation solution.

2. Mark all leaks.

3. Depressurize the lock and make whatever adjustments or repairs are necessary to seal the leaks.

4. Repeat Steps 1-3 as necessary until all leaks are eliminated.

5. Pressureize to 225 fsw (100 psig or Chamber MA WP) and hold for 5 minutes.
   DO NOT exceed maximum pressure rating for the pressure vessel (MA WP 135 PSI)

6. Depressurize the lock to 165 fsw (73.4 psig), Hold for 1 hour. If pressure drops below 145 fsw (65 psig), locate and mark all leaks as above and repeat steps 5 and 6. Repeat as necesssary until ending pressure is at least 145 fsw (65 psig).

7. Repeat steps 1 through 6 leaving the inner door open and outer door closed. Leak test those portions of the which have not yet been tested.

LEAKS:

View-port leaks: remove the gasket and clean or replace if necessary.

IMPORTANT

- Acrylic view-ports should not be lubricated. They should not cone in any contact with and lubricants, volatile detergent or leak detector. Always use non-ionic detergent for the leak test.

  When reinstalling the view-port do not over compress the gasket. Take up retaining ring bolts just until the gasket compresses evenly around the port.

Weldment leaks: Contact the appropriate technical authority for assistance.

Notes

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OSHA
THE OCCUPATIONAL SAFETY AND HEALTH AUTHORITY AND AGENCY

Head Office: #9 Alexandra Street, St. Clair, Port Of Spain

Telephone No.1 (868) 225 4300 Fax: 1(868) 225 5314 – website: www.osha.gov.tt

11th January, 2023

Ms. Sarah Sinanan
Secretary
Paria Commission of Enquiry
Southern Academy for the Performing Arts (SAPA)
Todd Street
SAN FERNANDO

Dear Ms. Sinanan,

Re: Enquiry into the tragic incidents which occurred on 25th February, 2022 at facilities owned by Paria Fuel Trading Co. Ltd. Located at No. 36 Sealine Riser on Berth No. 6, Pointe-a-Pierre

Submission on Behalf of the Occupational Safety and Health Agency – Proposed Legislative Amendments

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Introduction

Prior to 2006, Occupational Safety and Health in Trinidad and Tobago was governed by the Factories Ordinance, 1948, as amended in 1953. In 2004 the OSH Act was assented to on January 30th and came into effect on February 17th, 2006 (with the exception of section 98 which came into force on August 17th, 2007). The OSH Act was developed primarily because the Factories Ordinance proved to be too narrow in scope, outdated and inappropriate to deal with the expanding industrial sectors in Trinidad and Tobago. It was found that many occupations and workplaces fell far outside the ambit of the legal framework of the Factories Ordinance of 1948.

With the exception of minor amendments in 2006, in itself over a decade ago, the OSH Act has undergone no amendments, despite technological and other changes in the various economic sectors in Trinidad and Tobago. As enforcement activities and proceedings (via OSHA's Inspectorate and the Legal Department) pursuant to the OSH Act have significantly increased, certain discrepancies, areas for improvement, gaps and areas of ambiguity have been identified. The creation of an improved regulatory framework would facilitate greater compliance, enforcement, competitiveness in regional and international trade as well as adherence to Conventions and Treaties such as those with the ILO.

TRINIDAD AND TOBAGO
OSHA
THE OCCUPATIONAL SAFETY AND HEALTH AUTHORITY AND AGENCY

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Safety and Health Legislative Reform

In order to give effect to the objectives and commitment of the Government to a comprehensive and immediate review of all Labour Legislation as stated in its Official Policy Framework, the Ministry of Labour ("the Ministry") in collaboration with the Occupational Safety and Health Agency ("OSHA") hosted National Stakeholder Consultations on the Occupational Safety and Health Act Chapter 88:08 (the "OSH Act") on March 21 and 22, 2017 in Trinidad and on July 10, 2017 in Tobago. The Minister is empowered by Section 99 of the OSH Act to make Regulations for the purposes of promoting the safety, health and welfare of the working populace and to give effect to the OSH Act, in general.

The Occupational Safety and Health Authority (the "OSH Authority) is able to contribute to the Ministry's Legislative Agenda by submitting proposals by virtue of Section 66(e) of the OSH Act for the making of Regulations under the Act. Such proposals are primarily data driven supported by accident statistics over various industries.

Draft policies for nine proposed Regulations were developed by OSHA over the period July 2018 - March 2019 (which are at various stages of development), based on empirical data relating to health and safety and consultative sessions held in July 2017. Five of these draft policies were approved by the OSH Authority. Public consultations were held for policy documents relative to Safety of Pressure Systems Regulations, Provision and Use of Work Equipment Regulations, Gas Safety (Use Conveyance and Storage) Regulations, Blasting and Use of Explosives Regulations, Welfare Regulations as well as the National Occupational Safety and Health Policy on the following dates:

- Provision and Use of Work Equipment Regulations on August 21, 2018;
- Lifting Operations and Lifting Equipment Regulations on August 23, 2018;
- The National Occupational Safety and Health Policy on April 29, 2019 (Trinidad) and May 3, 2019 (Tobago);
- The Safety of Pressure Systems Regulations on May 1, 2019;
- The Gas Safety (Use Conveyors and Storage) Regulations on May 13, 2019;
- The Blasting and Use of Explosives Regulations on May 15, 2019; and
- The Occupational Safety and Health (Welfare) Regulations Policy on May 17, 2019.

OSHA

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Revision of the Draft Policy Position Papers was undertaken and a second draft was completed during the period of October 21- 25, 2019. The OSH Authority's Technical Operations Committee commenced a review of the revised draft policy documents in January 2020. In or around June 2020, OSHA received comments on submitted policy documents from the Line Ministry which were also reviewed, addressed and incorporated.

A second round of Consultations on the draft policy on Welfare Regulations pursuant to recommendations by the Joint Select Committee of Parliament was held virtually on September 28, 2021.
Work on amendments to the OSH Act was ongoing. Representatives of OSHA met with the Director of Public Prosecutions on January 19, 2022, as a means of consulting with his Office primarily on recommendations relative to the prosecution of summary offences under the OSH Act.

OSHA continued to receive valuable input from stakeholders and additional gaps were identified during the course of enforcement activities by OSHA's Inspectorate and Legal Department and further adjustments were made over the period following the public consultations.

Comments on the amended submission sent in March 2022 were received from MOL in June 2022 and the recommendations and advice were reviewed and incorporated accordingly. In August 2022 the following final draft policy documents were submitted and confirmed as final drafts.

i. Lifting Operations and Lifting Equipment Regulations ("LOLER")- Policy Paper 2018;
ii. Provision and Use of Work Equipment Regulations ("PUWER")- Policy Paper 2018;
iii. Gas Safety (Use, Conveyance and Storage) Regulations- Policy Paper;
iv. Safety of Pressure Systems- Policy Paper;
v. Blasting and Use of Explosives Regulations.

Additional inclusions and adjustments were made to the draft policy for Amendment to the Act, and accepted by the Ministry.

Diving Regulations

As hereinabove mentioned, OSHA's recommendations for prioritization of legislative reform are primarily driven by accident statistics. Public interest considerations would also be a factor in prioritization for legislative proposals. The number of diving accidents known to OSHA, was

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virtually non-existent until the reporting and investigation of one on January 2018 (critical injury) and subsequently on February 25th, 2022 when the fatalities of the LMCS divers occurred at Paria Fuel Trading Company Limited. Accidents and/or fatalities were far more frequent in other sectors such as Mining & Quarrying, Manufacturing and Wholesale & Retail.

It should be noted, however that OSHA has been a part of the Specification Committee for Commercial Diving (the "SCCD") created by the Trinidad and Tobago Bureau of Standards ("TTBS") which comprised stakeholders including large and small diving companies, from its inception in 2007 until 2018. The SCCD's purpose was to assist in the revision of the existing standards including the commercial diving standard TTS 539:1997. However, we're informed that consensus among the stakeholders on the use of the SCUBA diving in commercial diving operations was not reached and that attempts to reconvene in September of 2021 proved futile due to poor stakeholder response.

TTBS has two existing, voluntary standards for commercial diving:

- TTS 539:1997, Code of practice for safety in commercial diving operations
- TTS/CSA Z275.5:2010, Occupational Diver Training – Specification

The OSH Act also acknowledges the application of Standards that may be utilized in its enforcement as per certain provisions. Approved Standards are therein defined as follows:

"“approved standard" as the context may admit, means a national or international standard so declared or adopted by the Trinidad and Tobago Bureau of Standards under the Standards Act and includes an appropriate type as determined by the Authority."

OSHA intends to submit a proposal to the Ministry for the development of Regulations for Commercial Diving. Extensive Stakeholder Consultations are to be examined for 2023-2024. It is envisaged that international input and wide consultation would be required.

Kindly bring this correspondence to the attention of the Chairman.

Regards,

Ms Pettal John-Beerens
Deputy Director Legal

Kamini Persaud-Maraj
Attorney at Law
PEK2006123
No. 13 Caroni Savannah Road
Chaguanas.
Tel: 750-3953
Email: kaminiper8@gmail.com

COMMISSION OF ENQUIRY

APPOINTED TO ENQUIRE INTO THE TRAGIC

INCIDENTS WHICH OCCURED ON THE 25th FEBRUARY 2022 AT

FACILITIES OWNED BY PARIA FUEL TRADING CO.LTD

LOCATED AT NO.36 SEALINE RISER ON BERTH NO.6,

POINT-A-PIERRE

LMCS CLOSING SUBMISSIONS

One must take care not to cause injury to others, but there is no general duty to act for the benefit of others. The rule is that I must not harm my neighbour (misfeasance), not that I am required to save him (nonfeasance). "*The very parable of the good Samaritan…which was invoked by Lord Atkin in* ***Donoghue v Stevenson****…illustrates, in the conduct of the priest and the Levite who passed by on the other side, an omission which was likely to* *have as its reasonable and probable consequence damage to the health of the victim of the thieves, but for which the priest and the Levite would have incurred no civil liability in English Law."* Page 92 Winfield and Jolowitcz on Tort 13th edition taken from **Home Office v Dorset Yacht Co. Ltd** [1970] A.C. 1004 at 1060 per Lord Diplock. It seems that this legal position is the guiding light which pervades Paria's stance taken from the onset of their position on the Scope of Works to the decision not to permit a viable rescue of the men within the 30 inch pipelines at S.L.36.

SCOPE OF WORKS

Contrary to reasonable commercial considerations, industry standard and specifically stated conditions as expressed in the scope of work, **Paria Fuel Trading Company Limited** seems to be saying to this Commission that the contract between itself and LMCS was on a "Turn Key" contract basis.

I have extrapolated from various sources that the very basic features of a turn key contract vests (1) design (2) source of materials (3) control or substantial control of site and (4) completion time ENTIRELY TO THE CONTRACTOR. Turn key concept of contract envisions that the

CONTRACTOR takes CHARGE of the project. It is not subjected to a system requiring approvals and permits and vesting in the asset owner a STOP policy.

None of these key concepts were in LMCS control. In fact, in Paria's investigation report, they themselves were not convinced that this contract was a turn key contract. Page 1200 of the Core Bundle at clause 1.9 where it is stated that "Paria contracted LMCS Ltd to execute a TURN KEY TYPE CONTRACT entitled miscellaneous repairs and refurbishment works at No. 5 and 6 Berths." This report was subsequent to the incident, just to be clear.

This scope of work was, according to Paria's code system, assigned under code 8107 for Installation and Maintenance work which is a category designated as HIGH RISK WORKS. (Page 7701 of Bundle of Submissions). This particular code is instrumental in deciphering, one would expect, the contract and commercial considerations for the job to be tendered. The inherent high risk component of the contracted works therefore placed its execution to be subjected to a "Permit to Work/ Standard Work Instructions/Safety Rules" requirement. This is specifically codified in the

Scope of Works at paragraph 8.0. There is no inference of the fact of this condition. It is expressly stated. It follows in the context of industry standards. Paria did not attempt at this initial stage of its contract to extricate itself from this duty and standards contained in their PERMIT TO WORK/STANDARD WORK INSTRUCTION AND SAFETY RULES.

Paria's position advanced after the 25th February, 2022 is however different. I have, read and flipped and perused the Scope of Works from which Paria's conditions of the work were expressed and am still to find one clause which expresses that any of the contractor bidding for this scope of works was to provide expertise that is to say ADVICE on the job. We can accept that the contract is for a specialist services and equipment. But this is very different from being a specialist contractor hired for its expertise within the meaning of ADVICE.

At the very introduction at 1.0 of the SOW Paria page 560 of CB, being the author of this document, states "Paria Fuel Trading Company Limited (Paria) is seeking to engage the services of an experienced and qualified Construction and Fabrication Contractors for the execution of miscellaneous works detailed below". This Scope of Works is the basis of what Paria required. It is a document being communicated to a number of contractors that are registered under service code 8107 which according to Paria's Rajendra Mahase has some 259 recommended applicants. I invited you Mr. Chairman and Mr. Commissioner to look at this Scope of Works and to come to the very quick conclusion that Paria is by peddling a narrative of "turn key" and "special contractor" and "expert" is attempting to do nothing more than to shift the duty of care to ensure a safe system of work from itself to be squarely on LMCS Limited. [Paria has a clear appreciation of the difference between the SERVICE contract and ADVICE contract.]

Kenson's denial of certain duties, I believe, has shattered protection on privilege in respect of the contract existing between itself and Paria. I invite this Commission to consider Kenson's contractual obligations as Kenson was not treated as a separate entity from Paria (bound by agency).

The confirmation that LMCS understood it was a job for provisions of services and equipment are contained in:

1. LMCS proposal contained at CB – PAGE 654 where LMCS confirms that "the work entails the provision of labour, equipment, material as specified, and supervision for the Civil Works required…"
2. CB 658- the work plan would be carried out as follows:
   - LMCS Limited will work with Paria Fuel Trading Company Limited to confirm all engineering requirements (including quality control/assurance activities) for the contract prior to placement of the purchase orders for equipment and materials.
   - Paria Fuel Trading Company Limited and LMCS Limited will conduct Job Hazard Analysis (JHA's) and Risk Assessments as required for all activities associated with the Project.
3. CB 656 Project Control- Progress measurement and reporting frequency/formats will be determined by the LMCS Ltd and Paria Fuel Trading Company Limited Project Teams. Paria's reliance on LMCS "expert advice" in whichever incarnation of the term is plainly put unsupported and ought to be rejected as a matter of fact.

EXPERT

The value of having an EXPERT contractually called “project consultant” or “project engineer”, I submit, is the fundamental basis upon which the delta p event leading to the death of the 4 LMCS workers rests for several reasons. In the first place, the development of the scope of works lacked crucial information on the layout of S.L. 36. A schematic was presented. There may be no fault on the face of the drawing, but it was clearly misleading. To date we still don’t know the bottom profile of SL 36. This system it seems from the evidence is of some vintage. The contract carried out by LMCS I am sure will not be the last of contracts to be performed on this system. Paria had a duty to LMCS and any other contractor providing services on its system to have a comprehensive inspection report. This seems to be common sense.

The second aspect of the scope of work deficiency is the lack of this expertise to evaluate intricacies which the job required. Paria’s tender note at page 928 of the CB reads “LMCS has demonstrated in their prior performance that they have the required **management and resource competencies** to satisfy the contract requirements” and at page 931 under the rubric “Technical Evaluation” the notes states “A technical evaluation of the five bids submitted was conducted by Technical and Maintenance Department and only one bid submission was found to be technically compliant with the requirements in the scope of works.” What qualification and experience was brought to this evaluation process is? From the evidence, Paria is suggesting that LMCS possessed the expertise. Essentially hiring itself. Doing this clearly placed LMCS and its employees at an even higher level of risk in the performance of their work, as is evidence by the tragic incident. Clearly Paria lacked the expertise at the outset of the formulation of the scope and then evaluation.

Paria has admitted to knowing of its option of hiring a project engineer/consultant who would have had the requisite expertise to advise in the execution of this contract, but it chose not to. Mr. Terrence Rampersingh in his evidence relates that this was the MO of 2020 contract similar to this one. Saving the dollar for the cost of lives. That is what this decision comes down to.

EXECUTION OF WORKS

The works were executed, presumably, under a Safe System of Work policy which is the Paria's Permit to Work System/ Work Instruction/Safety System.

1. On the instructions issued by Paria for line clearing, I will submit that this is not a mere internal document. It was incorporated as an obligation in the Scope of Works at paragraph 8.0. However, the monitoring of this process for line content removal rest squarely with Paria (both in respect of measurements and systemic control). It is Kazim Ali's evidence that the measurement of line content received was "negligible" and LMCS aim was to ensure an ullage (See page 36-37 of the Transcripts of Day 4). What is clear is that between the contractor and Paria there seem to be a variance on the amount line content to be removed. A clear indication that a single appointed project manager/engineer from Paria would have eliminated misunderstandings. If LMCS knew the amount of content being removed, then it will have been clear that there wasn't a solid leg of liquid under the plug, on which its methodology was

premised. [In the investigation of the movement of barge issue with Dexter Guerra, there is a statement to Mr. Archbold about LMCS being concerned of the pollution **[see 2922 of Supplemental Witness Statement bundle]**. Certainly, if LMCS knew it removed all or most of the line content this will never have been a concern- POINT TO GENUINE BELIEF OF LINE CONTENT- STATEMENT BEFORE INCIDENT]

2. The PTW system incorporates 3 categories of approved documents (which it incorporates and should be taken together as a whole)- Method Statements, JHA's and Certificates. LMCS produced Method Statements and Job Hazards Analysis to Paria for review and approval. These were provided by way of emails. The purpose being to execute the works safely. This review and approval process must be predicated on Paria's competence and expertise to effectively evaluate and scrutinize the contractor's proposed work method. This is a burden that Paria carries. Save for one clarification about the plugs, all was accepted and approved. That specific clarification FROM PARIA dealt the plugs, where Paria was informed that the methodology to be

employed will be to removed them manually and to reinstalled at the top of the riser. IT CLARIFIES THE METHODOLOGY LMCS is to employ. The PTW **does not** specify methodology of the work to be accomplished. There is no more clarity to this.

This brings me to issue of the PTW 9320 which stated "barriers to be use". Barriers to be used cannot and should not be equated to barrier to remain or barrier not to be removed. This is a convenient argument mounted by Paria, as the removal of the barrier was the delta p event.

In this safe work system however, there are checks and balances in place. Therein lies the importance of Tool Box meeting. What we have on this issue is Christopher Boodram's evidence that the removal of the plugs was discussed [See: pages 6 and 7 of Day 2 Transcripts]. This is corroborated by the action of the workers in the chamber. Missing, as a check and balance, was Mr. Majardsingh from the toolbox meeting, who as the Applicant for the works that day and who would have been in the position to make an objection

RIGHT THERE AND THEN. Claiming that monitoring of LMCS or any other contractor performing high risk work periodically around 4 times per day is wholly unacceptable in the scheme of safe system of work. This is a system failure.

Communication within the chamber while the men worked. This was established with both camera and radio- a simple request to adjust the view could be made. It seems ludicrous that Paria can have paid personnel on site who was actually monitoring the works in chamber out of curiosity but couldn't do so a matter of duty. This is a systemic failure of Paria. KENSON/PARIA CONTRACT.

DELTA P EVENT

Operating in an environment of consistent systemic failure allowed for the delta p event to take place.

LMCS in proceeding with the methodology to establish an ullage, from which LMCS assumed there was a solid leg of liquid/fluid. However, Mr. Ziad Khan opined that in addition to the excessive line content removal that the pressure at #5 was locked in until 25th February, and **only**

released when the riser was opened to conduct the Carber Test. I will invite the Commission to consider that this opinion is not based on the facts. Paria's daily report sheets **(Page 7288, Line 1)** shows that the line content removal was completed on Feb. 5th 2022.

Mr. Ali stated that the pressure was released (bleed out) from both ends of the pipe via the risers prior to ullage measurements pages 53 to 61 of transcript for Day 4.

Additionally, the daily report sheet **(Page 7291 & 7292 of the Bundle of Submissions)** for 10th and 11th February shows that the piping at the top of the riser was removed at #5 and line plugs were installed and a new flange welded on the riser Berth 5. The line plugs were then removed and a blind flange placed on the newly installed flange. Paria's reports show that the line plugs were then installed on February 13th Berth No. 6.

RESCUE

It is accepted that attempting to remove the inflatable plug created the delta p event causing the men, tools and BREATHING AIR to be sucked into the pipeline.

Once the disturbed waters around the chamber settled and the chamber returned to normal function mode, Andrew Farah in two separate incursions determined:

(i) The men were no longer in the chamber nor were the tools, bolts and **diving gear**

(ii) The riser was full of water

(iii) There was no sign of the contents of the chamber in the immediate vicinity of the riser, on the seabed, or floating on the surface surrounding the berth

this led to the conclusion that the men were in the pipe.

After discussion with site personnel Kazim Ali, Andrew Farrah and Dexter Guerra decided that they had, at the least, the minimum resources to do an incursion into the pipe. In addition to this on site plan, Farah called out Conrad and Conan Beddoe for additional divers and equipment. Sometime within this time-frame Kazim Ali spoke with Collin Piper and was told of this deduction.

There was no indication of an ICT being activated. In fact, up until these hearings LMCS never understood that Paria had activated the standardised ICT. They seem to be functioning for various places. This only highlights further a systemic failure of Paria.

The evidence elicited has shown that:

1. Paria prevented LMCS Ltd. from executing rescue plans that were continuously modified as more resources and information came to hand. The first denial to mount rescue attempts came around 3:30 PM when the PTW was pulled with the countervailing instruction to cease all diving. (Closed out work permit)
2. Paria made the rescuers believe that TTCG will be conducting a rescue when in fact there was no such determination until around 9PM.
3. Paria had no plans or attempt at any rescue over 25th, 26th, 27th February 2022.
4. Paria was informed of proof of life within the pipeline by the fact of Christopher Boodram's survival and distress signalling continued up to and beyond 2:30AM Saturday 26th, 2022. Boodram's

emergence from the pipeline UNAIDED was indicative of the conditions for a rescue being probably. Instead of acting on proof of life, Paria chose to discredit:

(i) The knocking heard emanating from the pipe at #5, saying it was noise from the equipment running at #6 Berth, a distance of a quarter mile away.

(ii) After Christopher's life saving heroics, Paria also chose to create denial of the existence of air pockets, saying they were not seen on camara footage, even though Christopher Boodram and 4 men survived for three hours with five tanks (which would have only given them one hour to live if they each used a tank).

5. Mr. Piper claimed that he wanted more information from camara footage before considering any dive rescue, but his repeated requests up to 9.00 p.m. on Friday, to the Coast Guard, to do a dive does not support this claim. (**Page 3011 Paragraph 10)**. From the statement of Mr. Seales **(Page 3135 paragraph 23)**, it can be seen that the TTCG were requested to consider 12.15 a.m. on 26 February.

6. After the footage was received at midnight Mr. Piper again asked the Coast Guard to dive and remove obstacles in the line, even though they had already told him that they were not trained for that and commercial divers would be more suitable.
7. Mr. Piper knew that LMCS had experienced commercial divers, onsite, some related and some not related, who were prepared to dive, yet they were not asked.

MISINFORMATION

8. Colin Piper, Mushtaq Mohammed, Michal Wei and Randy Archbald all say that they got expert advice that they should not allow diving into the pipe. The experts listed were OSHA, TTCG, OTSL, HULL, HHSL, EERS, Eastern Diving Services, Mitchell Professional Diving Services (MPDSL). From this list, the evidence shows that TTCG, EERS, and MPDSL were only asked if they would conduct a rescue. They said they, themselves, would not perform a rescue but never advised Paria that a rescue should not be performed. Mr. Seales denied any involvement as an ICT member or advisor to Paria.

9. Mr. Piper advised all, that Christopher Boodram said: "The men did not make it".

10. Then the other misinformation given was that there were dive bottles lodged in the line, the distance of that blockage location kept increasing in what seems to be an attempt to solicit a particular advice from the "experts" or to deter a rescue plan being executed or to justify not taking any action. Consideration of Mr. Piper's evidence that the spooling of the ROV tether, the length of the tether from the top of the riser and the slack of the tether MUST BE considered in respect of ACTUAL distance. There may have been an error of some 300% which only suited to DETER rescue efforts.

FURTHER MISINFORMATION- DELIBERATELY TO PROPAGATE AN UNTRUTHFUL PERCEPTION IN PUBLIC

There is a difference, it must be appreciated between I'm not prepared to go or send my men down the pipeline as it is too dangerous for them, and it is too risky to send divers into the pipe to rescue the men. The willingness of competent divers trained to undertake these risks with equipment and support for the execution of the plan was all that was needed.

The first position seems to sit with ALL of the “EXPERTS” Paria placed reliance, while the latter seems to be the POSITION taken by Paria. It is of note that there is no evidence of “experts” being asked to show experience or a CV of any sort prior to Paria engaging them. In fact, it seems from the evidence that the experts weren’t experts at all. In fact, diving into pipeline “is not a thing”, yet there is evidence of Andrew Farrah, Kazim Ali, Christopher Boodram and Micheal Kurban diving into a pipeline.

One point of agreement from Mr. Donawa, Mr. Seales and Mr. Fuentes seems to be the best way to advise on a rescue plan was to undertake a site visit or soliciting information from on site personnel.

In his witness statement Mr. Piper made no mention of his fears of confined space rescuers dying whilst attempting to rescue people. Paria has its own Confined Space Rescue Protocol that could easily have been employed to formulate a rescue plan for the men in the pipe.

Mr. Piper's reference, spoke mainly of would-be rescuers rushing in to remove a victim without preparation: breathing air, communication and light. The incident happening at Berth #6 under water would negate any possibility of any rescuer impulsively rushing in, without his own breathing air, Scuba or surface supply.

LMCS PLANS

All plans considered by LMCS involved divers with air supply, and underwater light and initially rope for tethering and signalling and later umbilical in addition to rope that included camera lights and voice communication. This issue could have been easily dispelled with a hands-on approach with the divers on site or at the very least through Catherine Balkissoon.

Feet First / Head First?

LMCS always considered a feet first entry for rescue, this was what was discussed with Paria site personnel on Friday 25th and was the method of diving executed by Michael Kurban. If Paria had any degree of interest in a rescue then, the task of de-risking this methodology laid out by LMCS could have been explored with all on site via Catherine through simply conferencing with the ICT from on site with LMCS personnel.

NOT SERIOUS ABOUT SAVING LIVES- Time was passing along while workers were reported hearing knocking noise. This was determined by varying knocking intensity and frequency. This was first heard by LMCS people at around 6.15 by Beverly **(Page 465 Paragraph 36).**

PARIA, FROM THEIR EVIDENCE, DID NOT SHARE THIS VIEW. Their evidence is that they verified no knocking noises. From the autopsy report we know that there was life within this pipeline at the time the knocking noises were being heard. Paria continued to prevent a rescue diving plan from Berth 6, LMCS's main goal on saving these men turned to the entry point at Berth 5 where the knocking noises were being heard. On being informed of the knocking and confirming as coming from the pipe (ICT records knocking sounds heard at **1959 HRS, Page 1573.**

LMCS requested of Paria (i) Install riser extension at #6, removal of Blind Flange from top of Riser at Berth #5 and to remove chamber from over riser at # 6 Berth. This would have allowed at the very least an investigation of system and at best allow easier access into the riser for rescue purpose. Statements of Kazim Ali at (**Page 2867 & 2872 Paragraph 98)-23.01.10- Supplemental witness bundle.** ICT logs **(Page 1573)** Statement of Randolph Archbald (**Page 1323-Paragraph 58),** Mushtaq Mohammed **(Page 1453 Paragraph 59)**, Catherine Balkissoon **(Page 1332-Paragraph 24)** and Colin Piper **(Page 1361,1362-Paragraph 81,84)**

Compressor failure was not reason for the request of riser installation. Mr. Piper himself confirmed that LMCS possessed a back-up compressor. The compressor in operations was functioning. LMCS on information being presented in real time, revisited rescue from an alternate point of entry. In this regard, LMCS suggestion for the blank to be removed from Berth 5 to hopefully save the men's lives from that end. However, to do so the belief was that the riser being extended to atmospheric height will not interfere with construct within the pipe thereby allowing the blank to be removed from Berth No. 5 to conduct at the very least investigation from No. 5 riser to mount a rescue or at best to actually rescue the men from this end.

Eventually Paria authorized the addition of the riser extension and the removal of the blank. However, the permission to remove the blank was withdrawn and not authorize until 5.00 am on the 26th February. Therefore, from 10PM on Friday to 5:00 am on Saturday there was no point of entry into SL 36. This secured only one thing- prevention of any diver having access into the pipeline. Removal of chamber came until 9.00 pm on the 26th February and eventually removed from over riser top. Of course, installation of the riser only meant completion of the sub-sea works at riser 6.

The need for "policing" on site to control LMCS workers is a diversion of efforts on all fronts. It takes away Paria from attending to…whatever they were attending to and ONLY creation of distrust. Had Catherine Balkissoon genuinely felt threatened by the LMCS workers' behaviour, would she have continued to be in their presence on their barge?

Mr. Ali's meetings to plead for rescue on Saturday was not treated with any seriousness or thought. Then the meetings on 27th February, 2022 were clearly only for the benefit of indulging LMCS, as a decision to move to recovery was already made since Saturday night between Mr. Piper and Mr. Mohammed. In common parlance "a pappy show".

LMCS participation in this enquiry has been channelled to ensure that it delivers all that it has and all that it knows. However, despite the best efforts, it would not be surprising that the ever-evolving strategies engaged by Paria will warrant further information. LMCS itself possessed no strategy of conjuring or redesigning what has passed. However, what has become clear from the live evidence elicited is that there are three distinct categories of information- WHAT WAS, WHAT COULD HAVE BEEN AND WHAT SHOULD HAVE BEEN. These are not proceedings confined to pleadings and as this Commission will retire to deliberate on the evidence from the various documents, statements and viva voce evidence, I wish to volunteer to the Commission that should there be a need to seek any clarification on any aspect for which LMCS may assist, we stand ready.

Systematic failure of Paria in all stages:

1. From the design of the scope of works, commercial considerations outweighing safety considerations, improper evaluation process, lack of coherence between departments and with contractor, inefficiency and ineptitude in emergency response or refusal to respond, lack of consideration for the families.
2. Need for INTERNAL AUDIT OF THIS SYSTEM as a requirement of operations and it should be continuous.
3. Establishment of standards for school and diving- recognition and elimination of the hazards is fundamental.

THANKS

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FILED ON BEHALF OF PARIA FUEL TRADING CO. LTD AND HERITAGE PETROLEUM CO. LTD.

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THE REPUBLIC OF TRINIDAD AND TOBAGO

COMMISSION OF ENQUIRY INTO ALL THE CIRCUMSTANCES WHICH LED TO THE TRAGIC INCIDENTS WHICH OCCURRED ON FRIDAY FEBRUARY 25, 2022 AT FACILITIES OWNED BY PARIA FUEL TRADING COMPANY LIMITED (PARIA), LOCATED AT NO. 36 SEALINE RISER ON BERTH NO. 6, WHICH LED TO THE DEATHS OF FOUR (4) EMPLOYEES OF LMCS LIMITED.

CLOSING STATEMENT

INTRODUCTION

1. These submissions are made by Paria Fuel Trading Company Limited ("**Paria**") and Heritage Petroleum Company Limited ("**Heritage**") in circumstances where:

   a. they have not been called upon to answer any specific or general allegations of wrongdoing against them in relation to the events under enquiry; and

   b. the Commission has indicated that the well-known procedure in relation to the issue Salmon letters, should such letters prove necessary, will be followed in this enquiry before the delivery of its final report.

   Accordingly, the submissions which follow are necessarily to be treated provisional in nature and subject to such amplification and/or modification as Paria and/or Heritage consider necessary should the Commission take the view that they or either of them should be the subject of a Salmon letter.

2. As mentioned in Paria's/Heritage's Opening Statement, this Enquiry is largely concerned with an examination into the circumstances which led to the tragic loss of life four employees of LMCS Limited ("**LMCS**"), namely:

   a. Kazim Ali jr.;
   b. Rishi Nagassar;
   c. Yusuf Henry; and
   d. Fyzal Kurban

   on or about 25th February, 2022 while these men were in the process of carrying out specialist contract works under the control and direction of their employer, LMCS on a sealine riser at marine facilities owned by Paria.

3. Both Paria and Heritage recognize that the personal loss experienced by the families of these men is immeasurable and nothing can be done to truly compensate them for their loss.

4. Paria and Heritage appreciate that to assist in bringing closure to these persons and in an effort to avoid the reoccurrence of an event such as that which occurred on 25th February, their full and open participation in the Enquiry was and is essential. To this end, Paria and Heritage have voluntarily made available to the Commission all such persons in their respective employ that they considered relevant and helpful to the matters under enquiry, have together submitted extensive witness statements from 17 persons and have produced thousands of pages of documents for consideration by the Commission and others participating in this Enquiry.

5. While some may take the view that Paria should have handled matters differently, and although there may well be room for divergent views as to what Paria should and should not have done in relation to the retention of LMCS to carry out the works in question, the execution of the works up to and including the 25th February 2022, and the rescue and recovery efforts, at the end of the day the actions taken by Paria took were entirely reasonable in the light of the range of options open to it.

6. For the reasons which follow we submit there is no or no reasonable basis for Paria to be faulted and/or bear any liability in relation to:

    a. its selection of LMCS as a contractor to undertake the works;

    b. the role played by it during the execution of the works having regard, among other things, to:

        i. the fact that it did not possess the capability to execute such works;

ii. the fact that it took reasonable steps to satisfy itself that the independent contractor it ultimately hired for the works, namely LMCS, was a competent and well-established, specialist contractor operating in the oil and gas sector with the requisite knowledge, skill and experience in successfully executing works of a similar nature;

iii. the contractual arrangements ultimately entered into between Paria and LMCS following a competitive tender process; and

iv. the information and specialist advice provided to it by LMCS prior to and during the course of executing the works; and

c. its decisions and/or actions touching and concerning the rescue and recovery efforts which took place between February 25th and March 4th 2022.

THE WORKS

7. In summary, the works for which LMCS was contractually engaged by Paria following completion of Paria's tender process consisted of three (3) separate categories of work, that is to say:

a. LMCS was required to change out a section of subsea riser and tie in piping on Sea Line #36 at Berth No. 5 and Berth No. 6;

b. LMCS was required to remove, service and repair and reinstall marker buoys and storm mooring buoys located at Pointe-a-Pierre harbour; and

c. LMCS was required to fabricate and replace 300 feet of main walkways on Paria's main viaduct at the Pointe-a-Pierre harbour.

8. The matters which occupy this enquiry relate to those works identified at paragraph 7(a).

TENDER PROCESS

9. In an effort to secure suitably qualified and competent contractors to undertake the works Paria embarked upon a competitive tender process open to 27 contractors who were pre-qualified with it in relation to "marine installation-maintenance" services and duly registered as vendors (*see paragraphs 7-18 of witness statement of Rajendra Mahase, Paria's Materials Co-ordinator, dated September 12th 2022 and paragraph 26 of the statement of Mr. Manmohan Balkaran, Paria's Maintenance Lead, dated September 30th 2022*).

10. The tender process was engaged by Paria for approximately one (1) month from April 30th to May 28th 2021.

11. On May 4th 2021 a mandatory virtual site visit for prospective bidders was attended by 16 vendors. An in-person site visit was originally scheduled for vendors on May 10th 2021 but was cancelled due to the then Covid 19 pandemic restrictions.

12. All prospective bidders, including LMCS, were afforded a Clarification Period, up to May 13th 2021, during which they had the opportunity to seek further information and/or clarify any issue in relation to the tender. Paria received only one query from LMCS, which related to the length of the pile and which was answered by Paria. The queries received from all prospective bidders during the Clarification Period and responded to by Paria culminated in the generation of Addendum I, a contractual document which is referred to later in these submissions.

13. Five (5) bids were received during the period prescribed for submission of bids.

14. LMCS was the only bidder that provided all documents required by Paria's Scope of Works – Technical and therefore the only bidder which provided a valid technical bid (*see paragraphs 26 to 29 of witness statement of Manmohan Balkaran dated September 30th 2022*).

15. The technical specifications for the works with which bidders were required to comply provided, among other things, that:

   a. bidders are required to demonstrate that they possess the experience and resources (equipment, personnel, and technical capability) to successfully complete the works; and

   b. bids would only be considered valid if submitted, among other things, with: STOW certification or audited HSE management system for high-risk offshore services (inclusive of diving services, lifting services, piling works, pipeline construction and repairs), HSE plan, Quality Assurance Plan, Method Statement, overrarching risk assessment, Dive Plan and list of resumes for key personnel and their experience in similar projects.

16. Petrotrin's database disclosed that during the period 2015 to 2018 LMCS carried out 124 jobs for Petrotrin and obtained a rating of "acceptable" for each job with the only other available rating being "unacceptable". Previous jobs undertaken by LMCS for Petrotrin included but was not limited to re-routing of a SeaLine riser, structural repairs to Berths No. 6, renewal of piping and risers (*see paragraphs 12 to 17 of witness statement of Rajendra Mahase dated September 12th 2022.*).

17. In addition, in the year 2020 LMCS successfully completed subsea maintenance works at Berth No. 5 of an almost identical nature to those works in respect of which Paria had invited tenders. Indeed, those 2020 works involved the replacement of an old riser with a new riser with the aid of a hyperbaric chamber and required the installation of migration barriers at a subsea level. LMCS' performance in relation to that job was assessed as "Excellent" or "Very Good" over a range of seventeen (17) categories, two of which included "Compliance with applications, practices and Paria's standards" and "HSE compliance as per ITB (permits, PPE, etc.)" (*see paragraphs 35 to 43 of statement of Michael Wei dated August 16th 2022*).

18. Accordingly, it cannot be doubted that at the time of tender LMCS objectively presented as a specialist contractor that was well qualified and experienced to execute the Works in question.

19. Paria notes that during the course of the Enquiry, suggestions have been made to the effect that it ought to have had adequate internal resources with the relevant skill and experience to rigorously evaluate all of the technical aspects of the bids received (inclusive of method statements, risk assessments and emergency response plans) or that it should have retained an external consultant capable of so doing. While these are not unreasonable views, the reality is that the law did not impose such a requirement on Paria. Legally speaking, all that Paria was required to do was to take reasonable steps to satisfy itself that the independent contractor retained by it to carry out the works was competent.

20. Applying this legal standard, it could hardly be suggested that Paria was negligent in the selection of LMCS as contractor given LMCS' knowledge, extensive experience, STOW certification and track record in executing works of a similar nature to those in respect of which Paria had invited bids.

21. In any event, there is nothing contained in LMCS' Method Statement that accompanied its tender bid which, <u>if adhered to</u>, would have given rise to a Delta P event or to the risk of

such an event reasonably occurring. In this connection the following evidence is of critical importance:

a. LMCS' Method Statement (at tender) expressly provided that the liquid content from Sea Line #36 was to be removed to a level sufficient to allow the replacement of the corroded section and that once the level in the riser had dropped to 35 feet below sea level a line plug would be installed (*see pg. 659 Core Bundle of Documents*);

b. LMCS' HSE Manager Ahmad Ali testified that its Method Statement required that LMCS only remove enough line contents sufficient to give it room to install the plugs while leaving the rest of the contents in the line and that such removal would not have created a void in the line providing enough space for something to be sucked in (*see paragraphs 13 of Supplemental Statement of Ahmad Ali dated October 31st 2022*);

c. LMCS' Managing Director Kazim Ali Snr. testified that LMCS did not propose the removal of the entire line contents between Berths No. 5 and 6 because it wanted to set the plug on a solid leg of liquid and that LMCS didn't mention Delta P in its discussion in its Method Statement or Risk Assessment because Delta P was to be taken care of by ensuring that there would have been no pressure difference across the plugs (*see paragraph 26 of the Supplemental Witness Statement of Kazim Ali Snr dated November 22nd 2022*);

d. LMCS' Managing Director Kazim Ali Snr. also testified that he was of the impression that Paria understood that the method for the removal of liquid only required the creation of a 30 foot space to set the plug and that he did not think that Paria wanted LMCS to clear the entire Sealine (*see paragraphs 33 and 36 of the Supplemental Witness Statement of Kazim Ali Snr dated November 22nd 2022*);

e. Both LMCS and Paria interpreted and subsequently treated both LMCS' Method Statement, insofar as it pertained to removal of liquid content from the line AND as Paria's response to Query No. 1 of its Addendum I (*see pg 598 of the Core Bundle of Documents*) which referred to ensuring that the line is clear and dry, as meaning that LMCS would only remove the liquid contents of the line to a depth of 35 feet below sea level (*see the evidence of Kazim Ali Snr at pg 94 Ln. 1-16, of Transcript dated December 5th 2022; see also evidence of Jonathan Ramdhan, Paria's Operations Team Supervisor at pg 134 lines 10 to 14 of the Transcript dated December 6th 2022 and the evidence of Paria's Michael Wei at pg 115 lines 2 to 21 and pf 116 lines 2 to 13*); and

f. Mr. Zaid Khan, an expert witness, gave oral evidence to the effect that the divers would not have been sucked into the pipeline if LMCS had only removed the contents of the line to the depth of 35 feet.

22. Accordingly, given the contents of LMCS' tender package and the documents produced before the award of contract, the retention of an independent professional with sufficient knowledge, skill and experience to evaluate the technical aspects of the bids received could not have reasonably resulted in LMCS' bid being found to be deficient by reason of the fact that the method of executing the works identified by it created conditions for the occurrence of a Delta P event capable of sucking the divers into the pipe and/or that LMCS' Emergency Response Plan and Risk Assessment were inadequate in failing to cater for such a risk.

23. In the circumstances, it cannot be reasonably be argued that any causative link exists between Paria's acts or omissions in connection with the tender process and the Delta P event which subsequently occurred on the 25th February. Indeed, given LMCS' stated method of work as identified at the tender stage, the possibility of a Delta P event occurring could not have been reasonably foreseeable.

24. Further, it is also important to mention here that given LMCS' stated method for execution of the Works, the Works could not reasonably have been described as being extra-hazardous in nature.

THE CONTRACT

25. On June 1st 2021, Paria awarded the contract for the works to LMCS. Apart from the contractual terms and conditions contained in the Invitation to Bid documentation (comprising among other things the Technical Scope of Work, Commercial proposal and accompanying drawings), LMCS was also bound by Paria's General Conditions of Contract (*see pg. 973 Core Bundle of Documents and paragraph 34 of witness statement of Michael Wei dated August 16th 2022*).

26. The contract imposed the following material and extensive contractual obligations upon LMCS as set out in the applicable Technical Scope of Work:

   a. at item 3.1.4 that LMCS verify all measurements/ information on site prior to fabrication and removal of riser piping section;

   b. at item 3.1.5 that LMCS perform the following activities: isolation / de-isolation, de-pressurization/pressurization and draining /filling product from Sea Line #36 at Berth No. 6 to Berth No. 5;

   c. at item 5.1 that LMCS supply adequate, competent and certified licensed labour for the specific job functions, <u>full-time supervision</u>, materials, tools/equipment, etc. for timely completion of the scoped work;

   d. at item 5.12, that LMCS become familiar with and conform to Paria's permit to work procedure and maintain permits to execute the entire job;

e. at item 5.16 that LMCS prepare a Job Hazard Analysis and Risk Assessment for review by Paria;

f. at item 5.18, that LMCS follow all guidelines within Paria's Health and Safety Requirements for Contractors;

g. at item 6.1.1, that LMCS instruct its personnel on the safety regulations, safe working practices and conditions that are required for an industrial marine environment;

h. at item 6.1.2, that LMCS provide and maintain all safety equipment and requirements necessary for its personnel and for execution of work and that LMCS instruct its personnel on their proper use and maintenance;

i. at item 8.9 sub-paragraph 4.0, that LMCS conduct suitable and sufficient risk assessments or job hazard analyses for all activities and all work permits and that it develop and implement appropriate controls to ensure that the risk is as low as reasonably practicable;

j. at item 8.9 sub-paragraph 5.0, that LMCS ensure that its personnel have the required training and certification to carry out their duties in a safe manner;

k. at item 8.9 sub-paragraph 8.0, that LMCS personnel are required to follow Paria's Permit to Work Procedure at all times;

l. at item 8.9 sub-paragraph 9.0 that LMCS provide competent supervision <u>at all times</u> during the execution of the job; and

m. at item 8.9 sub-paragraph 10.0, that equipment must be used in accordance with the manufacturer's specifications.

27. On the other hand, Paria's contractual obligations were extremely limited in nature. This is hardly surprising given that the responsibility for executing the entirety of the works had been contracted by it to LMCS on the terms identified above.

28. All that Paria was contractually required to do, as identified at item 4 of the Technical Specifications, was to:

a. supply personnel for organising work permits and certificates, monitor contractor's performance and work standards and carry out quality assurance audits;

b. supply certain specified materials,

c. provide a slop barge to assist in the removal of line content;

d. provide personnel for acceptance of executed work; and

e. provide personnel to <u>oversee</u> isolation/de-isolation, de-pressurization/pressurization and draining/filling product from lines at Berth No. 5 and 6.

29. During the course of the evidential hearings Paria's witnesses were extensively cross-examined with a view to establishing that Paria, through its agent Kenson (Houston Marjadsingh), was bound by extensive obligations ordinarily imposed upon Applicants for work permits under Paria's Permit to Work System. The obligations in question were that the Applicant for a Work Permit shall be knowledgeable of the hazards associated with the job and the necessary controls for such hazards and that the Applicant shall also be responsible for the job and the safety of the people who work on the job.

30. With respect, this line of cross examination was entirely misplaced as it failed to appreciate that in the context of the specific contractual arrangements agreed to between Paria and LMCS those obligations which were ordinarily imposed upon an Applicant under Paria's Work Permit Procedure HSE 02 had been displaced and/or were simply not operative in the event that Paria or its agent was an Applicant. That this is so cannot be doubted owing to the following legal principles and factual analysis:

    a. it is a principle of contractual construction that where a contract incorporates the terms of another document and the terms of that other document conflict with the terms of the host contract, the terms of the host contract will prevail (*see* ***Lewison on the Interpretation of Contracts 4th ed. para 9.12***);

    b. in construing a contract (*see* ***Wood v Capita Insurance Services Ltd [2017] 4 All ER 615)***:

        i. the task is to ascertain the objective meaning of the language which the parties have chosen to express their agreement. It is not a literalist exercise focused solely on a parsing of the wording of the particular clause but the contract must be considered as a whole;

        ii. where there are rival meanings, a construction which is more consistent with business common sense is to be preferred; and

        iii. the task of construing a contract is a unitary exercise involving an iterative process by which rival interpretations are to be checked against the provisions of the contract and their commercial consequences investigated.

c. the terms of the contract between LMCS and Paria are contained in the Technical Scope of Works and Paria's General Conditions of Contract;

d. Paria's Permit to Work Procedure HSE 02 is a document incorporated into the Technical Scope of Works by reference (*see paras 5.12 and 8.9 (sub-paragraph 8.0) of the Technical Scope of Works*);

e. the Technical Scope places the following express contractual obligations upon LMCS:

   i. to execute the Works;

   ii. to provide full time supervision for the Works;

   iii. to implement an appropriate HSE Management System for its employees;

   iv. to prepare a Job Hazard Analysis and Risk Assessment in relation to the Works;

   v. to ensure that its employees are aware of the hazards related to the job;

   vi. to have an appropriate medical emergency response plan for its employees for medical injuries or illnesses;

   vii. to provide its employees with the required PPE to perform the job tasks and to ensure that they wear and use PPE when required;

   viii. to instruct its personnel on the safety regulations, safe working practices and conditions that are required for an Industrial Marine Environment; and

   ix. to provide all safety devices, emergency response equipment and other equipment for the job as required by the task risk assessment or Job Hazard Analysis;

f. these express contractual obligations make it clear that LMCS, not Paria, is to be knowledgeable of the hazards associated with the Works, the necessary controls for these hazards and the safety of all of its employees engaged in the Works (being the responsibilities ordinarily imposed on an Applicant under the Work Permit Procedure);

g. given that these express contractual obligations are imposed on LMCS, to require Paria to be responsible for the <u>same</u> obligations under and by virtue of the Permit to Work Procedure would conflict with what the parties had agreed in the provisions of the written contract between them, be contrary to business common sense, result in a commercial absurdity, and wrongly impose upon Paria commercial risks and obligations which the parties had expressly contracted that LMCS should bear.

31. In the circumstances, it would plainly be wrong for the Commission to view Paria's actions in relation to the events under inquiry as though it carried the obligations of an Applicant under its Permit to Work System.

32. The foregoing contractual analysis is of course not to be taken to mean that Paria's entire Permit to Work System is rendered inoperable. That system remains contractually intact and alive save that the obligations imposed upon an Applicant thereunder do not bite where Paria or its agent (Kenson) function as the Applicant.

33. In this regard, there is no question that that part of clause 5.0 of the Permit to Work Procedure which provides that Work cannot start until the Work Permit is properly authorised and issued still stands.

THE EXECUTION OF THE WORKS

Line Clearing and Installation of the Plug

34. Under the contract one of the first activities to be undertaken by LMCS was the removal of sufficient fuel oil from the line so as to facilitate the installation of migration barriers in order for the replacement of the Sealine riser to be undertaken.

35. It is undisputed that LMCS conducted this activity prior to the 13th February 2022 using an air blowing method *(see paras. 42,43 and 47 of the Supplemental Witness Statement of Kazim Ali Sr. dated 22nd November 2022*).

36. It is also undisputed on the evidence that after the process of air blowing had been completed by LMCS, an ullage of 35ft was measured by it in the riser *(see paras. 32 and 37- 40 of the Supplemental Witness Statement of Kazim Ali Sr. dated 22nd November 2022).*

37. On 13th February, 2022 LMCS installed a migration barrier in the riser to sealine 36 at Berth 6. On that date it also installed a hyperbaric chamber to the said sealine at the same location. These activities were expressly made the subject of Paria's Permit to Work No. 4832 (*see pg 1075 of the Core Bundle of Documents*).

38. Thereafter, on 15th February, 2022 LMCS engaged in a range of activities outlined at paragraph 18 of the Amplified Witness Statement of Kazim Ali Snr.

39. No work was undertaken by LMCS on site during the period 16th to 24th February, 2022.

The Events of 25th February, 2022

40. On the morning of 25th February, 2021 Paria issued Permit to Work No 9320 (*see pg 1074 of the Core Bundle of Documents*) by which LMCS was authorised to execute the works mentioned therein.

41. The Permit made no provision for the removal of the inflatable plug or the mechanical plug. On the contrary, it specifically provided that: "*migration barrier to be used*". This provision was an express, direct and unequivocal instruction from the Site Authority who issued the Work Permit (Paria's Mr. Johnathan Ramdhan) to the Contractor Official (LMCS's Rudolph Gonzales) who accepted, agreed to and signed the Permit (*see Section C Acceptance of Permit to Work No. 9320*) that the migration barrier must be used on the date of issue and for the duration of the Work Permit. There was no nuance, qualification of or restriction to this instruction and it was in fact a condition upon which the Work Permit was issued (*see Section B, Part 1 of Permit to Work No. 9320 "Requirements for Equipment Isolation and Clearance", Clause 5.3 Site Authority, Permit to Work Procedure and paragraphs 24, 36(3)(c) and 36(4) of witness statement of Johnathan Ramdhan dated September 30th 2022*).

42. The role and responsibilities of Contractor Official are critical under Paria's Permit to Work Procedure.

43. By his signature, Mr. Gonzales expressly agreed and conveyed to Paria that he understood the conditions and precautions required for the execution of the tasks authorised by the Work Permit and undertook, on behalf of LMCS, to execute the required works accordingly (*see Section C, Acceptance, Permit to Work No. 9320*). He was required to have a clear understanding of the job and the different steps involved and to be knowledgeable of the

hazards and necessary controls in relation to the job (*see Clause 5.6 Contractor Official, Permit to Work Procedure*).

44. In this regard, Mr. Gonzales was trained in Paria's permit to work system on July 21st 2021 (*see paragraph 36(10(c) of witness statement of Johnathan Ramdhan dated September 30th 2022)*.

45. As Contractor Official, Mr. Gonzales was directly responsible for the work and for the safety of all of LMCS' employees associated with the job (*see Clause 5.6 Permit to Work Procedure*). In this regard, he was required to ensure that all LMCS employees involved in the execution of the works did so in full compliance with all the precautions stated thereon and on the Certificates attached thereto.

46. Having regard to his critical role, he was required to be officially nominated by LMCS to be Contractor Official, at least at the supervisory level at LMCS and to remain on site AT ALL TIMES or be represented by a suitably competent and authorized alternate (*see Clause 5.6 Contractor Official, Permit to Work Procedure*).

47. There was no evidence before the Enquiry in relation to the performance by Mr. Gonzales or any representative of his of his critical role and responsibilities under the Permit to Work Procedure or that any suitably competent and authorised alternate remained on site at all times or at all as his representative.

48. In fact, the Commission did not hear from Mr. Gonzales at all, who was neither called as a witness nor did he provide a statement or other written evidence to the Commission and no other witness provided the evidence described immediately above.

It is submitted that given his critical role and responsibilities under Paria's Permit to Work Procedure, the absence of any evidence whatsoever concerning the performance by Mr.

Gonzales of his functions as Contractor Official left a significant void in the evidence required under the Commission's terms of reference.

49. The said Permit was issued and signed in circumstances where:

a. Paria's Permit to Work Procedure provides that work cannot start unless a work permit in respect of such work is properly authorised and issued;

b. The unshaken evidence from Paria's witnesses is that in the absence of a permit authorising the removal of the migration barriers LMCS was prohibited from so doing;

c. The use of work permits is common in the oil and gas industry and that where crucial aspects of work are to be undertaken there should be a separate work permit for every major activity, a fact confirmed by both Mr. Zaid Khan of In-Corr-Tech Limited (an independent expert with considerable experience in that industry) and also by Osei Flemming-Holder of Heritage (an individual with considerable HSE experience in the oil and gas industry) (*see the Transcript dated January 6th 2023, pg. 299 lns. 1-22*);

d. The removal of the mechanical plug and inflatable plug were crucial aspects of work and that for LMCS to undertake or embark upon the removal of the mechanical plug or inflatable plug on February 25th a work permit would have been necessary - a further fact confirmed by Mr. Zaid Khan;

e. There was nothing mentioned in the work permit concerning the removal of either of the plugs;

f. LMCS and its personnel were trained by Paria in respect of Paria's PTW system;

g. At all material times LMCS was well aware that the permit served as the "*most powerful control document*" in Paria's system of work. In this regard it is important to note that: -

i. The language of LMCS' own Method Statement (Revision 0) dated 4th January, 2022 provides in bold and italicised letters that all steps identified therein shall "*only be carried out in full compliance with Paria's PTW system*"; and

ii. LMCS' answer No. 3 contained in email dated February 18th 2022 and prepared by LMCS' Ahmad Ali and sent by him using Kazim Ali's email address to Paria's Randolph Archbald (*see Exhibit R.A.1 to Randolph Archbald's Supplemental Statement dated January 5th 2023*).

50. Notwithstanding these matters, LMCS deliberately removed the inflatable plug and the mechanical plug on 25th February, 2022 which gave rise to the immediate and violent Delta P event which caused the divers to be sucked into the pipeline.

51. It is useful here to address evidence from LMCS' witnesses to the effect that the removal of the migration barriers on February 25th 2022 was implicitly authorised either by the activities listed on the Work Permit (9320) or the fact that LMCS' Method Statement No. 116 accompanied such permit. This position is not credible and ought to be rejected because it is plainly contrary to:

a. the express language specified in the permit, that is to say, "*migration barrier to be used*";

b. LMCS' own evidence by which it recognised that a work permit was to be afforded paramount status in Paria's system of work in circumstances where LMCS' personnel were trained in Paria's PTW system;

c. the clear wording on LMCS' Method Statement dated 4th January, 2022 which acknowledged that all steps identified therein "*shall ONLY be carried out in full compliance with PARIA'S PTW System*";

d. the clear evidence from Paria, Heritage (Mr. Osei Flemming-Holder) and an independent expert Mr. Zaid Khan that before the migration barrier could be removed a work permit expressly authorising same was required as per industry standard; and

e. common sense, given that the removal of migration barriers was a crucial and significant item of work and the function of such barriers, that is to say, they were to be used for the purpose of energy isolation – a fact identified by Mr. Flemming-Holder in the course of his oral testimony (*Transcript January 6th 2023 pg 299, lns. 6-18*).

52. Indeed, Paria and Heritage submit that even the most generous interpretation of the language of the permit could not lead to it being properly construed as authorising the removal of the migration barriers on the 25th of February. There is simply no ambiguity in the language which could lead to such a result.

53. LMCS also sought in its evidence to contend that the removal of the migration barriers was discussed at Toolbox Meetings at approximately 9:15 am and 9:30 am on 25th February, 2022, presumably in an attempt to justify its removal of the barriers on that date. This position is untenable as a matter of fact. In this regard Paria and Heritage submit that:

a. The removal of plugs was plainly not discussed at toolbox meeting on February 25th. This is supported by contemporaneous documentation namely:

i. the Toolbox Forms themselves which, as Mr. Khan pointed out in his expert report, make no reference to the removal of the plugs (*see pgs 1070 and 1071 of the Core Bundle of Documents*); and

ii. Andrew Dopson's relatively contemporaneous written record of what transpired at the Toolbox meetings (contained in his Daily Activity Report dated 25th February, 2022 – *see pg 1022 of the Core Bundle of Documents*). Significantly, this document was prepared by him at a time when neither the Commission of Enquiry or legal proceedings of any nature were contemplated. Accordingly, there would have been no motivation for the document to have been manipulated to suit the circumstances relative to an inquiry into the cause of the Delta P event.

b. Under cross examination Andrew Dopson maintained that the removal of the plugs was not discussed at the Toolbox meetings;

c. Although contrary evidence was led before the Commission by LMCS employees in the person of Andrew Farah and Dhilpaul, Paria and Heritage submit that the COE ought to reject that evidence:

i. As to Dhilpaul, it is significant to note that in his witness statement of November 10th 2022 his evidence was that "*I discussed general safety as I am accustomed to doing and identified the general hazards around the work area. I can't recall exactly what I discussed.*" (*see para 21*) and that "*Kazim Ali Junior also spoke about the job to be done. I can't remember or recall what he said about the job in particular.*" (*see para 24*). He gave no evidence whatsoever in that statement that the removal of the plugs was discussed;

ii. Further, in Dhilpaul's statement given to OSHA dated March 14th (a mere 3 weeks after the incident) about the events of the 25th of February, in which he specifically addressed the toolbox meeting and what was discussed thereat, he did not identify that any discussion took place concerning the removal of the plugs;

iii. Further still, although under cross examination Dhilpaul sought, for the first time, to suggest that the removal of the migration barrier was discussed, it does not accord with his earlier detailed evidence which condescended to the events of the toolbox meeting; and

.

iv. Finally, Dhilpaul did not present as a witness of truth. He was evasive under cross-examination and effectively asked the Commission to believe that his memory as to the events of the 25th February magically improved between the 10th of November and the date upon which he gave oral testimony. This is not credible testimony as one would expect that Diapaus's memory would have been at its best on the 14th of March when he gave his statement to OSHA and not 8 months later when he came to testify before the Commission.

v. As to the evidence of Mr. Farah, although he did testify that the job scope for the day which included the removal of the plug was discussed at the toolbox meeting, that evidence is not supported by the toolbox forms nor the contemporaneous note (Daily Activity Report) of Mr. Andrew Dopson;

vi. Further, Mr. Farah himself produced no contemporaneous note and his evidence therefore rests squarely on his memory as to what happened 9 months prior;

vii. His demeanour and disposition under cross-examination was not one of a witness who came to give a credible account of what transpired on the 25th February and was prepared to dispute the obvious. This is best illustrated by the following aspects of his testimony under cross-examination:-

a. His steadfast refusal to acknowledge that it would be best practice for the person making a decision relative to a rescue to have no emotional connection to the persons to be rescued;

b. While he acknowledged that it was reasonable for a person seeking to be rescued to try to hold on to a rescue diver and not let go, he rejected the suggestion that that might pose a serious complication to the rescued diver in a 30- inch diameter pipeline;

c. When confronted with questions concerning the absence of a rescue plan for rescue divers, which he acknowledged was important, he was prepared to go so far to suggest that LMCS had formulated one on the 25th February notwithstanding the fact that no mention was made of such a plan in his witness statement of OSHA interview (pg. 724 Bundle of Submissions) and was unable to provide any details in connection with such a plan; and

d. He testified that a contingent of 3 people was adequate to execute the rescue of the 4 missing divers and to constitute a rescue team to rescue any rescue divers if something went wrong (*see pg. 147 the Transcript for December 8th*). This evidence defies common sense and is entirely at odds with the preponderance of expert evidence in relation to diving given to this Enquiry.

54. We therefore submit that the Commission ought to find as a fact that there was no discussion in relation to the removal of the plugs at the toolbox meeting of 25th February.

55. This would accord with the evidence of Terrence Rampersadsingh, Paria's former Maintenance Planner responsible for, among other things, overseeing the execution of the works, that the removal of the plugs also did not feature in his discussions with LMCS on February 24th 2022 about the works scheduled for Friday February 25th and the ensuing weekend. According to Mr. Rampersadsingh, this meeting was attended by Mr. Kazim Ali Snr, Kazim Ali Jnr (now Deceased) and Ahmad Ali of LMCS and himself. During the interview, Mr. Rampersadsingh read aloud from a note which he said he made just before he left Paria (on or around April 29th 2022) of the works that were actually discussed. He indicated that he made the note that he read out using a contemporaneous record he made on February 24th of the discussions during the meeting in addition to his memory of what was discussed. (*see Transcript of his interview with Commission dated December 1st 2022, pg. 87 ln 11 to pg. 90 ln 15*).

56. In any event, Paria and Heritage submit that even if the removal of the plugs was discussed at the Toolbox meetings and/or the meeting with Terrence Rampersadsingh on February 24th (which are both denied), such discussions were not capable of overriding the express requirement imposed on LMCS and its personnel to fully comply with the clear requirements of Paria's permit to work system.

57. In all the circumstances, the deliberate removal of the migration barriers by LMCS on February 25th which caused the Delta P event was:

a. wholly unauthorised, and in disobedience to a clear and direct instruction from Paria prohibiting the removal of such barriers; and/or clear breach of Paria's permit to work system which was well known to LMCS; and

b. wholly disregarded well-established industry standards and practice.

58. Paria wishes to make one further point in relation to the events of 25th February, 2022 and it is this. If the Commission rejects Paria's submission set out above to the effect that the obligations imposed upon an Applicant under its Permit to Work Procedure do not, as a matter of construction, apply where the Applicant is either an employee of Paria or its agent (a Kenson employee), on the facts Paria cannot be found to have been in breach of an Applicant's duty to continually monitor the job in accordance with clause 5.1 of the Permit to Work Procedure. The reasons for this are relatively straightforward.

59. First, the duty to continually monitor in the context of Paria's Permit to Work System can only be construed as a duty to monitor works which are the subject of a duly issued Permit to Work. The removal of the migration barriers was not the subject of any Permit to Work and accordingly no duty to monitor could reasonably be said to have arisen in relation thereto.

60. Second, a duty to monitor can only properly arise at a time when works are scheduled to be executed. Indeed, if the works were wrongly executed by LMCS outside of scheduled working hours it could hardly be said that Paria was in breach of a duty to monitor. So too in the case of works executed at lunch time. In this connection it is significant to note that on the evidence the activities relative to the attempt to remove/deflate the inflatable plug occurred during the luncheon interval on 25th February, 2022 between about 1345 hours and about 1445 hours, which resulted in a splash being seen on the remote monitor on Berth 6 at 14:45 hours. This much is confirmed by the combined evidence of Andrew Dopson

(*see paras 12 and 13 of his witness statement dated 2nd December, 2022*) and Kirt Scott (*see para 3 of his witness statement dated 2nd December, 2022*).

RESCUE/RECOVERY EFFORTS

61. In the course of this enquiry, Paria has been subject to a number of criticisms in relation to its conduct concerning rescue of the divers from the pipeline. On a proper review of the factual and expert evidence adduced before the commission, these criticisms are unfounded. As will be explained in detail below, Paria's actions in relation to the rescue efforts were wholly reasonable given the conditions under which it was operating, the resources available and the need to take into account the safety of potential rescuers.

62. In examining the reasonableness of Paria's conduct, the Commission is invited to consider eleven factors borne out by the evidence.

63. First, in the context of the contractual arrangements between Paria and LMCS the obligation to formulate and action an emergency rescue plan in respect of LMCS' employees rested on LMCS, not Paria. Paria was not obligated to play anything other than a supporting role.

64. Second, between 2:45 p.m. and 5:30 pm Paria was unaware that the divers were in the pipe.

65. Third, LMCS personnel were generally uncooperative and/or hostile to Paria's representatives on the 25th February 2022.

66. Fourth, owing to the inadequacy of LMCS' rescue plan and its inability to provide adequate resources for the purposes of attempting a rescue, Paria engaged multiple specialist service providers for that purpose. Those providers included: Mitchell's Professional Diving Services Company Limited, Eastern Emergency Response Services Limited, HHSL Safety Systems Limited, Subsea Global Solutions LLC, Offshore Technology Solutions Limited,

Hull Support Services Limited. Paria also enlisted the assistance of its affiliate company, Heritage which provided a variety of resources including but not limited to certain of personnel, namely, its dive supervisor Rolph Seales (Kenson) and its Operations HSSE Manager Osei Flemming-Holder (Heritage). Paria also contacted the Trinidad and Tobago Coast Guard requesting assistance for the purpose of a rescue.

67. Fifth, the information which Paria had concerning the conditions within the pipeline was inadequate in material respects, that is to say, Paria did not know the condition nor the location of the inflatable plug within the pipe. Paria also did not know precisely where the divers were located within the pipe ortheir physical condition, except the pieces of information which they were able to obtain from the Incident Command Team's brief conversation which was permitted with Christopher Boodram on the night of February 25th.

68. Sixth, the information Paria had about the conditions which obtained in the pipeline indicated that hazards existed therein. Paria was for some time understandably operating under the assumption that significant quantities of fuel oil were present in the line (by reason of the fact that LMCS' Method Statement prescribed that the line would be cleared of fluid to depth of 35 feet below sea level). The emergence of Christopher Boodram from the line at approximately 5:30 p.m. completely covered in oil supported this assumption. Further, as the evening progressed, Paria deduced that the inflatable plug was in the line thereby giving rise to the possibility of a further Delta P event within the line. Further still, into the night, Paria became aware, through the use of a camera, that an oxygen tank was lodged in the line.

69. Seventh, Colin Piper, Paria's Incident Commander, was at the time well aware of incidents locally and abroad where persons who attempted to rescue others had perished during the course of such efforts (*see para 102 of Colin Piper's Statement dated 1 September, 2022*).

70. Eighth, none of the entities or persons contacted by Paria were prepared to undertake a rescue and/or were able to do so. The Coast Guard advised that its personnel were neither trained nor did the possess the specialty equipment to undertake a rescue from within the

pipe. Andy Johnson of Eastern Emergency Response Limited advised that the confined space technicians attached to his company could not provide a rescue service as they were not trained to do an underwater rescue. Fitzroy King, dive supervisor of Mitchell's Professional Diving Service Company Limited advised that the risk of diving into the pipe was too high and he couldn't send his divers into the pipeline to remove the blockage (*see paragraph 28 of the witness statement of Rolph Seales dated 9th December, 2022; see also paragraph 7 of the witness statement of Fitzroy King dated 28th November, 2022*). Mr. Rupert Paul of dive supervisor of Offshore Technology Solutions Limited gave similar advice (*see paragraph 28 of the witness statement of Rolph Seales dated 9th December 2022*).

71. Ninth, several of the diving experts who have given evidence have advised that in the circumstances it would have been unsafe to enter into the pipeline to undertake a rescue of the divers. Krishna Fuentes, Rolph Seales, Anthony Donawa and Fitzroy King were included among them.

72. Tenth, the evidence of Rolph Seales and Krishna Fuentes is that for a rescue operation to be safely undertaken the number of divers required was in the order of 7 commercial divers, some with their own umbilical attached. 7 commercial divers, each outfitted with commercial diving equipment were not available on the night of 25th February, 2022 or even into 26th February, 2022.

73. Eleventh, although Michael Kurban, Conan Beddoe, Dexter Guerra and LMCS' Andrew Farah each testified that they would have been prepared to undertake a rescue, it is plain that they proposed to do so without proper regard to safety considerations and without using the appropriate resources. In particular:

    a. as to Conan Beddoe, from his evidence it was clear that he had not undertaken any proper risk assessment and was prepared to attempt a rescue with the assistance of only one other diver in circumstances where he recognised it was not normal practice to enter into a pipeline and he had never even done a rescue drill inside a pipeline;

b. as to Michael Kurban, Conan Beddoe observed that on the night of 25th February, 2022 he was not "in a sound mind" to properly tend him (*see paragraph 18 of the Witness Statement of Conan Beddoe dated 22nd October, 2022*). Additionally, as was apparent from Kurban's evidence, he had undertaken no proper risk assessment;

c. similarly, Dexter Guerra was prepared to participate in a rescue attempt in highly risky circumstances. His evidence was that he would remain in the hyperbaric chamber while another diver entered the pipe;

d. Andrew Farah bluntly testified that he was willing to pay the ultimate price of death (*see lines 19-23, pg. 1378 Transcript Bundle dated December 8th 2022*) in service of an attempted rescue of his "*very close*" colleagues and therefore, by his own admission, any risk assessment would be nugatory and pointless, for to him, no risk was too high. His so-called "dive plans" proposed by him on behalf of LMCS were devoid of any proper risk assessment and inadequately resourced. He testified that his team would consist of 3 divers and that would be a sufficient number of divers to undertake a rescue and also effect a rescue of a rescuer

74. Twelfth, none of the divers or diving professionals who gave evidence proffered a workable or credible rescue plan which could have been effected on 25th or 26th February, 2022.

75. For completeness, it is necessary to address one final allegation which has been levelled against Paria in connection with the issue of rescue efforts, namely, that Paria stopped LMCS and others from carrying out any rescue attempt on the night of 25th February, 2022 or during the course of 26th February, 2022. This allegation cannot be supported out on a

proper analysis of the facts. While it is not disputed that Paria told persons not to dive into the pipe because it was too dangerous, the reality is that persons were not prevented from so doing because the evidence shows that divers had entered into the pipe thereafter and remained in the water well into the night of 25th February, 2022.

CONCLUSION

76. It is submitted as follows:-

a. The decisions taken by Paria in the wake of the incident can only be fairly and properly be assessed in light of the conditions and circumstances which existed at that time and not with the benefit of hindsight and the subsequent availability of significant amounts of information, documents and time, which has been afforded to the witnesses who gave evidence at the Enquiry; and

b. The invitation made to the Commission by Counsel for the relatives of some of the Deceased divers to recommend criminal prosecution of Paria and/or Paria personnel is outrageous, wholly unsupported by the evidence and clearly designed for media consumption. There is no evidence of anything even approaching criminal conduct on the part of Paria or Paria officials.

77. The following recommendations are also commended to the Commission:

-

a. That guidelines in relation to the appropriate use of SCUBA diving gear and to the appropriate gear, procedures and practices for diving for the purpose of conducting commercial work be developed by the relevant authorities;

b. That a specific confined space policy, procedure and practice in relation to the oil and gas industry be developed by the relevant authorities; and

c. That a national registry of resources, including personnel, to respond to major emergencies be developed and implemented.

Dated this 13th day of January 2023.

....

GRETEL BAIRD
Instructing Attorney-at-Law for
Paria Fuel Trading Company Limited and Heritage Petroleum Company Limited

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THE REPUBLIC OF TRINIDAD AND TOBAGO

COMMISSION OF ENQUIRY INTO ALL THE CIRCUMSTANCES WHICH LED TO THE TRAGIC INCIDENTS WHICH OCCURRED ON FRIDAY FEBRUARY 25, 2022 AT FACILITIES OWNED BY PARIA FUEL TRADING COMPANY LIMITED (PARIA), LOCATED AT NO. 36 SEALINE RISER ON BERTH NO. 6, WHICH LED TO THE DEATHS OF FOUR (4) EMPLOYEES OF LMCS LIMITED.

****

LIST OF AUTHORITIES

1. Lewison on the Interpretation of Contracts 4th Ed. Para. 9.12.
2. Wood v Capita Insurance Services Ltd. [2017] 4 All ER 615.

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THE INTERPRETATION OF CONTRACTS

By

SIR KIM LEWISON
One of Her Majesty's Justices of the High Court

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PREFACE

Many a man who was pretty well satisfied of the meaning of a text of scripture or clause in the code, at first reading, has, by consulting commentators, quite lost the sense of it, and by those elucidations given rise or increase to his doubts and drawn obscurities upon the place.

John Locke:
An Essay Concerning
Human Understanding
Book III Chapter IX

The modern fashion is to say that the interpretation of a contract is just the same as interpreting any other utterance. However, the modern approach has not diminished the flow of disputes about what the words of a contract mean. The interpretation of contracts is still part of the daily diet of the courts.

In the 10 years that have now elapsed since Lord Hoffmann's formulation of the five principles of interpretation in *Investors Compensation Scheme Ltd v West Bromwich Building Society*[1] the courts have continued to expound more detailed principles of interpretation and to assess the extent to which those principles have changed in the light of *Investors Compensation Scheme*. There is still a need to consult commentators. I hope that this commentary will make more rather than less sense of the way in which the courts go about their task.

This book does not claim or intend to be an exercise in the theory or philosophy of language: a subject in which legal scholars are far more interested than they were 20 years ago when I first began work on the first edition of this book.[2] It is intended as a companion to the practising lawyer who is faced with a concrete problem in contractual interpretation. For the most part, the judges speak in their own words. So the book is a source book, rather than a synthesis.

I have added topics since the last edition. These include sections on the objectivity of interpretation: matters of impression: explanatory notes: definition clauses; deeming clauses and express obligations to fulfil contingent conditions. I have also expanded the discussion of the admissibility

[1] [1998] 1 W.L.R. 896.
[2] Professor Gerard McMeel, *The Construction of Contracts* contains a fine introduction to the subject.

Marginal notes stand upon a different footing. Marginal notes are not generally an essential part of the contract upon which they are marginalia and in case of conflict between the marginal note and the body of the contract the latter will prevail.[141]

11. INCONSISTENCY BETWEEN WORDS AND FIGURES

9.11 **Where there is an inconsistency between written words and figures in a contract, prima facie the words prevail.**

In *Saunderson v Piper*,[142] a bill of exchange contained an inconsistency between the amounts in words and figures. It was held that the words prevailed. Tindal C.J. said:

> " we cannot shake the rule of commercial writers, that where a difference appears between the figures and the words of a bill, it is safer to attend to the words."

In relation to bills of exchange, the rule has statutory confirmation in s. 9(2) of the Bills of Exchange Act 1882. The principle was recognised but confined to commercial documents by Simonds J. in *Re Hammond*,[143] in which he said:

> "No doubt there is a prima facie rule that, where words and figures conflict, the words ought to prevail, but no case has been brought to my notice where the rule has been applied otherwise than in the case of commercial documents."

He therefore refused to apply the principle to the construction of a will, but instead applied the rule that in a will the later of two provisions prevails. Since the figure followed the words, the figure prevailed.

The rationale behind the rule is that it is easier to make a mistake in the copying or transcribing of figures than in the writing out of the words expressing those figures. This no doubt is true when what is being done is the simple expression of a number. However, there are cases where the draftsman of a contract is attempting to describe in words a rather more sophisticated mathematical concept. In such cases it has been suggested that the judicious use of algebra will elucidate the meaning better than words.[144]

Illustration

A lease required a notice to be served triggering a rent review. The notice was to specify a rent. The notice served required the rent to be increased to

[141] *Garrard v Lewis* (1882) 10 Q.B.D. 30.
[142] (1839) 5 Bing.N.C. 425.
[143] [1938] 3 All E.R. 308.
[144] *London Regional Transport v Wimpey Group Services Ltd* (1987) 53 P. & C.R. 356.

"£8,850 (Eight thousand seven hundred and fifty pounds)". It was held that the words prevailed over the figure.

Durham City Estates v Felicetti[145]

12. INCONSISTENCY BETWEEN WRITTEN TERMS AND INCORPORATED TERMS

Where a contract incorporates the terms of another document, and the terms of that other document conflict with the terms of the host contract, the terms of the host contract will prevail.[146] 9.12

In *Sabah Flour and Feedmills Sdn Bhd v Comfez Ltd*[147] Parker L.J. said:

> "Those passages lend support to the proposition that if an incorporated document contains provisions which conflict with the provisions of the written document, then the terms of the written document would, in the ordinary way, prevail. For my part I am prepared to accept that is one rule of construction which may be applied in circumstances such as these."

So also in *Modern Building (Wales) Ltd v Limmer & Trinidad Co Ltd*[148] Buckley L.J. said:

> "Where parties by an agreement import the terms of some other document as part of their agreement those terms must be imported in their entirety, in my judgment, but subject to this: that if any of the imported terms in any way conflicts with the expressly agreed terms, the latter must prevail over what would otherwise be imported."

13. APPROACH TO POTENTIAL INCONSISTENCY

The court is reluctant to hold that parts of a contract are inconsistent with each other, and will give effect to any reasonable construction which harmonises such clauses. 9.13

The general approach was explained by Lord Goff of Chieveley in *Yien Yieh Commercial Bank Ltd v Kwai Chung Cold Storage Co Ltd*[149]:

> "Their Lordships wish to stress that to reject one clause in a contract as inconsistent with another involves a rewriting of the contract which can

[145] [1990] 1 E.G.L.R. 143, CA.
[146] See also para.3.09 above.
[147] [1988] 2 Lloyd's Rep. 18, CA.
[148] [1975] 1 W.L.R. 1281, CA.
[149] [1989] 2 H.K.L.R. 639, PC. See *Taylor v Rive Droite Music Ltd* [2006] E.M.L.R. 4, where the principle was applied but the court disagreed on whether two clauses were inconsistent with each other or could be reconciled.

[2017] 4 All ER 615

Wood v Capita Insurance Services Ltd

[2017] UKSC 24

SUPREME COURT

LORD NEUBERGER P, LORD MANCE, LORD CLARKE, LORD SUMPTION AND LORD HODGE SCJJ

7 FEBRUARY, 29 MARCH 2017

Indemnity – Construction of indemnity clause – Agreement for sale and purchase of share capital of insurance broker – Agreement indemnifying purchaser against loss 'following and arising out of claims or complaints' to regulatory authorities pertaining to mis-selling – Company making reference to regulator and agreeing remediation scheme – Whether clause requiring indemnity where no claim or complaint made by customer.

By share purchase agreement dated 13 April 2010 ('the SPA') the appellant ('Capita') bought the entire issued share capital in a company which carried on business as a specialist insurance broker ('the company'). The sellers of the company were its then managing director ('the respondent') and two of its directors. By cl 7.11[a] of the SPA, the sellers undertook to indemnify Capita against 'all … losses … suffered … and all fines, compensation or remedial action or payments imposed … following and arising out of claims or complaints registered with the [Financial Services Authority ('FSA')] … pertaining to any mis-selling or suspected mis-selling …' Shortly after Capita's purchase of the company's share capital, employees of the company raised concerns about its sale processes. The company conducted a review which revealed that in many cases over the relevant period, the company's telephone operators had misled or pressurised customers. Capita and the company informed the FSA of their findings and subsequently agreed with the FSA to conduct a remediation scheme to pay compensation to customers identified as potentially affected by the company's mis-selling. The respondent brought proceedings against Capita arising out of the termination of his employment in 2010 and Capita brought a counterclaim against him under the indemnity provision in the SPA, alleging that it had suffered loss as a result of the mis-selling or suspected mis-selling of insurance products in the period before completion of the sale. A preliminary issue arose as to the interpretation of the indemnity clause. The respondent contended that the circumstances fell outside the scope of the indemnity clause; in particular, as the requirement to compensate was not the result of a claim or complaint by a customer. The judge determined, in effect, that the clause required the respondent to indemnify Capita even if there had been no claim or complaint by a customer (see [2014] All ER (D) 152 (Oct)). The Court of Appeal disagreed. It found that the respondent's liability under the indemnity clause could not arise unless the matter in respect of which indemnity was sought followed and arose out of

[a] Clause 7.11 is set out at [18], below.

either a claim or a complaint (see [2015] All ER (D) 328 (Jul)). Capita appealed submitting that the Court of Appeal had placed too much emphasis on the words of the SPA and given insufficient weight to the factual matrix.

Held – Upon construction of a contract, the court's task was to ascertain the objective meaning of the language which the parties had chosen to express their agreement. The court had to consider the contract as a whole and, depending on the nature, formality and quality of the drafting of the contract, give more or less weight to elements of the wider context in reaching its view as to that objective meaning. Interpretation was a unitary exercise; where there were rival meanings, the court could give weight to the implications of rival constructions by reaching a view as to which construction was more consistent with business common sense. That unitary exercise involved an iterative process by which each suggested interpretation was checked against the provisions of the contract and its commercial consequences were investigated. Once the court had read the language in dispute and the relevant parts of the contract that provided its context, it did not matter whether the more detailed analysis commenced with the factual background and the implications of rival constructions or a close examination of the relevant language in the contract, so long as the court balanced the indications given by each. Textualism and contextualism were not conflicting paradigms in a battle for exclusive occupation of the field of contractual interpretation. Rather, the lawyer and the judge, when interpreting any contract, could use them as tools to ascertain the objective meaning of the language which the parties had chosen to express their agreement. The extent to which each tool would assist the court in its task would vary according to the circumstances of the particular agreement. It was therefore necessary to place cl 7.11 in the context of the contract as a whole, to examine it in more detail and to consider whether the wider relevant factual matrix gave guidance as to its meaning in order to consider the implications of the rival interpretations. In the instant case, the circumstances which triggered the indemnity were to be found principally in a careful examination of the language which the parties had used. The Court of Appeal had come to the correct view as to the meaning of the indemnity clause; the respondent's liability under the indemnity clause could not arise unless the matter in respect of which indemnity was sought followed and arose out of either a claim or a complaint. Accordingly, the appeal would be dismissed (see [10]–[14], [24]–[26], [40]–[43], below); *Rainy Sky SA v Kookmin Bank* [2012] 1 All ER 1137 and *Arnold v Britton* [2016] 1 All ER 1 followed.

Decision of the Court of Appeal [2015] All ER (D) 328 (Jul) affirmed.

Notes

For the interpretation of express contractual terms generally, see 22 *Halsbury's Laws* (5th edn) (2012) para 357.

Cases referred to

Arnold v Britton [2015] UKSC 36, [2016] 1 All ER 1, [2015] AC 1619, [2015] 2 WLR 1593.

Chartbrook Ltd v Persimmon Homes Ltd [2009] UKHL 38, [2009] 4 All ER 677, [2009] AC 1101, (2009) 125 ConLR 1.

Gan Insurance Co Ltd v Tai Ping Insurance Co Ltd (No 2) [2001] EWCA Civ 1047, [2001] 2 All ER (Comm) 299, [2002] Lloyd's Rep IR 667.

Investors Compensation Scheme Ltd v West Bromwich Building Society [1998] 1 All ER 98, [1998] 1 WLR 896, [1998] 1 BCLC 493, HL.

Prenn v Simmonds [1971] 3 All ER 237, [1971] 1 WLR 1381, HL.

Rainy Sky SA v Kookmin Bank [2011] UKSC 50, [2012] 1 All ER 1137, [2011] 1 WLR 2900, (2011) 138 ConLR 1.

Reardon Smith Line Ltd v Yngvar Hansen-Tangen [1976] 3 All ER 570, [1976] 1 WLR 989, [1976] 2 Lloyd's Rep 621, HL.

Sigma Finance Corp, Re [2009] UKSC 2, [2010] 1 All ER 571, [2010] BCC 40.

Appeal

The appellant, Capita Insurance Services Ltd ('Capita'), appealed against the decision of the Court of Appeal (Patten, Gloster and Christopher Clarke LJJ) of 30 July 2015 (*Wood v Sureterm Direct Ltd* [2015] EWCA Civ 839, [2015] All ER (D) 328 (Jul)) allowing the appeal of the respondent, Andrew Wood, against the decision, by way of preliminary issue, of Popplewell J dated 14 October 2014 ([2014] EWHC 3240 (Comm), [2014] All ER (D) 152 (Oct)) on construction of an indemnity clause in an agreement dated 13 April 2010 for the sale and purchase of the entire issued share capital of Sureterm Direct Ltd. The facts are set out in the judgment of Lord Hodge.

Edward Cumming (instructed by *Enyo Law LLP*) for the appellant.

Andrew Twigger QC (instructed by *Birketts LLP*) for the respondent.

Judgment was reserved.

29 March 2017. The following judgment was delivered.

LORD HODGE

(with whom Lord Neuberger P, Lord Mance, Lord Clarke and Lord Sumption agree).

[1] This appeal raises a question of contractual interpretation. It concerns an indemnity clause in an agreement dated 13 April 2010 ('the SPA') for the sale and purchase of the entire issued share capital of a company, Sureterm Direct Ltd ('the Company'), which carries on business as a specialist insurance broker, primarily offering motor insurance for classic cars.

[2] The sellers of the Company were the respondent, Mr Andrew Wood ('Mr Wood'), who owned 94% of its share capital, and Mr Christopher Kightley and Mr Howard Collinge, who owned 1% and 5% of its share capital respectively. Each was a director of the Company and Mr Wood was its managing director. The purchaser was Capita Insurance Services Ltd ('Capita'). Mr Wood remained as managing director of the Company until the end of 2010. He brought proceedings against Capita arising out of the termination of his employment and Capita brought a counterclaim against him under the indemnity provision in the SPA, which is the subject matter of this appeal. Mr Kightley and Mr Collinge were, but are no longer, parties to the proceedings.

[3] It is not necessary to set out in any detail the circumstances in which Capita came to make its claim under the indemnity. It suffices to summarise Capita's claim as follows.

[4] In about August 2008 the Company began to sell motor insurance through online aggregator sites such as Confused.com. The sales were not completed online: potential customers obtained a quotation from the

Company on the aggregator site and the Company then contacted the potential customer directly with a view to confirming their risk details before selling them the appropriate insurance policy.

[5] Shortly after Capita's purchase of the Company's share capital, employees of the Company raised concerns about the Company's sales processes, which had resulted in some customers paying substantially more than they had been quoted online. The employees alleged that the Company had presented customers with higher quotations without informing them why the quotations had increased. The Company had thus increased its own arrangement fees when neither the underwriting premium nor the risk profile had changed significantly. The Company responded to the allegations by carrying out a review of its sales between January 2009 and January 2011. This review revealed that in many cases the Company's telephone operators had misled customers into believing that an underwriter had required a higher premium or that their risk profile was worse than it was or had pressurised the customer to make sure that a sale was made.

[6] Capita and the Company were obliged to inform the Financial Services Authority ('FSA') of the findings and did so on 16 December 2011. The FSA informed them that the customers had been treated unfairly and had suffered detriment and that there would have to be redress. After the FSA had conducted a risk assessment visit to the Company in November 2012, Capita and the Company agreed with the FSA to conduct a remediation scheme to pay compensation to customers who were identified as potentially affected by the Company's mis-selling. Capita alleges that it, the Company and Capita's other subsidiaries have suffered loss as a result of the mis-selling or suspected mis-selling of insurance products in the period before the completion of the sale under the SPA. Capita's claim is for £2,432,883.10, comprising an estimate of the compensation at £1.35m, interest of about £400,000 and the costs of the remediation scheme.

[7] It is appropriate to record that some of Capita's allegations are disputed, including the extent of the mis-selling and any detriment to customers. Other than, perhaps, the facts narrated in para [4] above (which do not appear to be disputed), they are not facts by reference to which the SPA is to be construed. But the circumstances in which Capita and the Company were required to set up the remediation scheme are of some importance because Mr Wood contends that they fall outside the scope of the indemnity clause which is the subject matter of this action. In particular, the requirement to compensate was not the result of a claim by one or more of the Company's customers or a complaint by those customers to the FSA or another public authority. It resulted, as I have said, from information about the internal review which Capita and the Company gave the FSA and the requirement by the FSA that compensation should be paid to the customers.

Contractual interpretation

[8] In his written case counsel for Capita argued that the Court of Appeal had fallen into error because it had been influenced by a submission by Mr Wood's counsel that the decision of this court in *Arnold v Britton* [2015] UKSC 36, [2016] 1 All ER 1, [2015] AC 1619 had 'rowed back' from the guidance on contractual interpretation which this court gave in *Rainy Sky SA v Kookmin Bank* [2011] UKSC 50, [2012] 1 All ER 1137, [2011] 1 WLR 2900. This, he submitted, had caused the Court of Appeal to place too much emphasis on the words of the SPA and to give insufficient weight to the factual matrix. He did not have the

[2017] 4 All ER 615 at 619

opportunity to develop this argument as the court stated that it did not accept the proposition that *Arnold* had altered the guidance given in *Rainy Sky*. The court invited him to present his case without having to refer to the well-known authorities on contractual interpretation, with which it was and is familiar.

[9] It is not appropriate in this case to reformulate the guidance given in *Rainy Sky* and *Arnold*; the legal profession has sufficient judicial statements of this nature. But it may assist if I explain briefly why I do not accept the proposition that *Arnold* involved a recalibration of the approach summarised in *Rainy Sky*.

[10] The court's task is to ascertain the objective meaning of the language which the parties have chosen to express their agreement. It has long been accepted that this is not a literalist exercise focused solely on a parsing of the wording of the particular clause but that the court must consider the contract as a whole and, depending on the nature, formality and quality of drafting of the contract, give more or less weight to elements of the wider context in reaching its view as to that objective meaning. In *Prenn v Simmonds* [1971] 3 All ER 237 at 239–241, [1971] 1 WLR 1381 at 1383–1385 and in *Reardon Smith Line Ltd v Yngvar Hansen-Tangen* [1976] 3 All ER 570 at 575, [1976] 1 WLR 989 at 997 Lord Wilberforce affirmed the potential relevance to the task of interpreting the parties' contract of the factual background known to the parties at or before the date of the contract, excluding evidence of the prior negotiations. When in his celebrated judgment in *Investors Compensation Scheme Ltd v West Bromwich Building Society* [1998] 1 All ER 98 at 114–115, [1998] 1 WLR 896 at 912–913 Lord Hoffmann reformulated the principles of contractual interpretation, some saw his second principle, which allowed consideration of the whole relevant factual background available to the parties at the time of the contract, as signalling a break with the past. But Lord Bingham in an extra-judicial writing, 'A new thing under the sun? The interpretation of contracts and the ICS decision' (2008) 12 Edin LR 374–390, persuasively demonstrated that the idea of the court putting itself in the shoes of the contracting parties had a long pedigree.

[11] Lord Clarke elegantly summarised the approach to construction in *Rainy Sky* [2012] 1 All ER 1137, [2011] 1 WLR 2900 (at [21]f). In *Arnold* [2016] 1 All ER 1, [2015] AC 1619 all of the judgments confirmed the approach in *Rainy Sky* (Lord

Neuberger paras [13]–[14]; Lord Hodge para [76]; and Lord Carnwath para [108]). Interpretation is, as Lord Clarke stated in *Rainy Sky* (para [21]), a unitary exercise; where there are rival meanings, the court can give weight to the implications of rival constructions by reaching a view as to which construction is more consistent with business common sense. But, in striking a balance between the indications given by the language and the implications of the competing constructions the court must consider the quality of drafting of the clause (*Rainy Sky* para [26], citing Mance LJ in *Gan Insurance Co Ltd v Tai Ping Insurance Co Ltd (No 2)* [2001] EWCA Civ 1047, [2001] 2 All ER (Comm) 299, [2002] Lloyd's Rep IR 667 (at [13], [16]); and it must also be alive to the possibility that one side may have agreed to something which with hindsight did not serve his interest: *Arnold* (paras [20], [77]). Similarly, the court must not lose sight of the possibility that a provision may be a negotiated compromise or that the negotiators were not able to agree more precise terms.

[12] This unitary exercise involves an iterative process by which each suggested interpretation is checked against the provisions of the contract and

[2017] 4 All ER 615 at 620

its commercial consequences are investigated: *Arnold* para [77] citing *Re Sigma Finance Corp* [2009] UKSC 2, [2010] 1 All ER 571, [2010] BCC 40 (at [12]) per Lord Mance. To my mind once one has read the language in dispute and the relevant parts of the contract that provide its context, it does not matter whether the more detailed analysis commences with the factual background and the implications of rival constructions or a close examination of the relevant language in the contract, so long as the court balances the indications given by each.

[13] Textualism and contextualism are not conflicting paradigms in a battle for exclusive occupation of the field of contractual interpretation. Rather, the lawyer and the judge, when interpreting any contract, can use them as tools to ascertain the objective meaning of the language which the parties have chosen to express their agreement. The extent to which each tool will assist the court in its task will vary according to the circumstances of the particular agreement or agreements. Some agreements may be successfully interpreted principally by textual analysis, for example because of their sophistication and complexity and because they have been negotiated and prepared with the assistance of skilled professionals. The correct interpretation of other contracts may be achieved by a greater emphasis on the factual matrix, for example because of their informality, brevity or the absence of skilled professional assistance. But negotiators of complex formal contracts may often not achieve a logical and coherent text because of, for example, the conflicting aims of the parties, failures of communication, differing drafting practices or deadlines which require the parties to compromise in order to reach agreement. There may often therefore be provisions in a detailed professionally drawn contract which lack clarity and the lawyer or judge in interpreting such provisions may be particularly helped by considering the factual matrix and the purpose of similar provisions in contracts of the same type. The iterative process, of which Lord Mance spoke in *Re Sigma Finance Corp* (above), assists the lawyer or judge to ascertain the objective meaning of disputed provisions.

[14] On the approach to contractual interpretation, *Rainy Sky* and *Arnold* were saying the same thing.

[15] The recent history of the common law of contractual interpretation is one of continuity rather than change. One of the attractions of English law as a legal system of choice in commercial matters is its stability and continuity, particularly in contractual interpretation.

The Sale and Purchase Agreement

[16] The SPA is a detailed and professionally drafted contract. It provided for the sale and purchase of the Company's share capital (cl 3) for the consideration of £7,681,661 payable on completion (cl 4) and it also provided for deferred consideration (Sch 8). Clause 1 contained the following definitions which are relevant to the construction of the disputed indemnity:

> '**Authority** means any local, national, multinational, governmental or non-governmental authority, statutory undertaking, agency or public or regulatory body (whether present or future) which has jurisdiction over the Business or any decision, consent or licence which is required to carry out the Business and Authorities shall be construed accordingly.

Company means Sureterm Direct Ltd …

Completion Date means the date of this Agreement.

Employees has the meaning given to it at paragraph 6 of Schedule 4 [which refers to a list of all of the employees employed by the Company].

FSA means the Financial Services Authority and any body which supersedes it.

Regulatory Authority means any body by which any part of the Business is or was regulated pursuant to any Applicable Financial Services Laws (including, but not limited to, the FSA, the Personal Investments Authority Ltd, the General Insurance Standards Council, the Insurance Brokers Registration Council and including the Financial Services Ombudsman and any voluntary regulatory body with whose rules the Company has agreed to comply).

Relevant Person means an Employee or a former employee of the Company and any dependant of an Employee or a former employee of the Company.

Shares means all of the issued shares in the capital of the Company.

Warranties means the Tax Warranties and the warranties set out in Schedule 4.'

[17] Clause 7 dealt with warranties and indemnities. Each of the sellers severally warranted to the buyer on a proportionate basis in terms of the Warranties (cl 7.1); the Warranties were qualified by matters which had been fairly disclosed in the disclosure letter (cl 7.2); and where a Warranty was qualified by an expression such as 'so far as the Sellers are aware' that referred to the actual knowledge of the sellers, who confirmed that they had made due and careful inquiry of the Company's compliance manager, IT director and HR director (cl 7.3).

[18] The indemnity clause whose interpretation is in dispute is cl 7.11. It provided:

'The Sellers undertake to pay to the Buyer an amount equal to the amount which would be required to indemnify the Buyer and each member of the Buyer's Group against all actions, proceedings, losses, claims, damages, costs, charges, expenses and liabilities suffered or incurred, and all fines, compensation or remedial action or payments imposed on or required to be made by the Company following and arising out of claims or complaints registered with the FSA, the Financial Services Ombudsman or any other Authority against the Company, the Sellers or any Relevant Person and which relate to the period prior to the Completion Date pertaining to any mis-selling or suspected mis-selling of any insurance or insurance related product or service.'

[19] This clause must be seen in its contractual context. Schedule 4 contained 30 pages of detailed warranties. In Pt 12 of that Schedule, which concerned litigation, disputes and investigations, the sellers warranted that they were not aware of circumstances which were likely to give rise to any investigation or inquiry by any Authority (para 12.4) and that no breach of contract, tort, statutory duty or law had been committed for which the Company was or might be liable (para 12.5). Part 14, which was concerned with compliance and regulatory matters, included the following paragraph:

'14.1

(a) The Company conducts, and has conducted the Business in accordance with the requirements of all Competition laws and Applicable

Financial Services Laws applicable to the business and has not been and is not being investigated for any alleged non-compliance or infringement of such Competition Laws and Applicable Financial Services Laws ...

(c) The Company has no reason to believe that any action will be taken against it in relation to any of its current or past activities based on any alleged non-compliance or infringement of any Competition Laws and Applicable Financial Services Laws.'

[20] Part 14 also contained detailed warranties that the Company had complied with its regulatory obligations and that correspondence between the Company and all Regulatory Authorities had been disclosed, that the Company, its officers and employees had not been subject to any regulatory sanction and that no such sanction was likely or pending; and that the Company had not been subject to a regulatory investigation and, so far as the Sellers were aware, there were no circumstances which could give rise to a visit by any Regulatory Authority.

[21] Clause 8 of the SPA provided for limitations on the sellers' liability in Sch 5, which in para 1 provided that the aggregate maximum liability of all claims under the SPA (with one exception) would not exceed the purchase price and that the liability of each seller would not exceed his proportionate liability (ie 94%, 5% and 1%). That limitation applied to claims under cl 7.11 as well as under the warranties. But para 3 of Sch 5 imposed time limits on the warranties by providing:

'3.1 Save in respect of a Warranty Claim or a claim under the Tax Covenant notified in writing to the Sellers prior to such a date, the Sellers will cease to be liable:

(a) for any claim under the tax warranties or under the Tax Covenant on the seventh anniversary of Completion; and

(b) for any other Warranty Claim on the second anniversary of Completion.'

Thus, in contrast to the indemnity under cl 7.11, the warranties relating to, among other things, regulatory compliance, had a lifespan of only two years.

[22] In a judgment dated 14 October 2014 ([2014] EWHC 3240 (Comm), [2014] All ER (D) 152 (Oct)) Popplewell J decided the preliminary issue of the interpretation of the indemnity clause and held, in effect, that it required Mr Wood to indemnify Capita even if there had been no claim or complaint by a customer. The Court of Appeal (Patten, Gloster and Christopher Clarke LJJ) in a judgment written by Christopher Clarke LJ ([2015] EWCA Civ 839, [2015] All ER (D) 328 (Jul)) disagreed. In its order dated 30 July 2015 the Court of Appeal declared that Mr Wood's liability under the indemnity in cl 7.11 of the SPA—

'cannot arise unless the matter in respect of which indemnity is sought follows and arises out of either (i) a claim made against the Company, a Seller or a Relevant Person or (ii) a complaint registered with the FSA, the Financial Services Ombudsman or any other Authority against the Company, a Seller or a Relevant Person and, in either case, the claim or complaint (a) relates to the period prior to the Completion Date and (b) pertains to any mis-selling or suspected mis-selling of any insurance or insurance related product.'

[23] Capita appeals against that order, arguing that the contractual indemnity is not confined to loss arising out of a claim or complaint.

[24] In this case both Popplewell J and the Court of Appeal have considered and weighed both the language of the disputed cl 7.11 and the commercial considerations. They have both started by examining the language but have reached opposing conclusions. This disagreement is not caused by any failure to apply the correct principles but is, in my view, the result of an opaque provision which, as counsel for each party acknowledged, could have been drafted more clearly.

[25] I have concluded that the Court of Appeal has come to the correct view as to the meaning of this difficult clause. I set out below my reasons, which are essentially the same as those which Christopher Clarke LJ presented.

Discussion

[26] Clause 7.11 has not been drafted with precision and its meaning is avoidably opaque. My preliminary view of the meaning of the clause on a first reading was consistent with the view which the Court of Appeal favoured, namely that the indemnity covered loss and damage which (a) followed and arose out of claims or complaints against the Company, the Sellers or any Relevant Person, (b) related to the period before completion and (c) pertained to the mis-selling or suspected mis-selling of insurance products or services. But it is necessary to place the clause in the context of the contract as a whole, to examine the clause in more detail and to consider whether the wider relevant factual matrix gives guidance as to its meaning in order to consider the implications of the rival interpretations.

[27] The contractual context is significant in this case. The indemnity in cl 7.11 is an addition to the detailed warranties in Sch 4. The mis-selling which cl 7.11 addresses is also covered by the warranty in para 14.1 of Sch 4 (para [18] and para [19] above). But liability for the Sch 4 warranties is time-limited by Sch 5. In particular para 3.1(b) of that Schedule (para [20] above) required the Company to claim within two years of the completion of the sale and purchase. The scope of the cl 7.11 indemnity, breach of which gives rise to a liability which is unlimited in time, falls to be assessed in the context of those time-limited warranties.

[28] All of the parties to the SPA were commercially sophisticated and had experience of the insurance broking industry. Capita was not involved in the management of the Company before the share purchase. The Sellers were the directors and the only shareholders of the Company. They were the people who knew or ought to have known how the Company had operated its business; Capita would in all probability not have that knowledge. The parties to the SPA would have known this. That lack of knowledge explains why Capita required the disclosures in the disclosure letter and the detailed warranties in Sch 4; but it does not assist the court to determine the scope of the indemnity clause. The court is not aware of the negotiations which led to the SPA; they are not relevant to the task of interpreting that agreement: *Chartbrook Ltd v Persimmon Homes Ltd* [2009] UKHL 38, [2009] 4 All ER 677, [2009] AC 1101. Business common sense suggests that Capita had an interest in obtaining as broad an indemnity against the adverse consequences of mis-selling as it could obtain. But the sellers had given warranties of compliance with regulatory requirements, which covered such mis-selling, subject to the agreed limits of quantum and time. The sellers were exposed to a potential liability under those warranties for the two years after the

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Completion Date, during which Capita could learn of the Company's sales practices. One may readily infer that they had an interest in minimising their further exposure to liability after that time had elapsed. Business common sense is useful to ascertain the purpose of a provision and how it might operate in practice. But in the tug o' war of commercial negotiation, business common sense can rarely assist the court in ascertaining on which side of the line the centre line marking on the tug o' war rope lay, when the negotiations ended. I therefore turn to examining the clause in more detail before returning to the commercial context.

[29] In order to illustrate the competing contentions of the parties Popplewell J helpfully divided cl 7.11 into its constituent parts. I set that presentation out below with the addition in (B) of the sub-headings (i) and (ii) to assist my exegesis.

[30] Clause 7.11 thus divided provides:

> 'The Sellers undertake to pay to the Buyer an amount equal to the amount which would be required to indemnify the Buyer and each member of the Buyer's Group against

(1) all actions, proceedings, losses, claims, damages, costs, charges, expenses and liabilities suffered or incurred, and

(2) all fines, compensation or remedial action or payments imposed on or required to be made by the Company

(A) following and arising out of claims or complaints registered with the FSA, the Financial Services Ombudsman or any other authority against the Company, the Sellers or any Relevant Person

(B) (i) and which relate to the period prior to the Completion Date (ii) pertaining to any mis-selling or suspected mis-selling of any insurance or insurance related product or service.'

[31] Counsel for Capita submitted that the clause should be read by treating (2) and (A) as a composite phrase so that the Sellers were bound to indemnify against both (1) and (2+A), each of which was subject to the two conditions in (B). This meant that it was only the fines etc in (2) which had to follow on or arise out of claims or complaints made to the FSA or other Authority against the Company etc as provided in (A). Thus, it was submitted, the indemnity covered all liabilities in (1) provided only that (i) they related to the period prior to the completion date and (ii) pertained to any mis-selling or suspected mis-selling of insurance products etc.

[32] Counsel for Mr Wood submitted that the clause was properly construed by treating both (1) and (2) as being subject to three conditions, namely (A), B(i) and (B)(ii). He submitted that (A) should be read as if there was a comma after 'claims', so that it provided as a condition for the triggering of the indemnity under (1) or (2) that there must be either claims by customers, or complaints made to the regulatory authorities, in each case against the Company, the Sellers or any Relevant Person. Thus, on his approach, either a claim by a customer against the Company, the Sellers or an employee or former employee of the Company, or a complaint to a regulatory authority against the Company, the Sellers or an employee or former employee of the Company would trigger the indemnity if the two conditions in (B) were met.

[33] Both counsel accepted that, because of the breadth of the terms used in (1), the types of loss and damage in (1) covered all of the types of loss and damage in (2). Thus it was suggested that (2) must have been included only for

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the avoidance of doubt. This means that on Mr Wood's approach (2) was otiose while on Capita's approach the composite (2+A) was otiose. I find the latter proposition remarkable and unlikely for two reasons.

[34] First, and to my mind most significantly, (A) would serve no purpose by restricting the source of loss and damage if (A) governed only (2) and therefore (1) was unrestricted. (A) would not restrict the scope of the indemnity in any way. On Mr Wood's construction the words in (A) have a purpose as they limit the scope of both (1) and the otiose (2).

[35] Secondly, if one airbrushes out (2+A) as otiose, the clause does not specify against whom the actions, proceedings and claims in (1) are directed. The clause would read:

> 'The Sellers undertake to pay to the Buyer an amount equal to the amount which would be required to indemnify the Buyer and each member of the Buyer's Group against
>
> all actions, proceedings, losses, claims, damages, costs, charges, expenses and liabilities suffered or incurred, and which relate to the period prior to the Completion Date pertaining to any mis-selling or suspected mis-selling of any insurance or insurance related product or service.'

The identity of the persons against whom the relevant claims etc could be made so as to trigger the sellers' indemnity would, on Capita's approach, be left to implication. There must be a limit on who such persons could be as it would be absurd for Capita to have a claim against the Sellers for indemnity resulting from any mis-selling on its part before the Completion Date. But, even assuming that the target was mis-selling by or on behalf of the Company, it is far from obvious that the delimited class of persons would be 'the Company, the Sellers or any Relevant Person'.

[36] Capita made three further points against Mr Wood's interpretation. First, there is an element of tautology as the 'claims' in (1) are said in (A) to follow and arise out of 'claims'. But as Christopher Clarke LJ observed, tautology in commercial contracts is not unknown and the verbal exuberance (or torrential drafting) of (1) makes tautology difficult to avoid.

[37] Secondly, Capita pointed out that there is a comma after 'incurred' at the end of (1) and no comma after 'Company' at the end of (2). This could support the separation of (1) from (2) and the conjunction of (2) and (A). Similarly, Mr Wood's interpretation would involve inserting in (A) a comma after 'claims' and also after 'any other Authority' so as to limit both the claims and the regulatory complaints to those against 'the Company, the Sellers or any Relevant Person'. Again in agreement with Christopher Clarke LJ I do not think that the use of commas in this clause is a strong pointer in favour of Capita's interpretation, both because there are no set rules for the use of commas and in any event the draftsman's use of commas in this clause is erratic.

[38] Thirdly, the draftsman used an adjectival participle at the start of (A) ('following and arising out of') and 'changed tone' by using a relative pronoun ('and which') at the start of (B). But the use of the adjectival participle does not tie (A) exclusively into (2) because in (B) the adjectival participle ('pertaining to') unquestionably applies to both (1) and (2). These detailed points of style and syntax are of little assistance in construing an admittedly opaque clause.

[39] I return to the commercial context and the practical consequences of the rival interpretations. On Mr Wood's interpretation it requires a customer or

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customers to make a claim, or complaint to the regulatory authorities, against the Company, the sellers or a Relevant Person in order to trigger the indemnity. Thus if a whistle-blower alerted the regulatory authorities of suspected or actual mis-selling, or if (as in fact occurred) management, complying with their regulatory obligations, reported such mis-selling to the FSA, which ordered the payment of compensation, the indemnity would not be triggered. Yet in each case, the mis-selling before the date of completion causes the Company loss.

[40] The general purpose of cl 7.11, to indemnify Capita and its group against losses occasioned by mis-selling is clear. Had cl 7.11 stood on its own, the requirement of a claim or complaint by a customer and the exclusion of loss caused by regulatory action which was otherwise prompted might have appeared anomalous. But cl 7.11 is in addition to the wide-ranging warranties in Pt 14 of Sch 4 (paras [18] and [19] above) which probably covered the circumstances which eventuated. Capita had two years after completing the purchase to examine the sales practices of the Company's employees and so uncover any regulatory breaches in order to make a claim under the Sch 4 indemnities. Prima facie that was not an unreasonable time scale. Indeed, Capita was able to send its findings to the FSA within 20 months of the Completion Date. It is not contrary to business common sense for the parties to agree wide-ranging warranties, which are subject to a time limit, and in addition to agree a further indemnity, which is not subject to any such limit but is triggered only in limited circumstances.

[41] From Capita's standpoint the SPA may have become a poor bargain, as it appears that it did not notify the sellers of a warranty claim within two years of Completion. But it is not the function of the court to improve their bargain.

[42] In this case, the circumstances which trigger that indemnity are to be found principally in a careful examination of the language which the parties have used.

Conclusion

[43] I would therefore dismiss the appeal.

Appeal dismissed.

Andrew Moroney Barrister.

CLOSING ADDRESS OF RAMESH L. MAHARAJ S.C. COUNSEL TO THE COMMISSION OF ENQUIRY ON 13TH JANUARY 2023

INTRODUCTION

1. Chairman Jerome Lynch KC and Commissioner Gregory Wilson, as Counsel to the Commission and on behalf of my Team, Mr. Ronnie Bissessar and Ms. Vijaya Maharaj, I wish to thank both of you for so expertly managing the Procedural and now this Evidentiary Hearing and for your helpful and instructive directions so that the public has complete access to all the evidence and documents which are before the Commission.

2. I would like to give special thanks to you Mr. Chairman for the leadership you have provided to this Commission in ensuring that the commitment you gave to the public that the Enquiry would be completed expeditiously, has been kept.

3. Members of the public therefore have been able to participate in the hearings before this Commission without actually being present at the hearing.

4. This Commission is historically significant because it is the first, as far as I am aware locally, that has uploaded all of the documents, correspondence, orders and directions online consistent with the Access To Justice Principle. Further, all of the proceedings have been broadcasted live on national TV, streamed and the public has, by their social media comments, followed the proceedings with great interest.

5. This is one of the most important public Commissions of Enquiry held in Trinidad and Tobago. The Cabinet of Trinidad and Tobago recognized that these facts demanded a public enquiry and wide sections of members of the public have participated in the hearings before the Commission and have followed the events at the Commission of Enquiry.

6. I am sure that the public is anxiously awaiting the Report of this Commission of Enquiry and that the Government would lay that Report in the Parliament of Trinidad and Tobago.

7. This Commission has advised that a Final Report is likely to be presented to the President by 30th April 2023. This suggests a 9-month gestation period from your appointment as Chairman which is, as far as I am aware, one of the quickest, if not the quickest turnaround in the history of the Commonwealth.

8. The Commission's work was greatly assisted by the Secretary Ms. Sarah Sinanan and the Commission's staff and on behalf of the Legal Team assisting the Commission, I wish to express our gratitude for her and her Team's support, diligence and enthusiasm.

9. The Commission's deliberations were also assisted by the various Counsel for parties given standing and others who attended on behalf of witnesses and the Legal Team is grateful for their respective contributions.

10. I also wish to thank the members of my legal team Mr. Ronnie Bissessar and Ms. Vijaya Maharaj for their complete devotion and assistance in performing my functions as Counsel to the Commission.

11. Finally, I also wish to thank the persons behind the scene who, through their individual initiative and diligence, have helped to prepare the venue and have taken us to this point where the Evidentiary Hearing is likely to be closed today.

Structure

12. Submissions have been made on how the contract and Permit to Work Procedure ought to be interpreted and whether the Permit to Work Procedure is part of the contractual obligations of the parties. I would first respond to those issues in order to show that the Permit to Work Procedure imposes contractual obligations on the parties.

13. I will then deal with the non-delegable common law duty of care owed by Paria to ensure that measures were put in place for the works to have been done safely having regard to the inherently dangerous nature of the works. These principles of law were recently applied by the High Court of Trinidad and Tobago in a reported judgment.

14. I will refer to the Works on 25th February 2022 to show that there were serious breaches of the Contract and the Permit to Work Procedure by LMCS and Paria.

15. Then I would deal with the LMCS' documents which include the Method Statements, Risk Assessments, Job Safety Analysis and Emergency Response Plan which were submitted to Paria and which Paria reviewed and accepted. Both Paria and LMCS did not identify that a Delta P Hazard could have occurred in the method of the execution of the works. Those documents were reviewed and accepted by Paria but Paria in its evidence before this Commission admitted that it did not have the competence and expertise to do so. It, however, did not appoint an Expert Client Representative to assist it in that review. It is clear that the failure of both Paria and LMCS to identify the risk of a Delta P event in the execution of the works was the root cause of the accident.

16. I will then deal with Line clearing - the underlying factor which led to this accident was the removal of the line contents of Sealine 36 both in terms of the quantity and the method used. This caused the gaseous void in the pipeline which created a latent Delta P hazard when the habitat was installed. The latent Delta P hazard was activated when the inflatable plug was removed which caused the sea water to flood the habitat, the vortex was created and the five divers were sucked into the pipeline.

17. I will then deal with the post accident response by Paria and LMCS. There was no emergency response plan in place because the emergency response plan which was submitted by LMCS to Paria and accepted by Paria as a suitable emergency response plan did not identify a Delta P hazard. Consequently, there was no emergency plan in place on 25th February 2022 when the latent Delta P hazard was activated and caused the accident. In the circumstances I will summarize the evidence of the efforts made by both LMCS and Paria to show what efforts were made by both of them to rescue the divers from the pipeline taking into account the timeline which they had in order to rescue the divers alive from the pipeline.

18. I will then address the evidence of the treatment of the relatives following this tragic accident.

19. I will then address the Commission on proposed recommendations.

PRINCIPLES OF LAW WHICH GOVERN THE ASSESSMENT OF THE EVIDENCE

20. Where a Tribunal has to determine questions of fact, when there are disputed facts, the Courts have held that in determining the credibility of witnesses, it is essential that the Court weigh their credibility against the important contemporaneous documents. In other words, the credibility of a witness must be put correctly into the scales with the important contemporaneous documents. See PC Appeal No. 36 of 1987 between **Horace Reid v Dowling Charles and Percival Bain** and PC No. 59 of 1985 between **Attorney General of Trinidad and Tobago and others v Samlal** at paragraph 6.

21. It is a well-established principle of law that where a party, without reason, fails to call a witness whom it might be expected that the party call, if that person's evidence would be favourable to him, it would be open to the Court to infer that that person's evidence if called would not have helped that party's case. The same principle applies to the failure of a party to produce documents which it might reasonably be expected for the party to produce (See HCA No. 434 of 2001 between **Shairoon Abdool v BNL Insurance Co. Ltd** and **St. Louis v Canada** (Supreme Court of Canada) (1896) 25 SCR 649.

22. Any inconsistency between a witnesses' evidence and an earlier statement given by the witness goes to the credibility of the witness; a Tribunal can regard the evidence of that witness as unreliable unless the witness gives a reasonable explanation for the inconsistency. (see **Phipson on Evidence**, 19th Edition at page 381, para12-40)

THE CONTRACT BETWEEN PARIA AND LMCS

23. In the light of the submissions made before this Commission it is important to examine the main terms of the contract entered into between Paria and LMCS for the contracted works which are the subject of this Enquiry.

Scope of Works

24. The Scope of Works developed by Paria for the contract works is at **CB 2, page 564.** It was prepared based on the Scope of Works which had been done for a 2020 project completed by LMCS at Berth 5. **(*Terrance Rampersadsingh, Transcript, 1st December 2022 at pages 7 and 8)*.**

25. Both the 2020 and the 2021 projects involved the change out of subsea piping. The main difference between the 2020 and 2021 projects was that the 2021 project involved additional works above the sea and, further, the leak in the subsea pipeline was about 5 or 10 feet deeper. **(*Terrance Rampersadsingh, Transcript, 1st December 2022 at page 9).***

26. In dealing with the Scope of Works for the 2020 project which is contended to be similar to these works, Paria employed a Project Engineer who developed the scope of works and oversaw the execution of the whole project **(Transcript, 1st December 2022 at page 9 lines 21-23and page 30, lines 2-4).**

27. The Scope of Works for this project at **CB 2 page 564** refers to an estimated volume of product between isolation points being 2,000 barrels. Paria's evidence is that this represented an estimate of the volume of the product in the sub -sea line between Berths 5 and 6 ***(See Hassan Mohammed, Transcript 24th November 2022 at page 11, line 13 and Terrance Rampersadsingh, Transcript 1st December 2022,at page 12, lines 15-17.)***

28. The evidence of Paria was that neither the Scope of Works nor the Method Statements required the underwater pipeline between Berths 5 and 6 to be completely drained:

References:

(a) **Hassan Mohammed- his evidence was that whatever level the repair is to be carried out, there would be removal to below at least that level *(Transcript 24th November 2022 at page 12 , lines 17 to 19.)***

(b) **Terrance Rampersadsingh- His understanding of the scope of works was that it required only enough line content to be removed from Berth 6 to install the line plugs just below the area to be repaired. (*Transcript, 1st December 2022 at pages 13, lines 18 – 19).***

(c) **Johnathan Ramdhan-his evidence was that once the elbows were removed then they would drain partially to the point under where they had to perform their maintenance works *(Transcript 6th December 2022 at page 135 lines 13 to 15).***

29. (a) Paria's Addendum 1 to the Scope of Works at **Core Bundle 598**, Query 1 states, "*Who is responsible for pumping back from the berth to clear the lines with water*" and the response is "*the Contractor is responsible for the safe removal of hydrocarbon contents from the line and to ensure that the line is clear and dry*".

(b) Paria's evidence however was that this meant that only that part of the line where the works were to be carried out would be clear and dry.

References:

(a) Mr. Rampersadsingh stated that this was the jargon used as everyone is familiar with the steps. He stated that he understood this to mean that only the section of the pipeline where the works were going to be carried out must be clear and dry. (***Transcript, 1st December 2022 at page 15, lines 21- 25***);

(b) Mr. Hassan Mohammed stated that he understood that Paria was asking for the line to be clear and dry. He doesn't know if they meant up to a point where the repair is to be carried out safely. He stated it depends on the methodology to be used to repair the line. (***Transcript 24th November 2022 at page 1, lines 18 to 22*;** and

(c) Collin Piper- Mr. Collin Piper at Transcript ***14th December 2022at page 250 lines 1 to 6*** where he stated that it was his understanding that the pipeline would be clear and dry up to the point at which the contractor needs to insert the plug.

30. We shall demonstrate however when addressing the issue of line clearing later in our submissions, that the evidence of Paria's witnesses that the pipeline was not meant to be completely drained is inconsistent with the contemporaneous documentary evidence in respect of the line draining.

31. The Scope of Works also sets out the contractual responsibilities of the parties. The Contractor (LMCS) is required to provide competent supervision at all times during the execution of the job (***para 9.0 CB 2 at page 593).*** They are also required by Section 5.4 (***page 571***) to provide live video feed during the subsea works. At Sections 3.1.11 and 3.1.12 (***page 565),*** reference is also made to the provision of a video stream being provided top side during work activity for the Paria representative.

32. Paria's responsibilities are stated at Section 4, ***page 570 (CB 2)*** and include among other things:

(a) supplying all work permits/certificates (thereby recognising that Permits to Work are to be issued before works);

(b) monitoring contractor's performance and work standards, approving work to be done by the Contractor and carrying out quality assurance audits;

(c) providing slop barges to assist in the removal of line content; and

(d) providing personnel to oversee isolation/deisolation, depressurisation/pressurisation and <u>draining/filling product from lines at Berths 5 and 6.</u>

<u>RESPONSE TO THE SUBMISSIONS OF PARIA AND KENSON</u>

33. In response to their submission that there was no evidence that the Permit to Work Procedure was a contractual obligation under the contract, we submit as follows:

(a) **<u>Firstly</u>**, Section 2 of the Permit to Work Procedure ***(CB 1 page 26)***, under heading "Scope" states "this permit to work procedure applies to <u>contractor</u>, <u>maintenance</u>, civil, inspection and <u>Turnaround related activities</u>."

(b) **<u>Secondly,</u>** it is clear from Section 8 of the Scope of Works on ***page 593 (CB 2)*** that contractors and contracted personnel are required to follow the Permit to Work procedure and Standard Work Instructions at all times. There was therefore a contractual obligation that the Permit to Work procedure would apply to the contract.

(c) **<u>Thirdly</u>**, according to the evidence of Mr. Randy Archbald it is clear that the Permit to Work procedure did apply to this contract. At paragraph 11 of his witness statement [**WB 1316**], he stated that the Permit to Work procedure applies to contractor maintenance, civil inspection and Turnaround related activities and at paragraph 12 he stated that during the execution of the contract several Permits to Works were issued to LMCS by Paria.

(d) **<u>Fourthly</u>**, it is clear that the Permit to Work procedure sets out the roles and responsibilities of a Contractor Official at Section 5.6 on ***page 31 CB 1***. We address this next when dealing with the Permit to Work procedure in more detail.

(e) **<u>Fiftly</u>**, Paria had a common law non delegable duty of care and the Permit to Work system was therefore designed to ensure that that duty was carried out regardless of whether or not an independent contractor was retained. In these circumstances, both Paria and LMCS had a joint and concurrent duty of care to ensure that the works which were inherently dangerous were carried out safely. We will also address this later in these submissions.

(f) **Sixthly**, this is not a civil case in which there are pleadings. It is an Enquiry governed by the Terms of Reference. If Kenson's position is that evidence ought to have been led to show that the Permit to Work Procedure is not incorporated as part of the contractual terms, it had a duty to lead that evidence or cause it to be led in relation to that issue.

PERMIT TO WORK PROCEDURE

34. Paria's has a Control of Work system which controls the works to be done and how they are to be done (this system includes the Permit to Work procedure) (***CB 1, page 24***).

35. According to Terrance Rampersadsingh the Control of Works system not only includes the Permit to Work procedure but everything from the Operations Department notifying the Maintenance Department of the need for the job to the signing of the contract. He stated that all of this is part of the Control of Work system meaning that if work is not supposed to be done, it isn't done (***Transcript, 1 December 2022 at pages 32 and 32***).

36. Mr. Randy Archbald in his witness statement at paragraphs 10 – 11 (**WSB 4, pages 1315-1316)** states:

(a) The Permit to Work procedure was developed to provide a formal documented process for controlling risks associated with certain work activities such as contractors and maintenance works;

(b) Without a Permit to Work being generated no work can be undertaken by a contractor; and

(c) The procedure intended to among other things:

i. Establish the requirements for identifying critical information on jobs such as the nature and extent of the work to be done, the exact location of the job, the equipment to be used, the hazards involved and the precautions to be taken;

ii. Prevent incompatible work from taking place simultaneously;

iii. Clearly identifies who makes the application to do the job, who authorizes the job, who develops the necessary precautions and who gives approval for the work to commence;

iv. Ensure that work is not carried out unless there is proper authorization;

v. Clearly identifies high hazard work and the requirements/precautions to be followed; and

vi. Establish monitoring and auditing requirements for Permit jobs

37. The following is established in the Permit to Work procedure (***CB 1 page 28.paragraph 5.0)***:

(a) Wherever work is to the done within Paria, the Operations Department makes a request to the Technical and Maintenance Department for the specific work to be executed ;

(b) The Technical and Maintenance Department then plans the works in conjunction with the Operations Department ;

(c) Before the work can be started, all of the requirements of the Permit to Work procedure must be followed. This includes that work does not start until the Work Permit is properly issued and authorised, all persons on the job must receive a briefing from the appropriate supervision on the works to be done and all persons on the job must understand the precautions to be taken before they start work.

38. <u>Section 5 (including 5.1 to 5.6) deal with the roles and responsibilities of key personnel under Paria's Permit to Work procedure and they include the following</u>:

(a) The **<u>Applicant</u>** is described in Section 5. 1 as the person who initiates the job by completing Section A of the Permit to Work. The Applicant must have the necessary competence to execute the job, or to supervise the execution of the job and the Applicant shall be knowledgeable of the hazards associated with the job and for the safety of the people who work on the job. The functions of the Applicant include among other things:

(i) to continually monitor the job to ensure that it is performed in a safe manner and within the conditions prescribed in the Work Permit, Certificates and JHA/Risk Assessment; and

(ii) to stop the work if there are changes in site conditions that increase the risk or if new hazards are identified and promptly notify the Site Authority of these changes.

(b) It has been submitted on behalf of Paria that since the Applicant was a Kenson employee, that Paria was not the Applicant to the Permit to Work. This submission is wrong for the following reasons:-

(i) The evidence shows that although the Kenson persons were employed with Kenson they worked at Paria, they had their offices at Paria, they took instructions and directions from Paria personnel and were subordinates of Paria's officials.

(ii) Marjadsingh admitted in cross-examination that he was representing Paria to ensure that there was compliance with the works being done by LMCS and had a duty to stop the works if the works were not being done in accordance with the work permit [Transcript 6th December 2022, **HM/p. 130/lines 12-17**];

(iii) Marjadsingh also admitted that he took instructions from Paria, he works at Paria and Paria tells him what to do and how to do it [Transcript 6th December 2022, **HM/p. 133/lines 12-19**];

(iv) Terrence Rampersadsingh, Paria's then Maintenance Planner stated that Mr. Marjadsingh was his subordinate, that he took instructions and directions from him and that even though he was employed by Kenson he worked at the Maintenance Department of Paria [**Transcript 1st December 2022, page. 28/lines 14-26];**

(v) Also, the submissions made on behalf of Kenson to the Commission in this Enquiry agreed with this position; and

(vi) In any event, any issue concerning the relationship between Kenson and Paria is an issue between them and not a matter for this Commission of Enquiry.

(c) A **Competent Person** is described in Section 5.2.

(d) The **Site Authority** is described in Section 5.3. The roles and responsibilities of the Site Authority include the following:

(i) Ensures that a suitable and sufficient JHA has been prepared for the job;

(ii) Specifies on the permit any precautions to be taken during the work;

(iii) Periodically monitors ongoing work, either in person or through his team, to determine whether site conditions and precautions have been maintained; and

(iv) Suspends the job if unsafe conditions have developed or are likely to develop.

(e) The **Area Authority** is described in Section 5.4 of the Permit to Work procedure and its duties are stated therein.

(f) The **Senior Authority** is described in Section 5.5 of the Permit to Work procedure; and

(g) The **Contractor Official** is described in Section 5.6 of the Permit to Work procedure.

39. It is clear that the Permit to Work procedure is part of the contractual terms and obligations of the parties and binding on them.

40. The Permit to Work procedure is also consistent with Paria's obligations in the common law, having regard to the inherently dangerous nature of certain types of works undertaken at Paria's site.

Non -delegable duty in common law.

41. The general principle is that an employer (being Paria in this instance) is not generally liable for torts committed by his independent contractor (being LMCS in this instance). However that ordinary principle is displaced where the law imposes on the employer (Paria) a **non-delegable duty not merely to take care but to ensure that care is taken**. Lord Reed in **Armes v Nottinghamshire County Council** (2017) UKSC 60 defined non-delegable duties as follows:

> "**Non-delegable duties of care**
>
> [31] The expression 'non-delegable duties of care' is commonly used to refer to duties not merely to take personal care in performing a given function but to ensure that care is taken. The expression thus refers to a higher standard of care than the ordinary duty of care. Duties involving this higher standard of care are described as non-delegable because they cannot be discharged merely by the exercise of reasonable care in the selection of a third party to whom the function in question is delegated." (our emphasis)

42. Such a non-delegable duty arises where the employer (Paria) employs an independent contractor (LMCS) to execute inherently dangerous work from which, in the natural course of things, injurious consequences to others must be expected to arise unless measures are adopted to prevent such consequences.

43. In such circumstances, the employer (Paria) cannot relieve itself of its responsibility by proving that it had delegated the performance of this duty to the contractor (LMCS)

employed to do the work, however competent the contractor may be or even if the employer regards the Contractor as a Specialist Contractor. Where the work which the independent contractor is employed to do is of a character that is inherently dangerous unless done with proper precautions, the employer is responsible to anyone who sustains injury in consequence of the manner in which the work is done. (It is to be noted that under Section 5.1 of the Permit to Work Procedure, it is stated that the Applicant shall be responsible for the job and the safety of the person who work on the job –It is to be noted that -not only persons who are employed with Paria). See **Halsbury's Laws of England > Tort (Volume 97A (2021)) > 10. Tort and Employment > (2) Employer's Vicarious Liability > (vii) Non-delegable Duties > 381. Non-delegable duties in relation to hazardous activities** which states:

> "The first category of cases in which there are non-delegable duties is where the defendant employs an independent contractor to perform some function which is either inherently hazardous or liable to become so in the course of his work. These cases have often been concerned with the creation of hazards in a public place, generally in circumstances which apart from statutory authority would constitute a public nuisance. **An employer who employs an independent contractor to execute inherently dangerous work from which, in the natural course of things, injurious consequences to others must be expected to arise unless measures are adopted by which such consequences may be prevented, is bound to see that everything is done which is reasonably necessary to avoid those consequences.** He cannot, therefore, relieve himself of his responsibility in such a case by proving that he had delegated the performance of this duty to the contractor employed to do the work, or to some independent person, however competent the contractor or delegate may be. **In accordance with the same principle, where the work which the independent contractor is employed to do is of a character that is inherently dangerous to the public unless done with proper precautions, the employer is responsible to any member of the public who sustains injury in consequence of the manner in which the work is done.**

Performing operations on or near a highway by its very nature carries a risk of serious harm to highway-users, and there have been numerous cases where non-delegable duties of care have been identified in such situations. With regard to highways, a distinction must be drawn between the exercise of the public right to pass and repass, on the one hand, and the execution of work upon the highway, on the other. It has been said that the non-delegable duty in respect of inherently dangerous work arises only in respect of activities that are exceptionally dangerous whatever precautions are taken. The inquiry is into the intrinsic quality of the operation in question, disregarding circumstances that may have increased the danger on the facts of the individual case. In such cases it is a duty not merely to take care but to provide that care is taken so that if there is negligence on the part of the contractor, the duty on the employer is broken. However, this requirement for exceptional danger has been criticised in the Supreme Court."

44. Lord Sumption SCJ in **<u>Woodland v Essex County Council</u>** (2013) UKSC 66 gave a comprehensive analysis of non-delegable duties. He stated:

> "[5] The law of negligence is generally fault-based. Generally speaking, a defendant is personally liable only for doing negligently that which he does at all, or for omissions which are in reality a negligent way of doing that which he does at all. The law does not in the ordinary course impose personal (as opposed to vicarious) liability for what others do or fail to do. This is because, as Cory J observed, delivering the judgment of the majority in the Supreme Court of Canada in Lewis v British Columbia [1997] 3 SCR 1145 at para 17, a common law duty of care "does not usually demand compliance with a specific obligation. It is only when an act is undertaken by a party that a general duty arises to perform the act with reasonable care". **<u>The expression "non-delegable duty" has become the conventional way of describing those cases in which the ordinary principle is displaced and the duty extends beyond being careful, to procuring the careful performance of work delegated to others</u>**."

45. <u>It was however open to Paria to seek an indemnity from LMCS. In **Dalton v Henry Angus & Co** (1881) 6 All Cas 740, Lord Blackburn, who delivered the principal speech,</u>

regarded the interposition of an independent contractor as irrelevant, because of the nature of the duty. He put the point in this way:

> "Ever since [Quarman v Burnett (1840) 6 M & W 499, (1840) 151 ER 509] it has been considered settled law that one employing another is not liable for his collateral negligence unless the relation of master and servant existed between them. So that a person employing a contractor to do work is not liable for the negligence of that contractor or his servants. On the other hand, a person causing something to be done, the doing of which casts on him a duty, cannot escape from the responsibility attaching on him of seeing that duty performed by delegating it to a contractor. **He may bargain with the contractor that he shall perform the duty and stipulate for an indemnity from him if it is not performed, but he cannot thereby relieve himself from liability to those injured by the failure to perform it**: [Hole v Sittingbourne & Sheerness Rly Co (1861) 6 H & N 488, (1861) 158 ER 201; Pickard v Smith (1861) 10 CBNS 470, (1861) 142 ER 535; Tarry v Ashton (1876) 1 QBD 314, [1874–80] All ER Rep 738]."

These cases were all referred to in the local High Court Case CV2015-03381 between Ray Cheddie and Anor v National Infrastructure Development Company Ltd at paragraphs 100-107.

46. It is submitted that on the evidence, it is clear that the scope of works which Paria contracted LMCS to do was inherently dangerous and would have resulted in injurious consequences unless appropriate measures were taken to avoid a differential pressure hazard. Based on the above mentioned governing principles of law, it is clear that Paria in the circumstances had a common law duty of care to ensure that those precautions were taken. Having regard to the extent of the duty of care imposed on an employer (Paria) who employs an independent contractor (LMCS) to do inherently dangerous works, the employer (Paria) has a duty to employ competent experts to ensure it discharges that duty.

<u>WORKS ON 25th FEBRUARY 2022.</u>

47. LMCS contends that the removal of the plugs formed part of the work plan for 25th February 2022 and relied on the Method Statement attached to the Permit to Work whilst Paria contends that it was not part of the work plan on that day and relies on the fact that the Permit to Work (**page 1074 CB 3)** does not list the removal of the plugs as a task to be done and stipulates that the migration barrier was to be used.

<u>Johnathan Ramdhan</u>

48. Johnathan Ramdhan was the Site Authority pursuant to the Permit to Work procedure and the person who issued the Permit to Work.

49. Mr. Ramdhan in his witness statement stated that <u>he was not trained</u> nor did he possess the expertise to assess the suitability or <u>sufficiency of the JHA/JSA</u> even though this is <u>one of the duties of the Site Authority</u>. ***(para 36 (1) (a) on page 1475 Vol 4 WSB).***

50. Mr. Ramdhan had a duty as Site Authority to "**periodically monitor ongoing work, either in person or through his team to determine whether site conditions and <u>precautions were being maintained</u>**." He also had the duty to suspend the job if conditions were unsafe. Ramdhan in cross examination confirmed that he has no qualifications or experience in subsea work [**Transcript Day 5/p. 125/lines 24-27**]

51. He fulfilled this responsibility by posting Mr. Kirt Scott at Berth 6 on February 25 2022. In cross examination by the Commission Counsel, Mr. Ramdhan stated that Mr. Kirt Scott was posted at the site to periodically monitor to determine whether the site conditions and precautions to ensure operational safety were being maintained. He stated that the migration barrier was a precaution but there was no way to monitor the barrier because in order to monitor it you would have to dive and go into the chamber. (***pages 156 to 159 of Transcript 6th December 2022 (pages 961- 964 of Bundle of Transcripts***).

52. It is clear however from the evidence of Kirt Scott that he saw topside live footage of when the mechanical plug was being removed, but did not have the knowledge or

experience to identify that this was part of the migration barrier which was stated by Mr. Ramdhan on the Permit to Work as a precaution which was to be used.

53. At **Day 5/page 228/lines 19-25** (6 December 2022) Mr. Ramdhan's evidence was as follows:

> Q: Did you see them, um on screen, well you saw the pipe they were working on?
>
> A: Yes
>
> Q: Taking out something from the pipe?
>
> A: Yes.
>
> Q: What you saw they were taking out?
>
> A: First I saw, they were working, moving some bolts from on the blank. Right, and um during another time, um, another period because every time I pass I would take a look. I saw personnel operating a chain block and turning something.
>
> Q: And turning something. I See. I wonder if the witness can see the mechanical plug on the screen? I want to show you on the screen something and you will tell me if you recognize it, okay
>
> A: Yes
>
> Q: Was it something like that you saw them working on?
>
> A: Something like that I saw take out of the pipe.

54. The mechanical plug was removed before lunch on the 25th February 2022 (Christopher Boodram at paragraph 28, page 1572 of WSB 4) and according to Christopher Boodram it involved the use of a spanner to remove 22 bolts and took over 30 minutes to remove (***22nd November 2022, page 10 at lines 3 to 17, page 62 (lines- 26-27) and page 64 line 11)***

55. <u>It is clear therefore if Mr. Kirt Scott had the necessary competence and experience to monitor the works on behalf of Mr. Ramdhan as Site Authority, he would have been able to stop the works when the mechanical plug was being removed</u>.

<u>Houston Marjadsingh</u>

56. Houston Marjadsingh was the Applicant on the Permit to Work. He was a Kenson employee working for Paria at Paria and he admitted in cross-examination that he was representing Paria.

57. Mr. Marjadsingh's evidence was that he did not have any specialist knowledge about the job LMCS was doing. He filled out Section A of the Permit to Work based on information which he was given by Mr. Rampersadsingh. He stated that his function was to ensure that the form was completed and any documents to be attached were attached. (***See his witness statement pages 3049 to 3054 Supplemental Core Bundle)***

58. In cross examination (Transcript 7th December 2022), Mr. Marjadsingh's evidence included that:

    (a) He had no experience in subsea maintenance works (page 126, lines 26-27);

    (b) He first arrived at Berth 6 at about 2.00 p.m. on. 25 February 2022 (page 128, lines 24);

    (c) He did not monitor in the morning period as the first time he arrived was at 2.00 p.m. (page 135, lines 12-13); and

    (d) He was not present at the toolbox meeting at Berth 6 and signed the toolbox form when he arrived at Berth 6 (page 141, lines 10-26).

59. <u>It is clear therefore that Mr. Marjadsingh did not have necessary experience or competence to supervise the execution of the job by LMCS as required by Paria's Permit to Work Procedure at para 5.1. (*page 28 CB1*).</u>

60. He also failed in his duty as stated in the Permit to Work procedure at pages 28 and 29 to ensure that pre-start meeting was conducted with the crew to discuss the job and to ensure that all personnel read and understood the JHA and Assessment. Mr. Boodram's evidence was that the work plan was discussed at the toolbox meeting and that it included the removal of the plugs. If this is correct, had Mr. Marjadsingh been present at the toolbox meeting, he would have been able to assert Paria's position which is that the removal of the plugs was not part of the workplan and that the plugs were required to be in place during the execution of the works.

61. Further, he also failed in his duty to continually or periodically monitor the works. In fact, he did not monitor the works at all. He only arrived on the site at 2.00 p.m. The mechanical plug had been removed prior to lunchtime. [**Day 6/p. 132/lines 3-13**]. 5.1 of the Permit to Work procedure states that the Applicant which, in this case, was Paria, must have the necessary competence to execute the job or to supervise the execution of the job. It shall be knowledgeable of the hazards associated with the job and the necessary control for these hazards. It shall be responsible for the job and the safety of people who work on the job. It also required Paria to continually monitor the job to ensure that it is performed in a safe manner as prescribed in the Permit to Work, JHA risk assessments and to stop the work if there are changes in site conditions that increase the risk and if new hazards are identified.

LMCS' DOCUMENTS

62. It is undisputed that the Method Statements, Risk Assessments, Job Hazard Analysis and Emergency Response Plan for these works which were submitted to Paria, were reviewed and accepted by Paria and Paria acted upon these documents.

References:

(a) Method Statement dated 6th May 2021 at CB 2, page 654.

(b) Risk Assessments, at CB 2, pages 841- 848.

(c) Emergency Response Plan at CB 2, page 877.

(d) Method Statement 108 – Phase I line clearing (CB 3, page 1028)

(e) JHA for Phase I air blowing (CB 3, page 1030).

(f) Method Statement 115- Phase II line clearing (CB 3, page 1041).

(g) JHA for Phase II line clearing (CB 3, page 1044).

(h) Method Statement 116- to install subsea flange on Flange at 30-inch pipeline, Sealine 36, at Berth No. 6 (CB 3, page 1048); and

(i) JHA – to install subsea slip on Flange (CB 3, page 1062).

63. It is not disputed that a potential Delta P hazard was not identified in any of the documents submitted by LMCS to Paria and which were accepted by Paria.

64. (a) The LMCS' documents were reviewed and accepted by Paria's Multi- Departmental team comprising personnel from HSE, Maintenance and Operations Departments. Paria's evidence is that the purpose of the review was to ensure that LMCS understood what it was contracted to do, that it had identified the safety risks associated with the job and that it had developed a plan to manage those risks

(b) Further Paria's evidence is that because the works which were to be executed by LMCS were highly specialised in nature and were not of a kind which Paria had the competence or experience to execute, Paria necessarily relied on the specialist expertise of contractors such as LMCS to identify the relevant safety risks (***Witness Statement of Paul Yearwood, WSB Vol 4, page 1301 paragraphs 6-8***).

(c) Notwithstanding that Paria admitted that it did not have the competence or experience to execute the works, it held itself out as competent to review and accept the LMCS documents. Paria therefore did not conduct a genuine review of the LMCS documents and Paria on its own admission, relied exclusively on the specialist expertise of LMCS to identify the safety risks; and

(d) Paria did not take the steps to have a client representative/engineer expert to advise it in reviewing the LMCS documents before acceptance. Paria was in breach of the Permit to Work Rules and also in breach of the principles of the common law referred to above.

65. The above evidence must be considered in the context of the evidence of the Expert Mr. Zaid Khan of In-Corr Tech Ltd ***at page 1394 para 2.***1 (Suppl Core Bundle) of the Final Report, that the root cause of this accident was the failure by both Paria and LMCS to recognise that a latent hazardous differential pressure condition, Delta P would have been created by the methodology used in the execution of the works with particular reference to the removal of fuel oil from Sealine 36. He further stated that if this hazard was recognised, then simple mitigation steps and/or changes in methodology could have been instituted to eliminate this hazard.

66. It is our submission that the failure by LMCS and Paria to identify a Delta P hazard had a ripple effect throughout this project. As a result:

(a) the Risk Assessment and Job Hazard Analysis did not identify control measures to reduce the risk of such a hazard occurring and as a result no control measures were in place;

(b) There was no adequate Emergency Response Plan to the accident when it occurred as a result of a Delta P event; and

(c) LMCS and Paria employees who relied on the assessments of LMCS and Paria, were unaware of the risks and the control measures for those risks.

67. There was therefore a breach of duty of care by both Paria and LMCS.

LINE CLEARING

68. We all know according to the Final In-Corr Tech Ltd Report at paragraph 3.1.1 that:

> **"The removal of the contents with respect to the quantity and method, in line #SL36 between #5 and #6 Berths was the underlying factor that led to this accident.** The removal created a gaseous void in the riser and sea line, setting up

a latent differential pressure condition between the habitat and a gaseous void in the sea line, when the mechanical seal and inflatable plug were installed and the habitat pressurised**.”**

69. The line clearing process began on 18th January 2022 and was completed around 3rd February 2022 (***WSB Vol 4, para 9, page 1470, Jonathan Ramdhan***).

70. According to Johnathan Ramdhan (Paria's Operations Team Supervisor), LMCS undertook to conduct the line draining in accordance with Paria's Work Instruction effective 5 January 2022 (**see paragraph 9 on page 1470 WSB Vol 4**). The Paria Work Instruction is at **CB 3, page 1033.** This is a step by step instruction for the clearing of Sealine 36 between Berths 5 and 6 developed by Paria's Operation's Department. It was revised by Paria's Visham Harrichan, approved by Paria's Jason Beckles and authorised by Paria's Collin Piper.

71. Mr. Ramdhan stated that the purpose of the document was to oversee the draining process **(*Transcript 6th December 2022 page 131, lines 10-12*)** and that the Operations Department of Paria had control over the process (***page 131, lines 12-15***). It is to be noted that there are also Method Statements produced by LMCS for both Phases I and II **(CB 2 at pages 1028 and 1041).** On page 1038 (**CB 2**), it is stated on the Work Instruction that the Operator at Paria was to be assigned for monitoring and emergency response. Mr. Ramdhan in cross-examination also confirmed that Paria officials were witnessing, present and overseeing the draining process (**Transcript 6th December 2022**, **page 132, lines 7-12**).

72. Also, Section 8 of the Scope of Works (**page 593 CB 2**) required the contractor (LMCS) to follow not only the Permit to Work Procedure but also Standard Work Instructions. Therefore, LMCS would have had a contractual obligation to follow Paria's Work Instruction for the line clearing.

73. This Work Instruction was emailed by Paria Maintenance Planner Mr. Terrance Rampersadsingh to LMCS on 10 January 2022. **(Witness Statement Bundle (Volume 2)**

at page 917. This Work Instruction was attached to the email sent by Mr. Rampersadsingh.

74. The Scope of Works at paragraph 4.5 at **CB 2 at page 570**, provides that Paria's responsibility included providing ***personnel to oversee isolation/de-isolation, depressurization/pressurization and draining/filing product from lines at Berth #5 and Berth #6.*** Mr. Terrance Rampersadsingh of Paria who had the responsibility of overseeing the execution of the Project stated that this meant that Operations would have identified all of the points that need to be isolated, line up the clamps and the valves for the product to go in. He further stated that the contractor would be responsible for draining the product to the required height and the Maintenance Department would provide all the permits and all mechanical support that is required and that the process would be overseen by Paria through its Operations Department (**Transcript, 1st December 2022 at page 14, lines 10 -25).**

75. It was the evidence of both LMCS and Paria that the intention was never to drain the entire underwater pipeline between Berths 5 and 6 but rather to remove only sufficient content to achieve a 30 feet ullage at Berth 6 to install the plugs in order for the works to be carried out.

76. Mr. Kazim Ali Snr in his supplemental witness statement at paragraphs 31 and 32 (***Supp WSB 2860)*** described Phase I and Phase II line clearing process by way of air blowing.

77. This was a change from the original Method Statement which proposed the use of an air pump for the line clearing exercise. The use of the air pump would have involved introducing an air pump at an open riser at Berth No. 6. However, this method was changed to air blowing after LMCS was awarded the contract following discussions at a kick off meeting around June 2021 where LMCS and Paria looked at the job in more detail.

78. Mr. Kazim Ali Snr stated that they decided that the use of an air pump was not practical because they would have had to remove the flange from the top of the riser in order to get the pump in and this risked water entering the riser and was possibly an environmental

hazard concern. Further, the top of the riser would have had to be open for a prolonged period of time if an air pump was used and if water entered, this would have caused the oil in the riser to rise and escape from the riser into the sea causing pollution **(*See Kazim Al Snr at pages 2859 and 2860 of Supp WSB*).**

79. It is to be noted however that the evidence of Paria with respect to its understanding that the line clearing exercise was only to achieve a sufficient ullage to install the plugs is inconsistent with the plain language of the following contemporaneous documents:

i. The Scope of Works **at page 564 CB 3, para 3.1.5** where it is stated:

"*properly coordinated works with Paria Operations, Maintenance and HSE personnel to perform the following activities including but not limited to; isolation/deisolation, depressurization/pressurization and **draining**/filling product from line SL 36 at Berth 6 and Berth 5.*

ii. The Addendum I at **page 598** where it is stated that query 1- The Contractor is responsible for the safe removal of hydrocarbon contents from the line to ensure that the **line is clear and dry**.

iii. The Paria Work Instruction (**CB 3 at page 1033**) which refers to the scope being **"Clearing** of No. 36 SL Section between Berth #5 and Berth #6."

iv. The Permit to Work No. 9320 (**CB 3 at page 1074**) which states in Section B, - **Line Drained.**

v. Paria's Daily Work Reports (**CB 2 at pages 995-1014**) which are referred to below. Those documents record that Paria was aware that more than 1,252 barrels of oil were received in its tank farm and also in slop barges. This as we shall demonstrate, is more consistent with the entire line being drained than an intention to partially drain to achieve a 30 feet ullage. The Daily Work Reports show that Paria wanted the line to be drained and it participated in the draining process as it was monitoring the draining of the line.

vi. In order for the line draining process at Paria's compound to be done, Paria's resources and facilities including its workers were used in that process and it is clear from the Daily Work Reports that Paria kept a record of the draining of the oil.

<u>The quantity of line content removed during the air blowing process was 1,252 bbls</u>

Total content of topside piping

80. The evidence showed that Mr. Kazim Ali Snr. believed that 300 bbls had to be removed from the topside piping to drain the topside piping. With respect to the underwater piping, Mr. Ali Snr's evidence was that 60 bbls had to be removed to achieve a 30 feet ullage in the riser at Berth 6 (**see Mr. Ali's evidence at page 38, Transcript 5 December 2022 lines 1-2**).

81. Based on that evidence, therefore, no more than 360 bbls ought to have been removed during the entire line clearing exercise, that is 60 bbls from the underwater riser at Berth 6 and 300 bbls from the topside piping.

Daily Work Reports

82. (a)However, Paria produced contemporaneous Daily Work Reports (***CB 2 pages 995 – 1041)*** created by its Maintenance Technicians showing that 916 bbls were removed during Phase I and 336 bbls were removed during Phase 2. This is a total of 1,252 bbls.

(b) Those Daily Work Reports according to the evidence of Terrance Rampersadsingh were emailed to him on a daily basis. They were copied to Mr. Manmohan Balkaran, Assistant Planner and, where required, Operations (***Transcript 1st December 2022 at page 68, lines 22-27).***

OSHA Letter

83. I now refer to letter dated 20th July 2022 to OSHA from Paria signed by Mushtaq Mohammed (**pages 2905 -2908 Electronic Bundle of Submissions**). At page 2906, OSHA asked the question (<u>Question 4)</u> what was the volume of hydrocarbon removed

from sealine 36 between Berths 5 and 6 prior to the installation of the subsea slip on flange as per Method Statement?

Response:

"Given the configuration of the system, it was impossible to segregate and measure the displaced system."(our emphasis)

84. Question 5 was- what was the volume of hydrocarbon removed from sealine 36 between Berths 5 and 6 after the accident.

Response:

"The volume of hydrocarbon removed is estimated at 125 bbls. The quantity is based on the estimated spilled hydrocarbons (6 bbls and the recorded volumes of hydrocarbons recovered in the sea manatee 119.8 bbls)." (our emphasis)

In-Corr Tech Ltd's Report on Quantity of Oil drained

85. Mr. Zaid Khan of In Corr Tech Ltd in his letter dated 6th January 2022 (***Suppl Core Bundle 1536D)***, stated that out of the 916 bbls removed, during Phase 1 he estimated that approximately 200 bbls were drained from the top side piping (this is based on his personal knowledge of the capacity of the top side piping) and therefore that 777 bbls were removed from the underwater sealine during Phase I. In Phase II, he states that at least 336 bbls were removed from the underwater sealine.

86. Therefore, in his opinion, a total of 1,052 of the 2,000 bbls would have been removed from the underwater line. These figures do not take into account where air blowing occurred on occasions and the quantities of fuel oil removed were not recorded.

The quantity of the oil being removed was not taken into consideration.

87. The evidence shows that even though Paria had available to it, the daily records of the fuel oil being removed, those figures did not form part of any consideration by LMCS or

Paria to ensure that only the target amount was removed from the riser at Berth 6 to achieve a 30-foot ullage.

88. LMCS did not measure the quantity of fuel oil which was removed but was measuring the ullage (***Transcript 5th December 2022, at page 38, lines 1-2***).

89. It would appear that Paria also depended on the measuring of the ullage rather than considering the actual quantity of fuel oil which existed and what had been removed:

References:

(a) Johnathan Ramdhan (**Transcript 6th December 2022 at page 133, lines 11-14**) stated that he couldn't say the quantity which was removed. He stated that operations was overseeing the draining process by the contractor, LMCS and that LMCS was doing their "ullaging" to determine if the right amount of oil was removed.

(b) Visham Harrichan (Paria's then Operations Team Lead (Ag) (**Transcript 7th December 2022 at page 68, lines 14-16**) stated that he was of the impression that the ullage was actually giving the "amount in the line".

(c) Collin Piper (Operations Team Lead) (Transcript 14th December 2022 at **page 25 ,** at lines 21-22) stated that the "dip on the line" is the measurement that the contractor was going to.

90. Visham Harrichan also stated in cross examination that he could not say how much oil was drained or even how much had to be drained. ***(Transcript 7th December 2022at page 67-72).***

91. In fact, Mr. Harrichan was surprised by the actual amount of line content which was drained. ***See Transcript of 7 December 2022at page 75 lines 15- 20 and at page 76 lines 8-12***:

> "Q: So having become aware of that now, would you not agree that the unlimited draining of the line, the underwater line, between berth 5 and 6, should have been closely monitored if it had to be drained.

A: **Yes, and I thought it was closely monitored.**

…

Q: By whom?

A: **The Contractor and Maintenance Department.”**

92. However, Mr. Terrance Rampersadsingh of Paria’s Maintenance Department (who was in charge of overseeing the execution of the project) stated that he never worked out how many feet of content in the riser was equivalent to in terms of barrels. ***(Transcript 14th December 2022, page 54, lines 4 – 24).***

93. Mr. Collin Piper, Terminal Operations Manager, agreed that he had the overall responsibility of ensuring that the Paria Instruction procedure was established by reviewing and approving the work instruction and ensuring that the Offshore Team Lead understood the requirements of the work instruction ***(Transcript 14 December 2022, page 253 lines 3-8).***

94. Mr. Piper agreed that the Paria Work Instruction was a step-by-step process which was sequential for the line clearing process (***page 4, Transcript 15 December 2022, lines 3-6.***) However, notwithstanding the evidence of Johnathan Ramdhan that the line clearing was undertaken by LMCS pursuant to the Paria Work Instruction, Mr. Piper stated that the Work Instruction did not go to LMCS and is solely an internal instruction for Paria’s Operators.

95. However, this is inconsistent with not only Mr. Ramdhan’s evidence but also with the contemporaneous documentary evidence of the email (***the Witness Statement Bundle (Volume 2) at page 917)*** from Mr. Terrance Rampersadsingh copied to Mr. Manmohan Balkaran and sent to LMCS dated 10 January 2022. In that email, Mr. Rampersadsingh attaches the Paria Work Instruction and states:

> “Please see attached signed draining procedure, let us meet tomorrow at 10 a.m. to discuss draining schedules. I want to start as early as possible this week,

bearing in mind the Crude Ship Loading is on the 14th. I will discuss with Ops now to firm up on any other issues.” (our emphasis)

96. According to Section 5.3 of the Permit to Work Procedure, Paria as the Site Authority was directly responsible for the site/facility and is responsible for ensuring that conditions required for the safe conduct of the job are maintained. Paria pursuant to this duty and also in monitoring the works, should have been able to identify from its records, that more fuel oil than was required was being drained from the line. LMCS also ought to have known that more fuel oil than was required was being drained from the line.

Measuring the ullage did not detect the gaseous void.

97. The expert evidence of Mr. Zaid Khan (of In-Corr Tech Ltd) was that had the removal of the line contents to 35ft below sea level in the riser been undertaken, <u>no gaseous void would have been formed on installation of the plugs</u> (**page 1397 of Supp CB (first para)**).

98. Further, at paragraph 3.1.3 on page 1397, he stated that the method of air blowing from Berth 5 to 6, would have resulted in the removal of way in excess of the optimum quantity of oil from the line, thus creating a significant continuous gaseous void between Berths 5 and 6.

99. His evidence given in cross examination on 10th January 2022 also established that:

(a) The method of removal of line content would have given the impression that a target of a 30 feet ullage was attained in the riser when a dip measurement was taken, but this would not detect the gaseous void in the horizontal part of the line;

(b) He also stated that the pipeline sloped at 0.2 degrees. Berth 6 is 4 feet lower than the Berth 5 end and Berth 6 is deeper than Berth 5. The line is sloped and the initial stages of blowing would have resulted in a lot more liquid flowing out from the line than if it was level. He stated that the riser at Berth 5 would be emptied first as pumping was done from Berth 5.

(c) He also stated that during Phase I air blowing that a point would have been reached when more air than fuel would have been seen coming from the control valves at Berth 6 and onshore where the flow was being monitored and measured. This would have been an indication that a lot of the line content had been removed.

(d) He explained that when the compressor was shut down at Berth 5 at the end of Phase I, air will be locked in, and that pressurised air would have supported a column of liquid in Berth 6. Therefore, whoever took the dip measurement at Berth 6 would have wrongly thought there was still liquid to be taken out to achieve a 30 feet ullage.

(e) In Phase II, the pipe was pressurised internally and a dip hose used to remove the line contents at Berth 6. However, even when the ullage was achieved, it was a false ullage giving the belief that the line was still flooded because nobody looked in Berth 5 to see what was happening.

(f) When the carber test at Berth 5 was done on 25th February 2022, the pressure was released and it created a vacuum on Berth 6 under the plug and it accelerated and made the system more dangerous. That was a dangerous vacuum which could have dislodged the plug if it was not holding.

(g) He concluded that if the line was filled on both sides to the elbow, the incident would not have occurred and there would have been no conditions to establish a flow for a vortex to form.

(h) He also stated that whether it was 300 bbls removed or over 1,052 bbls removed, there would have still been a latent delta P hazard. When he did his report, he did not know the extent of the contents removed from the line. He went by the Method Statements supplied by LMCS which states 300 barrels would be removed. If 300 bbls were removed, there would have been a gap of 7 or 8 inches of air space along the top of the line, if more was removed, the gaseous void became larger. He stated that 300 bbls was way too much to be removed.

(i) He referred to LMCS' original plan which was to drain the topside piping, take off the elbow and to remove fluid out from Berth 6 by way of an air pump at Berth 6.

However, he doesn't know why there was a change. This would have been a safer method of removal.

100. The Expert's conclusions therefore were that had only enough line content been removed to create a 35 ft ullage then a Delta P event would not have occurred sucking the men into the pipe.

101. Further, he concluded that the method utilised of air blowing resulted in more than the target quantity of line content being removed which gave a false impression when a dip measurement was taken at Berth 6 that the line was full of content.

102. If Paria and LMCS had identified a Delta P hazard in the documents submitted by LMCS to Paria for review, this Delta P event would not have occurred because measures would have been taken to mitigate the risk of a Delta P event.

EMERGENCY RESPONSE OF PARIA AND LMCS

103. In examining the evidence of the rescue efforts made by Paria and LMCS after the accident occurred when the five (5) LMCS divers were sucked into the 30 inch pipeline, it is important to consider that evidence in the context that LMCS' Emergency Response Plan, Risk Assessments and Job Hazard Analysis were reviewed and accepted by Paria because Paria considered them satisfactory and that they captured and properly identified all credible scenarios, potential risks and hazards. Paria took the position that LMCS adequately specified mitigating control and emergency response measures (**See Michael Wei WB 1285 at para 75 and Randy Archbald WB 1318 at paras 18 and 19**).

104. It is also not in dispute that both Paria and LMCS did not identify in those documents the risk of a Delta P event.

105. In-Corr Tech Ltd in its Report at paragraph 2.4 [**CB 1395**] stated that LMCS' Job Safety Analysis, Method Statements, Risk Assessments, Toolbox Meetings, Paria's Permit to Work 9320 and its Bid Evaluation of LMCS' Proposal all failed to identify this potential differential pressure, Delta P differential pressure hazard.

106. The failure of both Paria and LMCS to identify a Delta P hazard caused the accident in which the five divers were sucked into the pipeline. Paria and LMCS were therefore jointly responsible for the accident and were therefore jointly responsible to make efforts to rescue the divers.

107. Paria was the Site Authority [**CB Vol 1 p. 30 at para 5.3 line 1**] and it was directly responsible for the site at Berth 6.

108. The Expert in his Report stated that the best time for the rescue was immediately following Boodram's emergence from the pipeline at about 5:30 p.m. and maintained that a rescue was possible. He explained that the risk of a secondary Delta P event was minimal because the system had stabilized and something would have had to trigger a Delta P event [**CB 1534 at 4.9.5**]:-

> *"Prior to Mr. Christopher Boodram's rescue, the entire system stabilised and equalised itself at both ends of SL 36 and this allowed Mr. Boodram to negotiate the pipe without any disruptions, as the system was static. <u>This condition was the best opportunity to attempt a rescue..</u>."* (emphasis added)

109. Mr. Zaid Khan in his evidence maintained that position in cross-examination and explained why the rescue was possible immediately after Boodram's emergence from the pipeline and why a secondary Delta P event would not be triggered by rescue divers. His expert evidence was not challenged

110. In fact, Mr. Piper and the IMT's evidence is that after the accident occurred at 2:45 p.m., conditions in the pipeline were static. At paragraph 120 of his witness statement **[WB 1367]**, Piper stated that *the conditions on either side of that inflatable plug appeared to have stabilised after the occurrence of the event*.

111. The evidence disclosed that LMCS devised three (3) rescue plans, but none were implemented by Paria because Paria from 6:25 p.m. on Friday 25th February 2022 prohibited diving into the pipeline for the LMCS divers to attempt a rescue. The evidence has disclosed that Paria did not have any consultation with the LMCS divers to review and assess their plans to rescue the divers from the pipeline.

PARIA ADMITTED THAT IT DID NOT HAVE THE EXPERTISE AND COMPETENCE TO REVIEW THE DOCUMENTS TO ASSESS THEM INCLUDING THE EMERGENCY RESPONSE PLAN

112. Paria admitted that it did not have the requisite expertise to review the Emergency Response Plan submitted by LMCS at the bid stage of the contract. Michael Wei in cross-examination said that Paria did not have the competent diving personnel to assist with planning and executing the job [**MW/Day 3/p. 171, lines 9-23 and p. 241, lines 19-23**].

113. Paria did not retain an Expert Client Representative to advise it in reviewing the Emergency Response Plan submitted by LMCS at the bid stage. Paria did not consult with the LMCS divers in relation to their three (3) rescue plans nor did they instruct any of the experts they brought in on 25th February 2022 to discuss the LMCS rescue plans.

RESCUE EFFORTS BY LMCS

114. LMCS had three (3) rescue plans:-

(i) the first was just after the accident and it involved Andrew Farah entering the pipeline with scuba; [**para 26 of Farah's witness statement; WB 446, Vol 1**]. He could not do it because Paria did not approve it; [**para 30 of Andrew Farah's witness statement; WB 446 Vol 1**];

(ii) the second plan was when Conan Beddoe arrived at Berth 6 at about 5:45 p.m. The plan was first for Conan to enter the habitat to make an assessment using a rope while Farrah and another person would be tending that rope from the barge. If Conan assessed that he could do a rescue, he would then go back in the habitat with Michael Kurban and Ronald Ramoutar. He (Conan) would then enter the pipeline using a rope and Michael Kurban and Ronald Ramoutar would be tending him into the pipeline. Conan would go in with scuba equipment feet first and share his air with any of the men he encountered and bring them out of the pipeline

[see para 14 of Conan Beddoe's witness statement WB 1244 and AF/Day 7/p. 107/lines 10-19];

(iii) the third plan was the second plan which was revised when Conan's brother Conrad Beddoe arrived with commercial equipment at 6:30 p.m. Conan supported by other experienced divers could enter the pipeline with commercial diving equipment [**para 40 of Farah's witness statement; WB 448 Vol. 1**]. The plan was for Conan to go in feet first and someone would tend the hose. The umbilical was 300 feet long. His intention was to go as far as the umbilical would allow. If Conan came into contact with one of the men, the plan was that he would bring him out via the pnemo (an additional half inch hose connected to the umbilical). The men would use the connection to breathe and Conan would hold them and bring them back up and the others in the habitat would assist to take him out. The diver who Conan rescued would be down by his feet so he would come out first and then the diver would then be pulled out. The plan was that if Conan encountered any obstructions, he would take them out one at a time. He would do this as many times as he could [s**ee para 21 of Conan Beddoe's witness statement WB 1244** and **AF/Day 7/p. 107/lines 10-19**].

115. Catherine Balkissoon was informed by the LMCS divers that they wanted to execute the rescue plans on more than one occasion and she was also informed that there was commercial air equipment available.

PARIA RECOGNIZED THE URGENCY OF A RESCUE BUT THE IMT DID NOT CREATE A TIMELINE

116. The evidence disclosed that Piper first heard of the accident at 3:10 p.m. [**WB 1348, para 13**] and Paria commenced sea searches at 3:10 p.m. [**WB 1351, para 28**]; the divers were reported missing at about 2:45 p.m. [**WB 1348, para 14 – Piper**].

117. Piper admitted that as Incident Commander it was his responsibility *to respond urgently to the emergency* [**WB 1345, para 7 lines 1-2**].

118. Piper admitted, when probed in cross-examination that, at 5:36 p.m. he heard that Boodram had emerged from the pipeline [**CP/Day 9/p. 211/lines 7-8**] and at [**CP/Day 9/p. 210 lines 27 to p. 211 lines 2**]:-

> *"…when [he] found out that Mr. Boodram emerged from the pipeline <u>that it was very important for [him] and the IMT to take urgent steps to see whether [he] could have saved human lives</u>".* (our emphasis)

119. Piper also said at paragraph 47 of his witness statement [**WB 1355**] that *in his mind this was an urgent and critical situation.* Catherine Balkissoon agreed that *time was of the essence* [**CP/Day 9/p. 48/lines 6-7**] for a rescue.

120. Michael Wei in cross-examination considered that the men might be alive some 13-14 hours after Boodram emerged and in his personal timeline (not the IMT's), there was no real prospect of the men still being alive after 7:00 a.m. on Saturday [**MW/3/p. 99/lines 4-27**].

121. Piper on being questioned suggested that the timeline for a rescue was 3-5 hours after Boodram emerged. He said that the IMT understood *that we had to work quickly* [**CP/Day 10/p. 32/lines 22-27; p. 33/lines 1-4**] but that no attempts were made to calculate the outer limits of the breathable air available to the divers. He said that the IMT had *limited information at that time* [**CP/Day 10/p. 33/lines 5-26**].

122. Later, Piper said that he was working with an outer limit of 5 hours which *may be midnight at the outside* [**CP/Day 10/p. 36/lines 11-16**] and agreed with the Chairman that *a timeline informs you about how to approach any potential rescue* [**CP/Day 10/p. 37/lines 1-5**].

123. Similarly, Mushtaq Mohammed said that Paria/the IMT did not establish a specific timeline for rescue but were thinking within the first 6-12 hours for available rescue [**MM/Day 11/p. 59/lines 9-23**]; see also **p. 180/lines 18-27 and 1-8**.

124. Piper's *midnight* timeline must be contrasted with Michael Wei's *7:00 a.m. on Saturday*, Mushtaq Mohammed's *6-12 hours*, Randy Archbald's *24 hours or 2:30 p.m*. on Saturday and Balkissoon's *time was of the essence* [**CP/day 9/p. 48/lines 6-7**]. All of Paria's witnesses agreed, however, that there were diminishing returns, so the longer the delay, the greater the likelihood that the divers will not be alive.

125. It follows, therefore, that notwithstanding Paria's evidence that it recognized the *urgency* of a rescue [**Piper at para 7 of his witness statement; WB 1345**] and for the IMT to take *urgent steps* to see whether lives could have been saved [**CP/Day 9/ p. 210/lines 27 to p. 211/line 2**], the evidence discloses that Paria's IMT failed to act urgently and decisively in that:-

(a) it continued to search the open waters until 5:30 p.m. on Friday even though Piper admitted that he considered the possibility of the men being in the pipeline since 3:20 p.m. when Kazim Ali Snr. told him that the plug was being removed [**CP/Day 10/p. 17/lines 7-27; p. 18/lines 1-22**];

(b) Paria knew since between 3:20 p.m. and 3:30 p.m. that LMCS' divers were prepared to go into the pipeline to do a rescue;

(c) Paria did not take steps to urgently speak to Boodram about the conditions of the pipeline even though Boodram was conscious and alert when he emerged at 5:30 p.m.; Piper agreed that Boodram was *not overly injured* [**CP/Day 9/p. 220 lines 20-25]**.

(d) Piper in questioning said that Shane Ramkissoon visited Boodram in the hospital [**CP/Day 10/95/lines 11-21**] and admitted that he did not know what Ramkissoon had asked Boodram, in particular, whether he had asked Boodram about the conditions in the pipe [**CP/Day 10/95-96/lines 26-27;1-10**]. The IMT Notes also do not show that the IMT through Ramkissoon asked Boodram about the conditions in the pipeline [**Suppl CB (IMT) 1573 and 1574**]. The IMT Notes at p. 1573 records that at 8:35 p.m. Ramkissoon was dispatched to the hospital by Piper and at 8:53 p.m.

records that Boodram was in a stable condition, but is silent as to the conditions of the pipeline.

(e) Boodram in his evidence when he was rescued **[CB/Day 2/47/lines 6-16]** said *that everybody was a set of headless chickens* and at [**CB/Day 2/p. 207 lines 23-27 and 208 lines 1-7**] made it clear that he was prepared to tell Paria or LMCS as soon as he was rescued, about the condition of the pipeline:-

> *"Q. Okay. Mr. Boodram, I want to ask you a very important question. If when you were rescued either Paria or LMCS wanted to find out from you the condition in the pipe in order to effect a rescue, would—were, were you in a position to tell them what the condition of the pipeline was …?*
>
> *A. … when I now come out de pipe my mind and everything was focused and tune een to everything to save dem fellas. If they had debriefed me there and then, they would a geh everything they coulda get from me.*
>
> *Q. Including the condition in the pipe?*
>
> *A. Everything ah coulda tell them."* (our emphasis)

(f) After Boodram emerged from the pipeline and stated *Fyzie is just behind him*, Michael Kurban shortly thereafter dived into the pipeline in order to rescue his father. He dived down the vertical and dived about 10 feet down into the horizontal of the pipeline. He had to return because he wanted a longer umbilical and he was prevented thereafter from going back into the pipeline.

(g) Piper knew since about 7:15 p.m. on Friday that there were competent LMCS divers willing to go into the pipeline to do a rescue [**CP/Day 9/ p. 211/lines 9-23]** but stopped diving at 6:25 p.m. and notified the Coast

Guard to stop diving at about 7:00 p.m. and refused to change the instructions;

(h) Paria did not act urgently to obtain information from the diving companies when they arrived and, instead, they were told to await further instructions;

(i) Paria continued to await a *rescue* from the Coast Guard (up until 1:00 a.m. on Saturday) even though the IMT knew since around 8:00 p.m. that the Coast Guard was not equipped for, nor did they have training and competence to dive into the pipeline;

(j) Piper's explanation for stopping diving into the pipe at 6:25 p.m. was that he had to assess the conditions in the pipe. He said that he did not want to act instinctively or emotionally [**CP/Day 9/p. 214/lines 7-15**]; and

(k) The IMT had a duty to explore all possible ways to rescue the men in upholding its first principle of the ICS which was to safeguard human lives and to act to uphold that principle of Paria's *Safety First* system [**para 20 of CP's witness statement; WB 1349; CB 107A-G**].

126. Wei's description of the performance of the IMT after much consideration as being *Excellent* was not supported by the evidence.

127. If Paria wanted to get information about the conditions of the pipeline to decide whether to authorise a rescue from within the pipeline, Paria could have gotten that information from Boodram and from Michael Kurban. Further, the IMT's handwritten Note contained an entry at 2:02 a.m. on Saturday 26th February 2022 stating *no signs of oil* [**Suppl CB (IMT) 1541**].

128. Further, all of the commercial equipment needed for the rescue dive were available to LMCS' divers by 7:14 p.m. on Friday [**Alvin Seetaram's witness statement at para 10; WB 396].** Seetaram's evidence to the Commission is that LMCS had all the necessary equipment for a rescue when *Waterworld* arrived at 7:14 p.m.

129. Catherine Balkissoon at para 16 of her witness statement **[WB 1330**] said that between 6:00 p.m. and 6:30 p.m., Andrew Farah (LMCS' Dive Supervisor) told her that LMCS' divers and their diving equipment (scuba tanks) were coming from Carenage and they wanted an escort. This means that a dive plan was being formulated. Balkissoon also said that she communicated LMCS' diving plans to the IMT.

130. Balkissoon agreed that she was not merely a conduit for the IMT and at paragraph 9 of her witness statement [**WB 1329**] she said she had to provide onsite logistical and technical assistance and support to the search and rescue efforts.

131. Balkissoon was asked whether Andrew Farah had spoken to her about a rescue plan that LMCS had devised to go into the pipeline and Balkissoon responded saying that Farah told her that LMCS had divers and commercial equipment and were willing to do a dive and rescue. Balkissoon said that she spoke to Collin Piper about it and Piper's response was to stand down [**CB/Day 9/p. 65-66/lines 18-27 and lines 1-6]**.

132. Balkissoon in questioning, said that Farah asked her more than once about a rescue and that her response was the same [**CB/Day 9/p/. 66/lines 7-27**].

133. Both Catherine Balkissoon [**CB/Day9/p. 23/lines 6-15]** and Mushtaq Mohammed [**MM/Day 11/p. 64-65 lines 26-27 and lines 1-12**] stated in their cross-examination that it was not possible to have an emergency plan to rescue someone after a Delta P event. This cannot be correct.

134. Balkissoon said [**CB/Vol. 4/1742-1743**] that the IMT did not have a written plan to deal with Delta P so that when the IMT met on 25th February 2022, it was now devising a plan.

135. Mushtaq and Balkissoon's views are important because it means (particularly with Balkissoon) that they were unlikely to be convinced about effecting a rescue of the divers from within the pipeline.

136. Balkissoon admitted in cross examination [**CB/Vol. 4/p. 1753; lines 10-19**] that she saw people diving and she considered *that it was her role to assist the IMT... to try to see*

whether there would be willing divers to effect a rescue. She said she *passed that information* to Piper around 7:00 p.m.

<u>PIPER KNEW SINCE ABOUT 7:15 P.M. THAT THERE WERE COMPETENT LMCS DIVERS WILLING TO GO INTO THE PIPELINE AND THAT THERE WAS COMMERCIAL EQUIPMENT AVAILABLE FOR A RESCUE</u>

137. Piper said that at some time during Friday evening he knew that *LMCS had equipment, commercial air supply equipment…experienced divers and had divers willing to go into the pipeline and [yet] took the position that it was not safe for them to go into the pipeline* [**CP/Day 9/p. 212/lines 12-16**].

138. In Paria's timeline it is recorded at 6:55 p.m. that *Divers diving equipment arrived on site* [**Suppl. CB (IMT); p. 1573**].

139. Piper said that even earlier, at 6:25 p.m., that it was not safe for divers to go into the pipeline after Visham Harrichan told him that LMCS' divers were diving into the pipeline [**CP/Day 9/p. 212/lines 17-27**].

140. Alvin Seeteram in his evidence confirmed that Subsea Global Solutions Limited had on board the *Waterworld* all the commercial diving equipment and lighting that was necessary for a rescue and that the Coast Guard had inspected his equipment; he said that *Waterworld had super lights, band masks, that is helmets, diving umbilicals, have high pressure, low pressure back up, air supply, umbilicals length of 375 feet and 200 feet* [**AS/Day 8 p. 11 lines 11-25**].

141. Seeteram also confirmed to the Chairman that while SGS' divers were not available to dive because they had used up their maximum dive time in previous dives, that all the equipment was available for the divers to use for the rescue.

142. Seeteram said that he was told that Ronald Ramoutar had available divers who could have used the equipment to dive into the pipeline and this was from about 7:15 p.m. on Friday evening [**AS/Day 8 p. 16, lines 1-14**]. He also said that the Coast Guard was impressed with SGS' equipment and confirmed to the Chairman that *there was nothing*

more that [Paria] could have wanted or desired in order to effect the rescue, over and above what [he] already had [**AS/Day 8 p. 17, lines 4-9**].

143. Paria's instructions that no one was to be allowed to dive in the pipeline continued.

<u>PARIA REQUESTED ASSISTANCE BUT WHEN THE DIVING COMPANIES ARRIVED THEY WERE TOLD TO AWAIT FURTHER INSTRUCTIONS</u>

<u>Mitchell's</u>

144. Mitchell's was contacted on **Friday at 5:05 p.m.** by Rolph Seales and at 5:23 p.m. received confirmation that Mitchell's would be able to provide its services [**paras 7, 8 of Rolph Seales' witness statement; SWB 3132**].

145. The Mitchell's Team arrived at around **8:40 p.m.** with surface air supply equipment and were told to remain on stand-by [**para 4 of Fitzroy King's witness statement; SWB 3016**].

146. After **1:00 a.m.** on Saturday, Rolph Seales asked Mitchell's to view footage of an underwater camera and Fitzroy King said Mitchell's divers were *too big to fit in that pipeline* and Mitchell were told to *stand-by* and at about **2:45 a.m.** Mitchell's divers were told to stand down and they returned to Mitchell's compound at about **3:10 a.m.** [**paras 7-8 of Fitzroy King's witness statement; SWB 3017**].

<u>Eastern Divers</u>

147. Eastern was contacted at **11:40 p.m. on Friday and at 12:30 a.m.** some of its members arrived at Berth 6 with the full team being assembled at the compound by 1:25 a.m. and was briefed by the Incident Commander.

148. Andy Johnson said that the Incident Commander told him that *due to the variables around the incident [Eastern] should prepare itself for retrieval of not rescue due the possibility that the divers may have expired* [**Andy Johnson's witness statement at paras 9-11; p. 1527 of the WB**].

149. After its assessment of the site, Andy Johnson told the Incident Commander that his team would not be able to make an entry to perform the rescue operation as approximately 120 feet of the 1,200 foot pipeline was filled with water (based on what was seen on the video footage). Eastern remained on stand-by offsite for the next 12 hours from 5:00 a.m. [**paras 14-20 of Andy Johnson's witness statement; WB 1529**].

Hull Support

150. Hull was contacted at about 4:30 p.m. but was unable to mobilize a crew – Gyasi Woodley who is Hull's Operation Manager said that he had several discussions with Rolph Seales and Hull advised against cutting the horizontal section of the pipe as being too risky [**Woodley's witness statement at paras 5 and 8; SWB 2991**].

OTSL

151. OTSL was contacted on Friday afternoon and its dive vessel arrived at Paria at about 8:30 p.m. and remained on stand-by until 5:30 a.m. on Saturday and was not called upon by Paria [**paras 6-8 of Ian Bertrand's witness statement; SWB 2842**].

HHSL and the cameras

152. HHSL was only contacted at about 10:50 p.m. on Friday by Michael Wei [**para 107 of his witness statement; WB 1090**]; a push rod camera with operating crew arrived from Atlantic LNG at 9:00 p.m. but that camera was not inserted until midnight [**paras 104, 105 of Michael Wei's witness statement; WB 1289**]. Collin Piper said that the push rod camera actually came at 11:00 p.m. [**para 134 of his witness statement; WB 1369**].

PARIA DID NOT GET ADVICE FROM ROLPH SEALES AND FUENTES TO CONSIDER LMCS' RESCUE PLANS

153. Paria had available to it Rolph Seales and Krishna Fuentes to request either or both of them to have discussions with the LMCS divers to consider their rescue plans so that Paria and the IMT could have made a decision whether to reconsider its decision to prevent the LMCS divers from diving into the pipeline.

154. Also, they could have attempted to contact an expert such as Mr. Zaid Khan of In-Corr Tech Ltd to give them advice as to whether there was a risk of another Delta P event after the pressure in the pipeline was stabilized. Such an expert could have also advised them about the risks of sending in divers in the pipeline to rescue divers from the pipeline.

155. Paria used the diving companies to support its unreasonable insistence on receiving conclusive video evidence of the inside of the pipeline. The evidence discloses that Paria became pre-occupied and distracted by the cameras and video and ignored the information by Boodram and Michael Kurban. In any event, the video when it was eventually received, confirmed that the line contained clear water (not oil) so much so that the model number on the tank pushed by the crawler was clearly visible.

156. Summarily, the evidence discloses that the IMT on Friday evening (we say as early as 7:15 p.m. when SGS came onsite) that there was commercial equipment for a rescue. In fairness to Piper, he did say in his evidence, that during Friday evening he knew that *LMCS had equipment, commercial air supply equipment…experienced divers and had divers willing to go into the pipeline*.

157. Piper (and by implication the IMT) therefore had actual knowledge (we say by 7:15 p.m.) that there was all the commercial equipments and competent divers and a rescue dive plan to make a feasible rescue. Piper's decision to maintain the prohibition cannot be regarded as reasonable or justified on any view: [**CP/Day 9/p. 212/lines 12-16**].

158. In its Opening Statement [**para 8 (g)**] Paria said it made *extensive and sustained efforts… to explore what feasible solutions were available to rescue these men, against a ticking clock, <u>in circumstances where the clear responsibility for the safety of the men… was always that of LMCS, not Paria</u>.* <u>(our emphasis)</u>

159. Paria says that LMCS as the contractor was regarded as the First Responder. A point repeated by Archbald in his *viva voce* evidence and underscored in Paria's Opening at para 9 (e) where Paria maintains that:-

> "*… the responsibility for the safety of the deceased men and Christopher Boodram while they were carrying out the works <u>rested squarely on LMCS… and</u>*

<u>*accordingly any attempts to impose such responsibility upon Paria is misplaced*.</u>" <u>(our emphasis)</u>

160. It is submitted that Paria had a joint responsibility with LMCS to take steps to first discuss LMCS' rescue plans with LMCS divers in order to assess their viability and then implement the best plan.

161. The inevitable conclusion from the evidence of the rescue efforts of Paria produced in these proceedings is that the hours between the time of the incident and the early hours of Saturday morning were squandered by Paria. This is the time period in which the men were most likely alive and as each hour passed the possibility that they were alive became less and less likely.

<u>THE FACT THAT PARIA FAILED TO IDENTIFY DELTA P AS A POTENTIAL RISK MEANT THAT NO EMERGENCY PLANS WERE DEVELOPED BY PARIA (OR INSISTED FROM LMCS) TO MITIGATE THIS RISK</u>

162. At para 4.0 of Paria's HSE Requirements for Contractor [**CB 12**] all Paria contractors *must conduct suitable and sufficient risk assessments or Job Hazard Analyses* (*JHAs*) *or Job Safety Analyses (JSAs) for all activities and for all Work Permits*.

163. At para 7.0 of this same document [**CB 13**] Paria requires all contractors *to have Emergency Response Plans (ERPs) for fires, gaseous emissions, spills <u>and any other credible scenarios</u>*. Moreover, at lines 2-4 of 7.0

> *"This [ERP] will be reviewed by Paria's HSSE personnel for adequacy prior to the commencement of any work."*

164. Wei's confirmation at para 76 of his witness statement [**WB 1285**] that Paria's Technical and Maintenance Department reviewed and accepted LMCS' documents including its risk assessment means that the risks identified by LMCS (which did not include Delta P) were accepted by Paria.

165. This means that Paria, wrongly, did not regard Delta P as a *credible risk*.

166. It also means that since Paria did not regard Delta P as a potential risk, Paria did not have any emergency response plans to deal with Delta P. Further, that Paria did not insist that LMCS include an emergency response plan to deal with Delta P.

167. Accordingly, when the incident occurred, neither Paria nor LMCS recognized the root cause of Delta P and because neither identified Delta P as a potential risk, neither had an emergency response plan to rescue the divers.

168. Certainly, Mr. Zaid Khan's view is that the Delta P was a credible risk and at 2.4 of his Report [**CB 1258**] he said that since both Paria and LMCS failed to identify Delta P as a risk *no steps to eliminate the hazard were implemented.*

169. OSHA agreed with Zaid Khan's assessment and at 5.3 and 5.4 of OSHA's Preliminary Report [**CB 1230**] it said that neither Paria nor LMCS's Emergency Plan *captured emergency scenarios*; in relation to LMCS, this was scenarios *specific to the job* and for Paria, scenarios *based on a risk assessment.*

170. It follows, therefore, contrary to Wei's evidence, Delta P was both a *credible scenario* required to be documented in an Emergency Rescue Plan approved by Paria (in accordance with Paria's HSE Requirements for Contractors at para 7.0 [**CB 13**]) and should have been included by LMCS in its Emergency Plan following a *suitable and sufficient risk assessment* (in accordance with the same HSE Requirements at para 4.0 [**CB 12**]).

171. Paria's failure to insist on the inclusion of Delta P as a credible scenario which should have been part of LMCS' Emergency Response Plan, meant that Paria's HSSE personnel did not carry out a proper or adequate review of LMCS' documents.

<u>TREATMENT OF THE FAMILY</u>

172. The families of Rishi Nagassar, Yusuf Henry and Fyzal Kurban were in the car park outside Paria's compound from Friday 25th February, 2022 to Sunday 27th February, 2022 seeking information on the rescue efforts.

173. Both the families of Rishi and Fyzal indicated that they were informed of the decision to transition to recovery on the news on the evening of Sunday 27th February, 2022.

174. The evidence of LMCS is that they had difficulty in contacting Rishi and Yusuf's families but they gave the contact details which they had to Paria. Paria's evidence is that the families were updated through a meeting at the Staff Club on Saturday 26th February, 2022 and thereafter by way of WhatsApp.

175. Mushtaq Mohammed's evidence is that the families were informed of the decision to move to recovery on the evening of 26th February, 2022 by him via WhatsApp call.

176. In cross examination, Mr. Mushtaq Mohammed (Transcript of 3 January 2022) stated:

(a) That arrangements were made to accommodate the families on Saturday afternoon (that is almost 24 hours after the incident) (***Page 95, line 20)***;

(b) The first time that Paria met with the families was on Saturday 26th February 2022 at the Pointe-à-Pierre Staff Club ***(page 96, lines 11-13***);

(c) Before this meeting, Mr. Mohammed says that he did not know that the families were in the car park since Friday afternoon trying to get information ***(page 97 lines 8-10)***; and

(d) Mr. Mohammed said that he wouldn't argue the point and conceded that this was not an acceptable position ***(pages 101-102).***

<u>RECOMMENDATIONS</u>

177. Companies like Paria which undertake inherently dangerous works, ought to employ a Client Representative or Engineering Expert to assist in the preparation of the Scope of Works, to review the contractor's documents and to oversee the execution of the project by the contractor in accordance with the Permit to Work procedure.

178. Persons performing the roles and responsibilities set out in the Permit to Work procedure ought to have dedicated training and qualifications to enable them to perform the functions in those roles in accordance with the Permit to Work procedure.

179. The Client Representative or Engineering Expert should be empowered to coordinate the various aspects of the project under the supervision of the General Manager to ensure that Paria's objectives to create a safe system of work is achieved.

180. The Permit to Work Form ought to be clear and unambiguous. It ought to be redone and fit for purpose. The Permit to Work Form ought to be clear in prioritizing the tasks including the sequence of the tasks and it ought to be contractually underpinned.

181. Work instructions should be clear and unambiguous and required to be co-signed by the Applicant and the Contractor.

182. Consideration ought to be given to amending the Permit to Work procedure so that a Permit to Work would be issued for specific tasks which are inherently so dangerous that they should be given special treatment; this Permit to Work would only be issued after the issuer is satisfied that a toolbox meeting was convened in relation to this task and the risks were discussed and the control measures understood and agreed.

183. There should be clearer guidelines in the Permit to Work as to the meanings of "periodically" and "continually". In this case, it was the duty of the Applicant to continually monitor, however he did not arrive on the site until 2.00 p.m. on 25th February 2022. Therefore, there was no monitoring by him at all prior to that time.

184. Every Risk Assessment or Job Hazard Analysis with respect to any project dealing with subsea works involving pipelines ought to address what we regard as an obvious risk of Delta P. There should be a section in every risk assessment under which this hazard is considered and specific control measures are identified.

185. The Incident Command System should be reconfigured to address operational emergencies which may be regarded as exceptional. This would assist with the

development of an action plan specifically identifying the control measures and what resources are necessary to conduct any rescue.

186. Under the Incident Command System, there should more regular training and drilling and the Incident Command System periodically audited. Consideration should be given to the establishment of a rotating Incident Commander so that depending on the nature of the emergency the most suitable trained and qualified Incident Commander would be automatically appointed.

187. High risk activities should be scheduled only on those dates and times when the key members of the Incident Command Team are on site. The evidence discloses that when this accident occurred, none of the key members of the ICT were at Paria's compound. The evidence also showed that even though the incident occurred at 2.45 p.m. the ICT was convened close to 5:00 p.m.

188. The protocols for the establishment, training and drilling of the ICT should be accessible to regulators and periodically updated and tested. It should be supported by an active communications team which will ensure (without the need for direction by the Incident Commander) that victims' families can be accommodated, supported and communicated with on a timely basis.

189. Consideration should be given to having OSHA regulate the operations of the Incident Command System and this includes OSHA regulating the composition, training, procedure and drilling of the Incident Command System and requiring these to be certified annually as fit for purpose.

190. There are no compulsory diving standards in Trinidad and Tobago. There are, however, voluntary standards which have issued by Trinidad and Tobago Bureau of Standards. However, those standards have not been made compulsory due to a lack of consensus among the stakeholders. Also, because they are voluntary, they are not enforced.

191. Accordingly, it is recommended:-

(a) that Paria and similar companies adopt and maintain international best practice for commercial diving in relation to its subsea repair and maintenance jobs;

(b) The Trinidad and Tobago Bureau of Standards be invited to prepare and implement (following stakeholder consultation) a compulsory standard regulating the commercial diving industry in Trinidad and Tobago; and

(c) OSHA implement regulations so that international best practice can be implemented in relation to health and safety on the subsea worksite.

192. In pipelines less than 48 inches in diameter, that consideration be given to augment existing pipelines and for all new pipelines to be configured to permit, particularly at the elbows, an additional installation or design to permit divers to be able to turnaround.

193. The Accreditation Council of Trinidad and Tobago be appointed an Accreditation Agency for commercial diving in Trinidad and Tobago by amending the Accreditation Council of Trinidad and Tobago Act Chapter 39:06.

OSHA'S POWERS TO PROSECUTE UNDER THE OSH ACT

194. Having regard to OSHA's Preliminary Report [**CB 458]** which suggests that both Paria and LMCS may be guilty of various offences under the OSH Act, the Commissioners may consider, based on the evidence, to recommend proceedings by OSHA.

195. **Section 91 (2) of the OSH Act** permits OSHA, following any accident in an industrial establishment and where it appears from the Commission's Report that the OSH Act was not complied with, to bring summary proceedings against the person liable to be proceeded against in respect of such non-compliance and these proceedings are required to be commenced within six (6) months after the making of the Commission's Report.

196. **The OSH Act** imposes duties on employers, occupiers, employees, manufacturers and suppliers of goods. Some of these duties are owed not only to persons working at the

industrial establishment, but also to visitors and persons who might be affected by the activities carried out at the industrial establishment.

197. **<u>Section 86 (1) of the OSH Act</u>** states as follows:-

> "*<u>Subject to subsection (2), where a person dies, is critically injured or develops an occupational disease in consequence of an employer, occupier or owner having contravened this Act, the employer, occupier or owner shall, without prejudice to any other liability or right of action arising out of the death or critical injury</u> or disease, be liable to a fine of one hundred thousand dollars, or of an amount equivalent to three years pay of that person, whichever is greater, and the whole or part of the fine may be applied for the benefit of the victim or of his estate, or otherwise as the Court may determine*." (our emphasis)

198. It is submitted that the evidence discloses breaches of the OSH Act by LMCS (as employer of the deceased/injured divers) and by Paria (as occupier of Berth 6).

199. The jurisdiction to hear and determine such complaints brought by an Inspector pursuant to the OSH Act lies in the Industrial Court (**<u>section 83 (1) of the OSH Act</u>**) but also the Magistrates' Court (**<u>section 80 of the OSH Act</u>**).

200. Therefore, OSHA has a statutory power to file a complaint against Paria/LMCS in the Industrial Court or in the Magistrates' Court for breaches of the OSH Act/Regulations in accordance with **<u>section 83(1)</u>** and **<u>section 80 of the OSH Act</u>** respectively.

201. We therefore recommend that the Commissioners consider making recommendations to OSHA pursuant to the provisions of the Act.

<u>CRIMINAL PROCEEDINGS</u>

202. Mr. Prakash Ramadhar on behalf of some relatives of the divers raised the issue of the Commissioners making recommendations for criminal prosecution arising from the evidence before the Commission. This issue has been engaging the attention of the legal

team assisting me and we undertake to provide to the Commissioners a written opinion when the research is completed so that the Commissioners will have it before they compile their Report.

203. We would have that research completed within the next 7 days. The law in this area has been developing and there is a decision in Trinidad and Tobago in the case of **INQ 10 of 2008: In the Inquest into the death of Ojo Moyo Oliver**. This is a decision of Her Worship Magistrate Nalini Singh delivered on 22 April 2009 sitting as a Coroner and who was recently appointed as a High Court Judge. There have been other cases decided in other jurisdictions which must be looked at before we conclude our opinion. One of the principles of law is that where there is gross negligence and/or recklessness whether by positive acts or omission which result in the death of an individual, there can be a prosecution for manslaughter.

204. That Legal Opinion which I would send to the Commissioners would not be made public and it would not be put on the Commission's website. That would be a private and confidential document.

Dated this 13th day of January 2023

Ramesh L. Maharaj S.C.

PARIA FUEL TRADING COMPANY LIMITED

Registered Office: #9 Queen's Park West, Port of Spain, Trinidad

Telephone (868) 612-2463

January 27th 2023.

Ms. Sarah Sinanan
Secretary to the Commission
Southern Academy for the Performing Arts (SAPA)
Todd Street. San Fernando

Dear Ms. Sinanan

Re: Commission of Enquiry into the circumstances which led to the tragic incidents which occurred on February 25th 2022 at facilities owned by Paria Fuel Trading Co. Ltd ("**Paria**") located at No. 36 Sealine Riser on Berth No. 6. Pointe-à-Pierre.

On the 13th January, 2023, Lead Counsel to the Commission, Mr. Ramesh Maharaj S.C., in the course of his closing address, made reference to a letter dated 20th July, 2022 from Paria to the Occupational Safety and Health Agency ("**OSHA**"). A copy of the said letter is attached for ease of reference.

Having referred to the said letter, the following exchange took place between Mr. Maharaj S.C and the Chairman to the Commission:

> "***Mr. Chairman:*** *Yes. So they were able to tell the amount of hydrocarbon—*
> ***Mr. Maharaj SC****: In the underwater—*
> ***Mr. Chairman****:— that came out of the pipe after—*
> ***Mr. Maharaj SC****: Yes.*
> ***Mr. Chairman****:—the incident happened, in other words, when they were pumping in order to recover the bodies, and they described that as about 125 barrels, but they were unable, at the time that this document was signed by Mr. Mushtaq Mohammed on the 20th of July, to tell OSHA how much had been taken out of the pipe before the accident happened.*
> ***Mr. Maharaj SC****: Yes.*
> ***Mr. Chairman****: Well that's not true, is it?*
> ***Mr. Maharaj SC****: No.*
> ***Mr. Chairman****: I mean, they did know?*
> ***Mr. Maharaj SC****: Yes, they did know.*

Mr. Chairman: *I mean, those daily report records were contemporaneous, were they not?*
Mr. Maharaj SC*: Yes. And they were dated when? From where? And I'm reminded that those records were compiled contemporaneously so in January and February of 2022.*
Mr. Chairman*: As and when it happened?*
Mr. Maharaj SC*: As and when it happened.*
Mr. Maharaj SC*: Yes.*
Mr. Chairman*: And so to say, as he does in OSHA's inquiry back in July of last year: "Given the configuration of the system it is* ***impossible*** ***<u>to segregate</u>*** ***and measure*** *the displaced volume", that is simply not the case, is it?*
Mr. Maharaj SC*: No.*
Mr. Chairman*: Or even if you were unable to give an exact figure, he was certainly in a position, was he not, to have given the figures that you've given us before we had the break?*
Mr. Maharaj SC*: Yes.*
Mr. Chairman*: One thousand two hundred and fifty-two barrels?*
Mr. Maharaj SC*: And this is a letter signed by the head of Paria.*
Mr. Chairman*: Yes. It's perhaps a pity we didn't put this to Mr. Mohammed when he was here.*
Mr. Maharaj SC*: Yes.*
Mr. Chairman*: Because it's something that perhaps he ought to have explained. What I'm going to do is this. This is obviously quite a serious matter. I think that the sensible thing would be to allow Mr. Mohammed, Mushtaq Mohammed, to address this.*
Mr. Maharaj SC*: Yes.*
Mr. Chairman*: So I'm going to ask Mr. Peterson, obviously it's of some importance, and there may be a perfectly good explanation, so can I ask that you invite Mr. Mushtaq Mohammed to have a look at the letter that he wrote? I mean, obviously it's been part of the bundle from the start to finish so it's not as though it's only something that's just emerged. It's perhaps, as I say, a little lamentable that this wasn't-- that he wasn't asked about it when he gave evidence, but, no loss. What we can do is, perhaps you'll be good enough to provide him with a copy of this and ask him if he would be good enough to explain what he meant by, in paragraphs four and five, if he's able and we will take that into account."*

In light of the above exchange Paria wishes to place on record the following facts and matters for consideration by the Commission.

1. Insofar as the exchange between the Chairman and Mr. Maharaj S.C suggests and/or implies that Paria knew how many barrels of hydrocarbons were taken out of Sealine 36 <u>and/or</u> that Paria misrepresented the true position to OSHA in relation to this issue, that suggestion is wholly erroneous owing to the following facts and matters:

   (a) At all material times Paria did not know the volume of hydrocarbons contained in Sealine 36. The Sealine had been out of commission for a considerable period of time during Petrotrin's (Paria's predecessor) operations due to a leak. Additionally, Paria had no estimate in its possession as to the volume of hydrocarbons in the line.

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(b) Sealine 36 (which is 30 inches in diameter) was temporarily connected into Sealine 66 crude system (which is 50 inches in diameter and consists of a network of pipes configured in a non-linear fashion) which in turn fed into Storage Tank No. 111 during the relevant period.

(c) The length of Sealine 66 from the point where it intersects with Sealine 36 to Storage Tank No 111 is 14,025 ft with a calculated volume of approx. 33,660 barrels.

(d) Although Paria does not precisely know the volume of hydrocarbons which were contained in Sealine 66 piping network during the months of January and February, 2022, it does know, from the general nature of its operations due to thermal expansion and its loading operations, that Sealine 66 is normally not completely filled with hydrocarbons thereby leaving vapour spaces within the line. Those vapour spaces have been known to range anywhere between 3% and 5% of the capacity of the line.

(e) The method employed by LMCS for moving hydrocarbon content out of Sealine 36 was air blowing at a pressure of 40 psi. Further, given that Sealine 36 empties into Sealine 66 and Sealine 66 in turn is emptied into Storage Tank 111, air blown in this manner will not be confined to Sealine 36. It will necessarily filter into Sealine 66 and Tank 111.

(f) Accordingly, the process of air blowing caused both the movement of hydrocarbons contained in Sealine 36 and the movement of hydrocarbons contained in Sealine 66. The process of air blowing:

- resulted in a commingling of hydrocarbon content from both Sealines within Sealine 66 which was ultimately emptied into Storage Tank 111; and/or

- caused hydrocarbons from Sealine 66 to be moved into Tank 111 without a measurable volume attributable to Sealine 36.

(g) Paria's "*Maintenance Department Daily Work Report*" referred to by the Chairman and Mr. Maharaj SC in the extract of the transcript of proceedings referred to above does not constitute a record of what volume was drained into Storage Tank 111 from Sealine 36 only but is instead a combination of hydrocarbons derived from both Sealine 36 and Sealine 66.

(h) Accordingly, although Paria's *Maintenance Department Daily Work Reports*" which are in evidence before the Commission show approx. 1247 barrels of hydrocarbons (18 Jan 798 barrels; 21 Jan 118 barrels, 3 Feb 276 barrels and 3 Feb 55 barrels) being drained into Storage Tank 111, that aggregate figure cannot properly be attributed to content from Sealine 36 only.

(i) At all material times Paria did not have a system in place which allowed the amount of content drained from each of Sealine 36 and Sealine 66 into Storage Tank 111 to be individually measured. Additionally, the nature of Paria's commercial operations did not and does not require it to have such a segregated system in place.

(j) Further, the figures shown in Paria's "*Maintenance Department Daily Work Reports*" ought to be viewed with caution and treated as potentially unreliable. This is because temperature correction factors were never used for the volumes recorded on the Paria's "*Maintenance Department Daily Work Reports*" relative to the quantity of hydrocarbons drained into Storage Tank 111. In this connection it is critical to note that a 5 degree difference in tank temperature during the course of the day accounts for a difference of measurement of 401 barrels in Tank 111 at a 20 foot tank as level.

(k) The fact that temperature correction factors were not taken into account is understandable because the levels in Storage Tank 111 were being monitored for the limited purpose of ensuring that the process of air blowing was working and not otherwise. This was required because, as the Daily Work Reports show, on some days no product was received in Storage Tank 111 notwithstanding that air blowing was in progress.

Accordingly, Paria's response to OSHA at item 4 of its letter dated 20th July, 2022 was correct in all material respects.

2. Insofar as the Chairman's remarks suggest that Paria did not provide OSHA with Paria's "*Daily Work Reports*" (see pgs 992 to 1019 of the Core Bundle) for any and/or all of the following days:

<u>January</u> 1st, 2nd, 3rd, 18th , 19th , 20th, 21st, 22nd, 23rd, 25th and 31st

<u>February</u> 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 21st, 22nd, 23rd and 24th

the same is wholly erroneous and misleading as those reports were in fact provided to OSHA by Paria under cover of email dated 15 August 2022 issued by Paria's Randolph Archbald to OSHA's representatives.

The text of the entire email (which is enclosed) reads as follows:

> "***From:*** *Archbald, Randolph <Randolph.Archbald@paria-tt.com>*
> ***Sent:*** *Monday, 15 August 2022 10:08 pm*
> ***To:*** *fayola.mcdonald@osha.gov.tt; jason.loorkhoor@osha.gov.tt*
> ***Cc:*** *Gretel Baird <gretelbaird@outlook.com>; Ali, Anesia <Anesia.Ali@paria-tt.com>; Gayadeen, Sanjay <Sanjay.Gayadeen@paria-tt.com>; Sinanansingh, Joanne <Joanne.Sinanansingh@paria-tt.com>*
> ***Subject:*** *Response to OSH August 15 2022*
>
> *Hello Ms McDonald,*

Please find attached letter and link with information requested by OSH Agency. If you have any difficulties accessing the link please contact us immediately.

OSHA 6th Response – 15th August 2022

Randy Archbald
HSEQ
Paria"

In particular, the link which is referenced in the body of the email as "*OSHA 6th Response – 15th August 2022*", once clicked, takes the reader to a folder entitled "*Item 11- Daily Work Reports and Project Schedules*" where all of the relevant "Daily Work Reports" can be found.

In the circumstances, Paria trusts that the foregoing adequately addresses the matters arising out of the exchange between the Chairman and Mr. Maharaj S.C.

Yours faithfully
PARIA FUEL TRADING COMPANY LIMITED

Mushtaq Mohammed

MUSHTAQ MOHAMMED
General Manager

PARIA FUEL TRADING COMPANY LIMITED

Registered Office: #9 Queen's Park West, Port of Spain, Trinidad

Telephone (868) 612-2463

20th July 2022

Ms. Fayola Mc Donald
Safety & Health Inspector I
Occupational Safety and Health Agency
Level 5, Duke Place
Duke Street
PORT-OF-SPAIN

Dear Ms. Mc Donald

Re: <u>Critical accident that occurred at Berth #6 Paria Fuel Trading Company Limited located at Southern Main Road, Pointe-a-Pierre on 25th February 2022, involving Mr. Christopher Boodram, Mr. Kazim Ali Jr., Mr. Rishi Nagassar, Mr. Yusuf Henry and Mr. Fyzal Kurban</u>

Reference is made to the matter at subject, your letters dated 1st July 2022 and 12th July 2022 relative to the OSH Agency's ongoing investigation.

PARIA previously provided to the OSH Agency information and documents on 25th March 2022 and 4th April 2022 pursuant to requests made by Mr. Jason Loorkhoor, Safety & Health Inspector II on 3rd March 2022 and 16th March 2022. Further, information was submitted on 15th July 2022 pursuant to your request by letter dated 14th June 2022. There were two (2) outstanding items requiring responses from PARIA, items 1 and 18. We advised that our response to item 18 would be provided by 20th July 2022, however, compiling this information is taking longer than expected and we herein request an extension of time to 29th July 2022 to respond to same.

In response to your request by letter dated 1st July 2022, we herein submit the following:

1. **The method statement and risk assessment for the removal of hydrocarbon from Sealine 36 between Berths 5 and 6 prior to the installation of the subsea slip-on flange 30" diameter.**

   Response:
   PARIA's procedure and LMCS Ltd. Job Safety Analysis for Clearing of 36 SL section between Berth 5 and Berth 6 provided in folder titled "Item 1 – Procedure and JSA".

Ms. Fayola Mc Donald
Safety & Health Inspector I
Occupational Safety and Health Agency
Re: Critical accident that occurred at Berth #6 Paria Fuel Trading Company Limited located at Southern Main Road, Pointe-aPierre on 25th February 2022, involving Mr. Christopher Boodram, Mr. Kazim Ali Jr., Mr. Rishi Nagassar, Mr. Yusuf Henry and Mr. Fyzal Kurban

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2. Clarification on whether an air driven pump or an air compressor was used to remove hydrocarbon from Sealine 36 between Berths 5 and 6 prior to the installation of the subsea slip-on flange 30".

Response:
PARIA confirms that an air compressor provided by LMCS Ltd. was used to remove hydrocarbon from Sealine 36 between Berths 5 and 6 prior to the installation of the subsea slip-on flange 30".

3. The rationale for utilizing the equipment, in item 2, above to remove content from the Sealine 36 diameter between Berths 5 and 6

Response:
An air compressor was logistically more practical given the configuration of the pipeline.

4. The volume of hydrocarbon removed from Sealine 36 between Berths 5 and 6 prior to the installation of the subsea slip-on flange 30" diameter as per method statement.

Response:
Given the configuration of the system it is impossible to segregate and measure the displaced volume.

5. The volume of hydrocarbon removed from Sealine 36 between Berths 5 and 6 after the accident.

Response:
The volume of hydrocarbon removed is estimated at 125bbls. The quantity is based on the estimated spilled hydrocarbons (6bbls) and the recorded volumes of hydrocarbons recovered in the Sea Manatee (119.8bbls).

6. A description as to how the water level was maintained within the positive pressure enclosure (habitat) during dry works.

Response:
Compressed air was continuously supplied to the positive pressure enclosure (habitat) during dry works. The air compressor was located on the crane barge (Adventurer 1) and via hoses, was routed to the positive pressure enclosure (habitat). The air supplied was sufficient to maintain the water level at the bottom of the positive pressure enclosure and catered for leakage, namely at the crane cable nozzle ports, top vent valve and top flange.

7. **Evidence as to how the air pressure was maintained within the positive pressure enclosure (habitat) during dry works.**

Response:
PARIA does not have this evidence as LMCS Ltd. was responsible for the works within the positive pressure enclosure (habitat).

8. **A measurement which indicates how far below the newly installed 30" diameter flange was the water level in the habitat during dry works.**

Response:
PARIA does not have this measurement recorded as LMCS Ltd. was responsible for the works in the hyperbaric chamber.

9. **The distance of the water level within the pipeline below the newly installed slip-on flange 30" diameter, prior to the accident.**

Response:
PARIA is still reviewing its records to respond to this item. We will provide a response on or before 29th July 2022.

10. **Clarification on whether the flange was blinded at Berth 5 at the time of the incident.**

Response:
The flange was blinded at Berth 5 at the time of the incident. The blind flange was temporarily installed as the final tie-in spool was to be re-installed at a later date.

11. **The project schedules inclusive of the daily progress reports submitted to Paria Fuel Trading Company Limited from the commencement of the project to the day of the accident, in accordance with Paria Fuel Trading Company Limited, Scope of Work Technical Section 8.8.3.**

Response:
PARIA is still reviewing its records to respond to this item. We will provide a response on or before 29th July 2022.

Ms. Fayola Mc Donald
Safety & Health Inspector I
Occupational Safety and Health Agency
Re: Critical accident that occurred at Berth #6 Paria Fuel Trading Company Limited located at Southern Main Road, Pointe-aPierre on 25th February 2022, involving Mr. Christopher Boodram, Mr. Kazim Ali Jr., Mr. Rishi Nagassar, Mr. Yusuf Henry and Mr. Fyzal Kurban

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Please see enclosed for your records the following documents:

1. List of documents submitted by duty holder to Occupational Safety and Health Agency; and
2. Statement of Truth.

Should you have any further queries, the Company stands ready to co-operate fully herein.

Yours faithfully
PARIA FUEL TRADING COMPANY LIMITED

MUSHTAQ MOHAMMED
General Manager

From: Archbald, Randolph <Randolph.Archbald@paria-tt.com>
Sent: Monday, 15 August 2022 10:08 pm
To: fayola.mcdonald@osha.gov.tt; jason.loorkhoor@osha.gov.tt
Cc: Gretel Baird <gretelbaird@outlook.com>; Ali, Anesia <Anesia.Ali@paria-tt.com>; Gayadeen, Sanjay <Sanjay.Gayadeen@paria-tt.com>; Sinanansingh, Joanne <Joanne.Sinanansingh@paria-tt.com>
Subject: Response to OSH August 15 2022

Hello Ms McDonald,
Please find attached letter and link with information requested by OSH Agency.
If you have any difficulties accessing the link please contact us immediately.

OSHA 6th Response – 15th August 2022

Randy Archbald
HSEQ
Paria

PARIA FUEL TRADING COMPANY LIMITED

Registered Office: #9 Queen's Park West, Port of Spain, Trinidad

Telephone (868) 612-2463

15th August 2022

Ms. Fayola Mc Donald
Safety & Health Inspector I
Occupational Safety and Health Agency
Level 5, Duke Place
Duke Street
PORT-OF-SPAIN

Dear Ms. Mc Donald

Re: <u>Critical accident that occurred at Berth #6 Paria Fuel Trading Company Limited located at Southern Main Road, Pointe-a-Pierre on 25th February 2022, involving Mr. Christopher Boodram, Mr. Kazim Ali Jr., Mr. Rishi Nagassar, Mr. Yusuf Henry and Mr. Fyzal Kurban</u>

Reference is made to the matter at subject, your letters dated 14th June 2022 and 1st July 2022 relative to the OSH Agency's ongoing investigation and our responses dated 15th July 2022, 20th July 2022 and 29th July 2022.

At the date of writing only two requests from the OSH Agency remain to be satisfied, namely:

(a) OSH Agency's request, pursuant to item 1 of its letter dated 14th June 2022, for:

1. Internal accident investigation reports containing the following:

i. a description of the accident and how it occurred
ii. the immediate and root cause(s) of the accident
iii. any corrective measures instituted to prevent reoccurrence
iv. witness statements from all relevant parties

(b) OSH Agency's request, pursuant to item 11 of its letter dated 1st July 2022, for:

11. The project schedules inclusive of the daily progress reports submitted to Paria Fuel Trading Company Limited from the commencement of the project to the day of the accident, in accordance with Paria Fuel Trading Company Limited, Scope of Work Technical Section 8.8.3.

Ms. Fayola Mc Donald
Safety & Health Inspector I
Occupational Safety and Health Agency
Re: Critical accident that occurred at Berth #6 Paria Fuel Trading Company Limited located at Southern Main Road, Pointe-aPierre on 25th February 2022, involving Mr. Christopher Boodram, Mr. Kazim Ali Jr., Mr. Rishi Nagassar, Mr. Yusuf Henry and Mr. Fyzal Kurban

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As to request (a) above:

The process of compiling the report is ongoing. A copy will be forwarded to the OSH Agency once finalised.

As to request (b) above:

The revised project schedules submitted by LMCS Ltd. to PARIA on 19th January 2022 and 28th January 2022 are enclosed. These project schedules are provided in folder titled "*Item 11 – Daily Work Reports and Project Schedules*".

LMCS Ltd. provided their daily progress reports verbally which PARIA included in the Daily Work Report for offshore works. These reports are provided in folder titled "*Item 11- Daily Work Reports and Project Schedules*".

Please see enclosed for your records the following documents:

1. List of documents submitted by duty holder to Occupational Safety and Health Agency; and
2. Statement of Truth.

Should you have any further queries, the Company stands ready to co-operate fully herein.

Yours faithfully
PARIA FUEL TRADING COMPANY LIMITED

Michael Wei

MICHAEL WEI
Technical and Maintenance Manager

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COMMISSION OF ENQUIRY
INTO
ALL OF THE CIRCUMSTANCES WHICH LED TO THE TRAGIC INCIDENTS WHICH OCCURRED ON FRIDAY FEBRUARY 25, 2022, AT FACILITIES OWNED BY PARIA FUEL TRADING COMPANY LIMITED, LOCATED AT NO. 36 SEALINE RISER ON BERTH NO. 6, POINTE-A-PIERRE, WHICH LED TO THE DEATHS OF FOUR (4) EMPLOYEES OF LMCS LIMITED

SUBMISSIONS OF LMCS LIMITED ON LEGAL PROPOSITION RELATING TO NEGLIGENCE AND/OR CRIMINAL LIABILITY OF PARIA FUEL TRADING COMPANY LIMITED

BRIEF OVERVIEW

The Commission of Enquiry was appointed by the President of the Republic of Trinidad and Tobago.

The Commission is in charge of its own procedure and by Rules issued on 13th July, 2022 under **section 9 of the Commissions of Enquiry Act Chapter 19:01**, it published those rules. The Evidential hearings were concluded on the 13th January, 2023, which is specific to the Commission's Terms of Reference at (1) (i-xii) concerned mainly with the inquisition into facts. However, arising from these Term of Reference at (2), is the Commission's mandate:

To make such findings, observations and recommendations arising out of its deliberations, as may be deemed appropriate, in relation to:

1. whether there has been any breach of duty by any persons or entities;
2. whether there are any grounds for any criminal proceedings to be initiated against any persons or entities;
3. whether criminal proceedings should be recommended to the Director of Public Prosecutions for his consideration;
4. the appropriate and best practices and/or policies and/or procedures to be utilised by companies such as Paria and LMCS for the conduct of these types of maintenance exercises and in response to these types of incidents;
5. the policies, measures, mechanisms and systems that should be implemented to prevent the recurrence of the tragic incidents which occurred on Friday February 25, 2022 and continuing up to the recovery of the bodies of the four (4) LMCS' divers; and
6. making any other recommendations that may be deemed necessary in the circumstances.

INVITATION FOR LEGAL SUBMISSIONS

On the final day of Live Evidential Hearing on 13th January, 2023, the Hon. Chairman to the Commission invited the parties, apart from the Legal Team to the Enquiry, to proffer their respective legal submission on the narrow issue of THE DUTY TO RESCUE the LMCS Limited (hereinafter "LMCS") workers trapped within the S.L. 36 between Berth

No. 5 and Berth No.6. With permission obtained from the Commission's Secretariat, these are the submissions on behalf of LMCS Limited.

UNCONTROVERTED EVIDENCE

It is uncontroverted evidence is that Paria prevented and/or directed and/or withdrew permission to LMCS Limited (whether by its own personnel or its volunteer divers on their behalf) to mount a rescue of the 4 men- Fyzul Kurban, Kazim Ali Jr, Rishi Nagassar and Yussuf Henry.

MULTIPLE CAUSES OF ACTION IN NEGLIGENCE

It may well be undisputed that the law is settled in respect of the proposition that Paria Fuel Trading Company Limited (hereinafter "Paria") has a non-delegable duty of care owed to the workers of LMCS Ltd at SL 36, Berth No. 6 on the 25th February, 2022. This proposition is supported on both a factual and legal front- classification of the works as "high risks", extrapolation from the evidence of the fact of the job being inherently dangerous and subject to the PTW system. See: the development of the principles that the employer's duty are threefold- "competent staff, adequate material and a proper system and effective supervision" **Wilsons and Clyde Coal co. v English** [1938] A.C. 57 to the local case of CV 2015-03381 **Ray Cheddie and Anor v National Infrastructure Development Company Limited** (already referenced by Counsel to the Commission in his submissions made on 13th January, 2023).

This particular non-delegable duty of care to which Paria is saddled is however separate and apart from the duty under consideration. That is to say, **the duty of Paria Fuel Trading Company Limited to ensure that LMCS Ltd workers trapped in SL 36 were rescued or, alternatively stated, that Paria had a duty to allow rescue attempts of the 4**

workers trapped in S.L. 36. Consequently, there are multiple breaches of duty arising from the incident of 25th February, 2022 leading to the death of the 4 LMCS employees.

THE DUTY OF CARE IN NEGLIGENCE

The general concept of duty of care is best explained in the treatise **Charlesworth & Percy on Negligence 12th Ed at paragraph 2.2** as follows:

"The word "duty" connotes a relationship by which an **obligation is imposed** upon one person for the benefit of another to take reasonable care in all the circumstances. Whether or not a duty of care exists on given facts is a **question of law**. Unless the existence of such a duty can be established, an action in negligence must fail. As Lord Wright put it in *Grant v Australian Knitting Mills Ltd*:

> "All that is necessary as a step to establish the tort of actionable negligence is to define the precise relationship from which the duty to take care is deduced. It is, however, essential in English law that the duty should be established: **the mere fact that a man is injured by another's act gives in itself no cause of action**: **if the act is deliberate, the party injured will have no claim in law even though the injury is intentional, so long as the other party is merely exercising a legal right:** if the act involves lack of due care, again no case of actionable negligence will arise unless the duty to be careful exists." (emphasis mine).

This is the justified veil behind which Paria, seems to be carefully shielding behind in its IMT's indecision to mount a rescue for the 4 LMCS workers and/or allow LMCS rescue divers to mount its rescue plans. This is so since on the face of the law, there seems to be no legal obligation which imposes a duty to rescue.

DUTY TO RESCUE AT COMMON LAW

There is no general duty to rescue a person in peril. In **Hargrave v Goldman** (1963) 110 CLR 40 at page 66 per Windeyer J it was stated that the law "casts no duty upon a man to go to aid of another who is in peril or distress, **not caused by him**". As such, it is fortunate that for every rule there must be exceptions. Lord Nicholls of the House of Lords in the case of **Stovin v Wise** [1996] 3 ALL ER 801 at page 807 states:

> "…the **bystander does not owe** the drowning child or the heedless pedestrian a duty to take steps to save him. **Something more is required** than being a bystander**. There must be some additional reason why it is fair and reasonable that one person should be regarded as his brother's keeper and have legal obligations in that regard**." (emphasis mine)

This proposition was the premise of the address by Chief Justice Terrence Higgins of the Supreme Court of the Australian Capital Territory titled "The Rescuer's Duty of Care". Chief Justice Higgins went on to state that there are 2 instances where **such a duty to rescue may arise**. The first being where the danger was created by the rescuers themselves: **Sutherland Shire Council v Heyman** (1985) 157 CLR 424 at pages 478-479. The second **circumstance arising from relationship between the endangered and the rescuer**: **Horsley v MacLaren** (1971) 22 DLR 3rd 545 (emphasis mine). At any rate, Chief Justice Higgins went on to state that common examples of such relationships include that of employers and employees.

In **Horsley v MacLaren**, *op cit* "M, an invited guest on a cabin cruiser, which was owned and was being operated by the respondent K, accidentally fell overboard. In the course of rescue operations, another invited guest, H, dived into the water to help him. The effort was without avail. The rescuer was pulled from the water by others on board, could not be resuscitated and was later pronounced dead. The body of the rescuee was never recovered. It was held per curiam **that there was a duty on the part of the respondent K in his capacity as a host and as the owner and operator of the cabin cruiser to do the**

best he could to effect the rescue of M." The majority of the Court decided that the rescue effort of the boat owner/operator, which was not done to recommended standard, was not a matter of negligence but a matter of error of judgment. There was dissent to this finding. There are two crucial elements of this case that are noteworthy. The first being that the obligation to rescue arose from the relationship between the owner/operator of the boat and invited guest. The second element being that the boat owner/operator did as a matter of fact employ a rescue manoeuvre.

It is uncontroverted that LMCS employees were present at Berth No. 6 at SL 36 for the sole purpose of executing works for Paria. There was an employer/contractor or employer/employee relationship in existence. It is fair and reasonable to accept that this relationship created the fertile ground for the duty to rescue to arise. Further, after Christopher Boodram's emergence followed by Michael Kurban's failed attempt to rescue the men (but his safe return from SL 36), Paria, as a matter of uncontroverted fact prevented any diving into SL 36, which sole purpose was for rescue. In other words, rescue was PREVENTED. Sometime between 6:30 PM and 7:00 PM on the said 25th February, 2022 LMCS Limited possessed the requisite man-power and equipment to proceed with rescue.

DECISION TO PREVENT LMCS DIVERS FROM RESCUE BY PARIA

Quite apart from the relationship of employer/contractor Paria is the owner/controller of the asset in question, i.e., SL 36. Paria has in its evidence disclosed that it could not allow rescue efforts as LMCS divers were "emotional" and considered instead the dangers to the rescuer. The facts below seem to have played little significance to Paria:

- That the divers were competent and possessed the requisite equipment. This should have been considered favourably by Paria, both at the material real time of the unfolding of the events on 25th February, 2022 and in hindsight.

- That the divers were suitably qualified and by the time of Christopher Boodram's unaided emergency from the pipeline, it was REASONABLE to assume that a strong, competent diver with all the necessary equipment would have been successful in mounting a rescue for the retrieval of the men or even introduction of breathable air to the men for their eventual rescue or at the very least allow for the development of an alternative rescue plan.

In **Tomlinson v. Congelton Borough Council** [2004] 1 AC 46, a matter concerning damage sustained by the Tomlinson while using a public lake, Lord Hoffman addresses "free will" as follows:

45. *I think it will be extremely rare for an occupier of land to be under a duty to prevent people from taking risks which are inherent in the activities they freely choose to undertake upon the land. If people want to climb mountains, go hang gliding or swim or dive in ponds or lakes, that is their affair. Of course the landowner may for his own reasons wish to prohibit such activities. He may be think that they are a danger or inconvenience to himself or others. Or he may take a paternalist view and prefer people not to undertake risky activities on his land. He is entitled to impose such conditions, as the Council did by prohibiting swimming.* ***But the law does not require him to do so****.*

At paragraph 46 he continues *"A duty to protect against obvious risks or self-inflicted harm exists only in cases in which there is no genuine and informed choice, or in the case of employees, or some lack of capacity, such as the inability of children to recognise danger (British Railways Board v Herrington [1972] AC 877) or the despair of prisoners which may lead them to inflict injury on themselves (Reeves v Commissioner of Police [2000] 1 AC 360).*

47. *It is of course understandable that organisations like the Royal Society for the Prevention of Accidents should favour policies which require people to be prevented from taking risks. Their function is to prevent accidents and that is one way of doing so. But they do not have*

to consider the cost, not only in money but also in deprivation of liberty, which such restrictions entail. The courts will naturally respect the technical expertise of such organisations in drawing attention to what can be done to prevent accidents. But the balance between risk on the one hand and individual autonomy on the other is not a matter of expert opinion. It is a judgment which the courts must make and which in England ***reflects the individualist values of the common law." (emphasis mine)***

While these views were expressed in the context of a person engaging in a risky recreational activity in a public space, it is instructive as to the choices taken by individuals, whether as recreation or to rescue. In various territories there have been legalisation which have been promulgated to address the issue of negligence of rescuers. This however does not arise in this case, as there was no rescue allowed.

As stated in the closing address of LMCS, Paria's modus operandi on the 25th February, 2022 up until 27th February, 2022 seemed to have been guided by the proposition of Law that: "one must take care not to cause injury to others, but there is no general duty to act for the benefit of others. The rule is that I must not harm my neighbour (misfeasance), not that I am required to save him (nonfeasance). "*The very parable of the good Samaritan…which was invoked by Lord Atkin in* ***Donoghue v Stevenson****…illustrates, in the conduct of the priest and the Levite who passed by on the other side, an omission which was likely to have as its reasonable and probable consequence damage to the health of the victim of the thieves, but for which the priest and the Levite would have incurred no civil liability in English Law."* Page 92 Winfield and Jolowitcz on Tort 13th edition taken from **Home Office v Dorset Yacht Co. Ltd** [1970] A.C. 1004 at 1060 per Lord Diplock. It seems however, that this was gross negligence on Paria's part.

CRIMINAL LIABILITY AT LAW ON GROSS NEGLIGENCE

In the case **of Inquest into the death of Ojo Moyo Oliver**, INQ 10 of 2008, Nalini Singh (sitting as Coroner) as she then was, aptly summarizes the law at page 12 as follows:

> *"It is stated in **Archbold 2008** at paragraph 19-110 that where an allegation of manslaughter is based on **AN OMISSION TO ACT** (not itself being unlawful), the issues to be left to the jury are whether a duty of care was owed to the deceased, whether there has been a breach of that duty; whether the breach caused death; and whether it should be characterised as gross negligence and, therefore a criminal act.*
>
> ***Charlesworth & Percy on Negligence** (London: Sweet and Maxwell, 2006) is also useful in this regard since it is stated at paragraph 1-16 under the rubric "Criminal Negligence" that "it must be proved, to the criminal standard, that the conduct of the accused was, in the first instance, such as to amount to **a breach of duty of care towards the victim**. The Crown must then show that the negligence in question **caused the victim's death** and should be characterized as gross negligence and therefore a crime. It is for the judge to direct the jury whether the facts are capable of giving rise to a duty of care and for the jury to decide, in light of the judge's directions, whether there was indeed such a duty on the particular facts. The jury must then consider whether, having regard to the risk of death, the accused conduct was so bad in all the circumstances as to amount to a criminal act or omission."*

The evidence already summarized is worth repeating as it shows that:

1. Paria prevented LMCS Ltd. from executing rescue plans that were continuously modified as more resources and information came to hand.

2. Paria closed out work permit soon after the incident in its first step at preventing LMCS from attempting a rescue, prior to Christopher Boodram's unaided emergency into the chamber.

3. Subsequent to Christopher Boodram's emergence, Michael Kurban attempted a rescue dive but the length of the breathing apparatus was not long enough to go far into the horizontal portion of SL 36.

4. Paria knew of Michael Kurban's safe emergence from the pipe in his attempted rescue, without oil on his person, but ignored the significance of same towards allowing rescue when additional competent, qualified divers and equipment came on site.

5. Paria did not attempt and rescue over 25th, 26th, 27th February 2022.

6. Paria was informed of proof of life within the pipeline; distress signalling continued up to and beyond 2:30AM Saturday 26th, 2022. Instead of acting on proof of life, Paria chose to discredit:
   (i) The knocking heard emanating from the pipe at #5, saying it was noise from the equipment running at #6 Berth, a distance of a quarter mile away.
   (ii) Paria also chose to deny the existence of air pockets, saying they were not seen on camara footage, even though Christopher Boodram and 4 men survived for three hours with five tanks which would have only given them one hour as all were alive.

7. Mr. Piper claimed that he wanted more information from camara footage before considering any dive rescue, but his repeated request up to 9.00 p.m. on Friday, to the Coast Guard, to do a dive does not support this claim.

8. After the footage was received at midnight Mr. Piper again asked the Coast Guard to dive and remove obstacles in the line, even though they had already told him that they were not trained for that and commercial divers would be more suitable.

9. Mr. Piper knew that LMCS had experienced commercial divers, onsite, some related and some not related, who were prepared to dive, yet they were not asked.

10. Colin Piper, Mushtaq Mohammed, Michal Wei and Randy Archbald all say that they got expert advice that they should not allow diving into the pipe. The experts listed were OSHA, TTCG, OTSL, HULL, HHSL, EERS, Eastern Diving Services, Mitchell Professional Diving Services (MPDSL) . From this list, the evidence shows that TTCG, EERS, and MPDSL were only asked **if** they would conduct a rescue. They said they, themselves, would not perform a rescue but, never advised Paria that a rescue should not be performed.

11. Mr. Piper advised all, that Christopher Boodram said: "The men did not make it". The other misinformation given was that there were dive bottles lodged in the line, but, they kept increasing the distance of that blockage location in the line in their advice to "experts".
    It is of note that there is no evidence of "experts" being asked to show experience or a CV of any sort prior to Paria engaging them. It was obvious that none of the had experience diving in pipeline of any size, unlike LMCS's Andrew Farrah, Kazim Ali and Micheal Kurban which they wrongly claimed was "not a thing". They produced no evidence to show this.

12. In his witness statement Mr. Piper made no mention of his fears of confined space rescuers dying whilst attempting to rescue people. Paria has its own Confined Space Rescue Protocol that could easily have been employed to formulate a rescue plan for the men in the pipe. The study Mr. Piper referenced, spoke mainly of would-be rescuers rushing in to remove a victim without preparation: breathing air, communication, and light. The incident happening at Berth #6 being under water would negate any possibility of any rescuer impulsively rushing in, without

his own breathing air, Scuba, or surface supply. All plans considered by LMCS involved divers with air supply, and underwater light and initially rope for tethering and signalling and later umbilical in addition to rope that included camera lights and voice communication. Had Mr. Piper relayed these fears in the numerous phone calls with LMCS they could have been easily allayed.

13. Paria and Mr. Piper treated LMCS as being "emotional" and disregarded the plans for rescue dive related on site to Catherine Balkissoon. There was no other willing "expert" other than LMCS and its volunteer divers, who was capable and willing to take the risk of rescue. Yet Paria, disregarded them and instead relegated the plans as being "mutterings".

14. Mr. Piper was quick to act on suggestion of installation of the riser at Berth #6 but did not accede to removal of blind flange at Berth #5 until 5AM on 26th February, 2022 thereby ensuring that no diver had access to SL 36 to attempt a rescue from around 10 PM on 25th February, 2022 to 5AM on 26th February, 2022 (all the while there being signalling being heard at Berth No.5.

CONCLUSION

From the legal authorities and facts as established before this Commission, it seems clear that Paria's decision to disallow rescue by LMCS divers (whether employed or volunteered) amounts to gross criminal negligence as:

1. Beyond a reasonable doubt, Paria owed a duty of care to the LMCS employees trapped within SL 36 from the relationship of employer/employee (contractor);

2. The fact that LMCS was an independent contract is immaterial to Paria's duty of care to provide a safe system of work (non-delegable) and a duty to rescue the entrapped workers.
3. Paria breached its duty of care to rescue by refusing rescue plans of LMCS;
4. The refusal to allow LMCS divers (whether employed or voluntary) to carry out rescue plans secured the death of 4 workers in the pipeline as no attempt was made by Paria to rescue them.

In these circumstances, it is submitted that there is sufficient evidence, beyond a reasonable doubt, to support:

1. A finding that there was a breach of duty by Paria to rescue the LMCS employees and in particular, Mr. Collin Piper;
2. There is sufficient evidence disclosed which supports a finding that there are grounds from criminal proceedings in manslaughter against Paria and in particular Mr. Collin Piper;
3. A recommendation for the DPP to consider the evidence can be made with a view of criminal charges being laid.

Unless further clarifications are required, these are the submissions of LMCS.

Dated this 3rd day of February, 2023.

K. Persaud

KAMINI PERSAUD-MARAJ

To: Secretary of the Commission of Enquiry
Ms. Sarah Sinanan

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COMMISSION OF ENQUIRY
INTO
ALL OF THE CIRCUMSTANCES WHICH LED TO THE TRAGIC INCIDENTS WHICH OCCURRED ON FRIDAY FEBRUARY 25, 2022, AT FACILITIES OWNED BY PARIA FUEL TRADING COMPANY LIMITED, LOCATED AT NO. 36 SEALINE RISER ON BERTH NO. 6, POINTE-A-PIERRE, WHICH LED TO THE DEATHS OF FOUR (4) EMPLOYEES OF LMCS LIMITED

BUNDLE OF AUTHORITIES

No.	Document	Page
1	Winfield and Jolowitcz on Tort (13th Edt: 1989)	**1**
2	Charlesworth & Percy on Negligence- 12th Edition	**5**
3	The Rescuer's Duty of Care- Address by Chief Justice Terence Higgins 26th Sep. 2006	**7**
4	Case: Horsely v MacLaren and the ship "Ogopogo" and Richard Jones [1972] R.C.S. 441	**21**
5	Case: Tomlinson (FC) v. Congleton Borough Council et al [2003] UKHL 47	**53**
6	Inquest into the death of Ojo Moyo Oliver Inq 10 of 2008 (22nd April, 2009)	**77**

Dated this 3rd day of February, 2023.

K. Persaud

KAMINI PERSAUD-MARAJ

To: Secretary to the Commission of Enquiry

WINFIELD AND JOLOWICZ

ON

TORT

THIRTEENTH EDITION

BY

W. V. H. ROGERS, M.A.

of Gray's Inn, Barrister;
Professor of Law in the University of Leeds

LONDON
SWEET & MAXWELL
1989

tion of law but a proposition of
ras never actually instructed to
self proof of negligence.[80] The
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nally and reasonably incidental
that an employee disobeys an
he protection of his employer's
contributory negligence.[83] The
only when the relationship of
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y upon it. Such a person will,
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wed individually to each work-
particular workman which are
employer will affect the precau-
to fulfil his duty. Thus in *Paris* v.
l only one eye and it was there-
d with goggles even though the
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a similar job. Conversely, "an
d obvious risk may not reason-
recautions as an inexperienced
dvice or admonition."[86]

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yer's duty is a duty of care only

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oyer and skilled workman as equivalent to that
W.L.R. 100, 105, *per* Viscount Simmonds. In
nough to inform workers about the availability
; in use from time to time. *Osarak* v. *Hawker*
1982, is an entertaining case, turning on safe
Railway Premises Act 1963.
987] A.C. 906.

on the facts).
teer workers, Munkman, *op. cit.*, pp. 630–633.
[1968] 1 Q.B. 94.
, 754, *per* Lord Radcliffe. Note that it is not the
cation to the facts: *McPhee* v. *General Motors*

and, though a high standard is required, there are limits to the protection which the employer must provide, even against foreseeable risks to his employee.[87] In *Withers* v. *Perry Chain Co.*[88] the plaintiff had previously contracted dermatitis from contact with grease in the course of her work and was therefore given by her employers the driest work they had available. This work she accepted without protest but nevertheless she again contracted dermatitis and sued her employers on the ground that, knowing that she was susceptible to dermatitis, they should not have permitted her to do work carrying a risk of causing that disease. Her action was dismissed by the Court of Appeal because the employers had done everything they reasonably could have done to protect the plaintiff short of refusing to employ her at all. "In my opinion there is no legal duty on an employer to prevent an adult employee from doing work which he or she is willing to do. If there is a slight risk . . . it is for the employee to weigh it against the desirability, or perhaps the necessity, of employment. The relationship of master and servant is not that of a schoolmaster and pupil. . . . It cannot be said that an employer is bound to dismiss an employee rather than allow her to run a small risk."[89]

Independent contractors

It might be supposed, therefore, that an employer who entrusts some task to a third party (not a servant), whose competence he has taken reasonable care to ascertain, has thereby discharged his own duty of reasonable care. To state the law in this way, however, would be to deny the *ratio decidendi* of *Wilsons and Clyde Coal Co.* v. *English*[90] that the employer's duty is personal and is not discharged simply by the appointment of a competent person to carry out the necessary tasks. In that case the defendant employers were held liable in respect of an injury sustained by a miner because the system of working was not reasonably safe. The system had been devised by the manager of the mine, a fellow servant of the plaintiff, to whom the employers were obliged by statute[91] to leave the matter, but yet, despite the existence of common employment and despite the fact that the employers personally had done everything they possibly could, they were held to be in breach of their duty to the plaintiff. Their duty was "the employer's personal duty, whether he performs or can perform it himself, or whether he does not perform it or cannot perform it save by servants or agents. A failure to perform such a duty is the employer's personal negligence."[92] The employer's liability, therefore, not being a vicarious liability, was not defeated by the doctrine of common employment.

[87] See, *e.g. Latimer* v. *A.E.C.* [1953] A.C. 643. For the standard of care in negligence generally see *ante*, pp. 111–121.
[88] [1961] 1 W.L.R. 1314.
[89] *Ibid.* at p. 1320, *per* Devlin L.J. See also *Foufoulas* v. *F.G. Strang Pty. Ltd.* (1970) 44 A.L.J.R. 361.
[90] [1938] A.C. 57; *ante*, p. 187.
[91] Coal Mines Act 1911, s.2(4).
[92] [1938] A.C. 57, 83–84, *per* Lord Wright. See also *per* Lord Thankerton at pp. 64–65; *per* Lord Macmillan at p. 75; *per* Lord Maugham at pp. 87–88.

There can be little doubt that the concept of the employer's personal duty was developed in order to reduce the hardship created by the doctrine of common employment. In practical effect, however, it extends to cases which never were covered by that doctrine, for it involves the proposition that the employer's duty is not so much a duty to take reasonable care as a duty that care be taken. It thus carries the implication that the employer is liable in respect of matters covered by the personal duty for damage caused by the negligence of others, in particular independent contractors. A man can be liable vicariously only for the torts of his servants done in the course of their employment, but a duty that care be taken is not fulfilled if anyone concerned is guilty of a failure to take care.[93] This view of the law is confirmed by the decision in *McDermid* v. *Nash Dredging and Reclamation Co. Ltd.*[94] The defendands were a wholly owned subsidiary of S, a Dutch company, and their function was to employ British staff engaged in S's dredging work in Sweden. While the plaintiff, an employee of the defendants, was aboard a tug owned by S he was seriously injured as a result of the negligence of the skipper (an employee of S) in putting the engines astern without warning to the plaintiff. Whether the case was looked at as one of failing to devise a safe system (for which finding the Court of Appeal thought there was scope on the evidence) or failing to follow a system in itself safe (as the trial judge thought) the defendants were liable because they had delegated the performance of their duty to take care for the plaintiff's safety to S and its employees on the tug and they could not escape their liability when that duty was not fulfilled. Given the connection between the defendants and S the decision is not surprising,[95] for if the law were otherwise the plaintiff's rights would be at risk from the chances of corporate organisation,[96] but it does not mean that the employer is liable whenever his employee is injured at work as a result of the negligence of a third party. To hold otherwise would be inconsistent with the decision in *Davie* v. *New Merton Bord Mills*[97] where the House of Lords specifically rejected the argument that the employer was in breach of his personal duty by reason of the negligence of the manufacturers of a standard tool which, because of an undiscoverable latent defect, injured the plaintiff employee. So far as injury resulting from defective equipment is concerned, the result of *Davie's* case was reversed by the Employer's Liability (Defective Equipment) Act 1969,[98] but the underlying *ratio* of the case remains. This, it is submitted, is that the employer is only responsible for the negligence of someone other than his servant if it can fairly be said that he has delegated the performance of his duty of care to employees to that

[93] See *post*, pp. 582.
[94] [1987] A.C. 906; Weir, *Casebook on Tort* (6th ed.), 260; *Kondis* v. *State Transport Authority* (1984) 55 A.L.R. 225.
[95] The tug was skippered turn and turn about by an employee of S and an employee of the defendants. Had the accident occurred on the next shift there could have been no disputing the defendants' liability.
[96] No proceedings were brought against S because of the difficulties of effecting service against a Dutch company in respect of a claim arising in Sweden and because of a practice of the legal aid authorities not to support claims against a foreign defendant in respect of a foreign tort. Had S been sued, they might have been entitled to limit their liability under the Merchant Shipping Act.
[97] [1959] A.C. 604; Weir, *Casebook on Tort* (6th ed.), p. 255.
[98] See *ante*, p. 191.

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[99] The House of Lords in *Davie*
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[4] See, *e.g.* Offices, Shops
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and Safety at Work, etc.
[5] See further *Encyclope*

person. In *Davie's* case itself the employers had discharged their duty by buying from a reputable supplier a standard tool whose latent defect they had no means of discovering.[99] Similarly, if a lorry driver delivering goods to a factory were negligently to run into and injure a workman, the workman's employer would not be liable: the lorry driver (and *his* employer) cannot reasonably be described as the independent contractor of the employer, his negligence does not negative the exercise of care in the employer's personal duty for it is unrelated to any aspect of that duty, and the employer has delegated nothing to him. But if, for example, a gas fitter negligently installs a gas appliance at the employer's premises with the result that a workman is injured by an explosion, it is submitted that the employer's personal duty with regard to the safety of the place of work has not been fulfilled and he is liable,[1] whether or not the workman is entitled to rely upon the Act of 1969.[2]

Breach of Statutory Duty[3]

The employer's common law duty to his workman exists by virtue of the relationship of master and servant and therefore applies wherever that relationship exists, but no similar generalisation is possible in the case of duties imposed by statute. The application of those duties is governed purely and simply by the statute which creates them. Nevertheless the number of statutory duties which affect the employer's liability to his workman in one way or another is now so great that for the enormous majority of workmen it is no longer true to say simply that their employer's duty is the common law duty described above. That duty always exists, but in factories, in mines and quarries, on building sites, and in most other forms of employment,[4] a host of specific obligations are superimposed upon it by statute and statutory regulations. It would be out of the question in a book of this kind, however, to consider in detail even a limited number of these obligations[5] and the purpose of the following paragraphs is to do no more than show how a few of the more important of them operate in relation to employer's liability. For

[99] The House of Lords in *Davie* approved the decision of Finnemore J. in *Mason* v. *Williams & Williams Ltd.* [1955] 1 W.L.R. 549, where the judge had not been "embarrassed by the citation of authority": [1959] A.C. 604, 617, *per* Viscount Simmonds.

[1] *Sumner* v. *William Henderson & Sons Ltd.* [1964] 1 Q.B. 450. The judgment of Phillimore J. was later set aside ([1963] 1 W.L.R. 823) but for procedural reasons only.

[2] Under the Hague-Visby Rules, the carrier of goods by sea must "exercise due diligence to make the ship seaworthy," and there may be an analogy between this duty and the employer's. In a question concerning the carrier's liability a distinction apparently exists between the manufacturer of the ship, for whose negligence the carrier is not liable, and the repairer of the ship, for whose negligence the carrier is liable. See *Angliss (W.) & Co. (Australia) Ptd.* v. *P. & O. Steam Navigation Co.* [1927] 2 K.B. 456 and *Riverstone Meat Co. Pty.* v. *Lancashire Shipping Co.* [1961] A.C. 807 (Weir, *Casebook on Tort* (6th ed.), p. 261). In the latter case it was regarded as almost self-evident that the carrier is in general liable for the negligence of independent contractors.

[3] For the action for breach of statutory duty in general, see *ante*, Chap. 7. For the Health and Safety at Work, etc., Act 1974, see *ante*, p. 188.

[4] See, *e.g.* Offices, Shops and Railway Premises Act 1963. The principal statute for agricultural employment, the Agriculture (Safety, Health and Welfare) Act 1956 is little more than a framework for making regulations and some of its functions in this respect are superseded by regulations made under the Health and Safety at Work, etc., Act 1974: see S.I. 1975 No. 46.

[5] See further *Encyclopedia of Health and Safety at Work, Law and Practice.*

Charlesworth & Percy on Negligence 12th Ed.

Main Volume

Part I - General Principles

Chapter 2 - The Duty to Take Care

Section 1. - Concept of a Duty of Care

Sub-section (A) - Introduction

Generally

2-01

The word "duty" connotes a relationship by which an obligation is imposed upon one person for the benefit of another to take reasonable care in all the circumstances. Whether or not a duty of care exists on given facts is a question of law.[1] Unless the existence of such a duty can be established, an action in negligence must fail. As Lord Wright put it in *Grant v Australian Knitting Mills Ltd*[2]:

> "All that is necessary as a step to establish the tort of actionable negligence is to define the precise relationship from which the duty to take care is deduced. It is, however, essential in English law that the duty should be established: the mere fact that a man is injured by another's act gives in itself no cause of action: if the act is deliberate, the party injured will have no claim in law even though the injury is intentional, so long as the other party is merely exercising a legal right: if the act involves lack of due care, again no case of actionable negligence will arise unless the duty to be careful exists."

Put in compendious form, so far as the law of tort is concerned, a man is entitled to be as negligent as he pleases towards the whole world, provided that he does not owe any particular person a duty to take care.[3]

2-02

The requirement for a duty exists because the potential scope of negligence as a basis for legal liability is virtually unlimited. On its face "negligence" looks only to the quality of the defendant's conduct and not to factors such as the likely or possible number of claimants, the likelihood that loss would be caused, the nature and extent of particular loss and the circumstances in which the loss came to be inflicted. Thus, principles have had to be devised to delimit the boundaries of liability. One solution is the requirement that the potential defendant must owe to the victim a legal duty to take care. The language of duty provides a formula for expressing how far the law ought to extend.

Duty and Other Elements to Liability

2-03

This chapter deals only with the requirement in every negligence action that the defendant owes to the claimant a duty to take care. However, the role played by the other components of actionable negligence-breach of the duty, damage caused by the breach and damage which is not too remote-must always be taken into account, both in theoretical analysis and practice. Lord Pearson has recognised that "it may be artificial and unhelpful to consider the question as to the existence of a duty of care in isolation from the elements of breach of duty and damage".[4] It follows that it is always useful to consider for what purpose a duty of care is required, before going on to consider whether negligence can be established. Not every wrongful act can be compensated. Not every consequence of a compensable wrong can be the subject of an award of damages. The law has to draw a line[5]:

> "Sometimes it is done by limiting the range of the persons to whom duty is owed. Sometimes it is done by saying that there is a break in the chain of causation. At other times it is done by saying

The icon [!] indicates a paragraph or footnote that contains consolidated text from the supplement.

that the consequence is too remote to be a head of damage. All these devices are useful in their way. But ultimately it is a question of policy for the judges to decide."[6]

2-04

The elements of liability are conceptually distinct, and it is helpful if they are kept separate for the purposes of analysis. Whether a duty exists, whether a duty found to exist has been broken and whether the breach caused damage in fact are clearly different inquiries, even though they each control the question whether a defendant ought to be held liable for a claimant's loss. The distinction between the question of the duty owed to the claimant and the question as to the damage in respect of which the defendant is liable is harder to pin down. Both the Court of Appeal and the House of Lords have recognised the overlap between defining the scope of the defendant's duty, and the loss for which, whether by way of the rules of causation or remoteness, or both, he or she should be liable. These questions are discussed further below.[7] For the moment it can be said that, broadly speaking, the question of duty is concerned with putting claims into differing *categories* involving, for example, mental injury, or economic loss, or omissions, each requiring special treatment in accordance with relevant concerns of policy and principle. Whereas the existence or otherwise of a duty is determined by reference to policies of general import, the inquiry into the legal cause of harm and/or the remoteness of the damage takes account of the random and contingent features of the particular case at hand. It asks whether there was in the particular circumstances a sufficiently close or proximate connection between the defendant's initial negligent act and the damage suffered by the claimant. The element of foreseeability of harm plays a key role in this inquiry, just as it does in relation to whether a duty exists.

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1. See *Black v Fife Coal Co Ltd [1912] A.C. 149 at 159*, per Lord Kinnear; *Deyong v Shenburn [1946] K.B. 227 at 233*, per du Parcq L.J.; *Letang v Cooper [1965] 1 Q.B. 232 at 241*, per Lord Denning M.R.

2. *[1936] 1 A.C. 85 at 103.*

3. *Le Lievre v Gould [1893] 1 Q.B. 491* per Lord Esher M.R. at 497: "English law does not recognise a duty in the air, so to speak; that is, a duty to undertake that no one shall suffer from one's carelessness": *Bottomley v Bannister [1932] 1 K.B. 458 at 476*, per Greer L.J.

4. *Dorset Yacht Co Ltd v Home Office [1970] A.C. 1004 at 1052.*

5. See, e.g. *Compania Financiera "Soleada" SA v Hamoor Tanker Corporation Inc; The Borag [1981] 1 W.L.R. 274 at 281, CA*, per Lord Denning.

6. *Lamb v Camden LBC [1981] Q.B. 625 at 636*, per Lord Denning.

7. See Ch.5, para.5-01 (remoteness) and Ch.6, para.6-15 (causation), below.

THE RESCUER'S DUTY OF CARE

Royal Life Saving Society Quinquennial Commonwealth Conference
Bath, United Kingdom
26 September 2006

Chief Justice Terence Higgins*
Supreme Court of the Australian Capital Territory

Good afternoon ladies and gentleman.

Today I will discuss the rescuer's duty of care, which will involve an analysis of the legal concept of duty of care and accompanying ideas such as the standard of care. I will also talk about the duty of care that is owed to a rescuer.

For our purposes today, the term 'rescuers' is potentially confusing as the law talks about rescuers more broadly than the one context of trained lifesavers, lifeguards or first aiders. Rescuers, as far as the law is concerned, are people who render assistance to a person in trouble and that may be in any number of circumstances. To add more complexity, Australian law distinguishes between rescuers volunteering for a community organisation and rescuers of the Good Samaritan variety. That leaves a third category, namely, that of 'professional' rescuers – persons engaged by certain organisations, to perform the role of rescuer.

The law of negligence imposes a duty on us all to take care so as to avoid injury, loss or damage to another. Lord Atkin of the House of Lords described this duty in the seminal case of *Donoghue v Stevenson*, and I quote:

> *You must take reasonable care to avoid acts or omissions which you can reasonable forsee would be likely to injure your neighbour.*[1]

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* I would like to acknowledge the research and drafting assistance provided by my Associate, Ms Anna Haynes.

[1] *Donoghue v Stevenson* [1932] AC 562 at 580.

With that knowledge, a common question arises, inquiring whether there is a duty to rescue. Does the passer-by who hears a call of distress emanating from a burning building have a legal duty to do what they can to render assistance or rescue those in trouble?

A DUTY TO RESCUE?

To quote Lord Nicholls of the House of Lords:

> *...the bystander does not owe the drowning child or the heedless pedestrian a duty to take steps to save him. Something more is required than being a bystander. There must be some additional reason why it is fair and reasonable that one person should be regarded as his brother's keeper and have legal obligations in that regard.*[2]

Under the common law, there is no duty on the ordinary citizen to rescue another citizen.[3] There may well be a moral duty or a social expectation to go to another's aid, however there is no legal duty to rescue. The law 'casts no duty upon a man to go to the aid of another who is in peril or distress, not caused by him'.[4]

This last point indicates the first of two exceptions to the general rule; namely, there is a duty to rescue where the danger is created by the rescuer themselves.[5] For example, a motorist whose car is broken down and unlit on a roadway, owes a duty of care to other motorists and should remove the hazard or warn of its presence.[6]

Secondly, a duty to rescue may arise from the relationship that exists between the rescuer and the endangered.[7] That relationship is characterised by trust and responsibility and results in a duty to act in certain circumstances. Common examples

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[2] *Stovin v Wise* [1996] 3 All ER 801 at 807.
[3] *Hargrave v Goldman* (1963) 110 CLR 40; *Jaensch v Coffey* (1984) 155 CLR 549 at 578 per Deane J; *Sutherland Shire Council v Heyman* (1985) 157 CLR 424 at 477-81 per Brennan J.
[4] *Hargrave v Goldman* (1963) 110 CLR 40 at 66 per Windeyer J.
[5] *Sutherland Shire Council v Heyman* (1985) 157 CLR 424 at 478-9 per Brennan J.
[6] *Ticehurst v Skeen* (1986) 3 MVR 307 (NSW SC).
[7] *Horsley v Maclaren (The Ogopogo)* (1971) 22 DLR (3d) 545 (SCC).

of such a relationship include teachers and pupils; employers and employees; carriers and passengers.

In 1996, a significant change was made to the common law in Australia. The case of *Lowns v Woods*[8] confirmed that there is no general common law duty to rescue,[9] but found there was a duty on a medical practitioner to come to the aid of a non-patient. The plaintiff, Patrick Woods was on holiday with his family when he suffered an epileptic seizure. The young boy had been earlier diagnosed with epilepsy and his family was well aware of the dangers inherent in this condition. When the plaintiff's mother returned from her morning walk to find Patrick fitting, she immediately instructed her eldest son to fetch an ambulance and her daughter, Joanna to fetch a doctor.

Dr Lowns was preparing for the day at his surgery when Joanna presented at the doorstep and requested he come to the plaintiff's aid. The doctor refused to come, indicating the plaintiff be brought to his surgery. Joanna returned to her mother. Patrick was conveyed by ambulance to another surgery and ultimately to hospital, where the seizure was quelled.

The Court of Appeal found that in the circumstances, the doctor owed a duty of care to the patient and that duty was breached by his failure to attend.

Had Dr Lowns come to the child's aid and administered Valium, the Court determined that serious brain damage and paraplegia would most likely have been avoided. This finding was made on the grounds of proximity: physical, circumstantial and causal.

The basis for a finding of circumstantial proximity included the fact that Dr Lowns was 'an adequate medical practitioner to whom a direct request for assistance was made'[10] and in circumstances where he was able to meet the request and was aware of the seriousness of the situation.

[8] *Lowns v Woods* (1996) Aust Torts Reports 81-376 (NSW Court of Appeal).
[9] Ibid. 63,155 per Kirby P and 63,166 per Mahoney JA and 63,175 per Cole JA.
[10] Ibid. 63,176 per Cole JA.

The Court specifically considered the provisions *Medical Practitioners Act* 1938 which stipulates the grounds for professional misconduct. President Kirby, now Justice Kirby of the High Court of Australia, spoke of the 'noble profession of medicine' and commented as follows:

> *This is a high standard. It goes beyond what is expected, and imposed by the law, in the case of other professions. It goes far beyond what may be expected and demanded of an ordinary citizen.*[11]

The significance of the case is that it is the first time an Australian Court has found that a medical professional was subject to a duty to act or 'rescue', in the context of a non-patient. The decision attracted much media attention.

For our purposes today, the decision is not on point, as it concerns a doctor as opposed to a volunteer or 'professional' rescuer. The terminology is potentially confusing, so I will pause here to clarify that when I speak of 'professional' rescuers, I am referring to people such as lifesavers and lifeguards trained by organisations like the Royal Life Saving Society. 'Professional' rescuers have undergone training and assume responsibility for community safety in various settings.

It has been suggested that in light of the *Lowns v Woods* decision, persons who possess skills which are 'equally life-saving' or 'injury-preventing' to a medical practitioner, and who hold themselves out as possessing those skills, could be subject to a duty to rescue.[12]

Indeed, there are those who argue strongly in favour of imposing a 'limited prima facie duty to rescue' on rescuers.[13] The basis for such an argument is not only physical proximity, that is being physically in a position to assist. Rather, it derives from the potential rescuer's 'role' in society, as someone the general public looks to in

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[11] Ibid. 63,155.
[12] J Tibballs, 'Legal Liabilities for Assistance and Lack of Assistance Rendered by Good Samaritans, Volunteers and their Organisations' (2005) 16 *Insurance Law Journal* 254, 261.
[13] N Gray and J Edelman, 'Developing the Law of Omissions: A Common Law Duty to Rescue?' (1998) 6 *Torts Law Journal* 240, 241.

an emergency. This would include lifeguards, firefighters, coastguards and security personnel, upon the basis that such persons 'assume a responsibility to individuals in vulnerable situations'.[14]

You will recall that certain relationships give rise to a duty to rescue and as such are an exception to the general rule. Some commentators argue that the imposition of a duty to rescue on 'professional' rescuers is a logical extension of this already recognised category of affirmative duty.[15] The justification for extending the duty to rescue to include 'professional' rescuers such as lifeguards is founded upon the basis of 'control' – namely that a rescuer, by virtue of their training 'enjoys a peculiar vantage in preventing accidents', so that they are distinct from the average citizen.[16]

On this basis, it is argued that 'any class of professional person which has rescue as an aspect of its work, and which carries on its duties in accordance with standards of conduct or specialised training',[17] should be subject to a duty to rescue. On first glance, this appears uncontroversial – rescuers are engaged in the practice of rescuing. However, the breadth of any positive duty to rescue must be explored. What of a rescuer who is off duty? Or a retired rescuer?

Mahoney JA provided a very strong dissent to the majority of the Court in *Lowns v Woods*. His Honour was not minded to create 'a new civil obligation'[18] and made clear his sentiments that it is for the Legislature to do so.

In closing, however, his Honour did comment on the case at hand 'that the balance of social utility would lie in favour of the imposition of some form of obligation to attend a person upon call. But that obligation is … one which must be subject to qualifications and exceptions.'[19]

In determining how the Courts and the Legislature view 'the balance of social utility' is best struck I will now examine the State and Territory legislation relating to

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[14] Ibid. 244.
[15] Ibid. 249.
[16] Ibid. 250.
[17] Ibid. 251.
[18] *Lowns v Woods* (1996) Aust Torts Reports 81-376 at 63,168.

rescuers. In doing so, I will move to explore the duty of care a rescuer must adhere to should they engage in rescuing.

THE RESCUER'S DUTY OF CARE

In examining the rescuers duty of care, it is necessary to explore how the prospective rescuer is classified under the law.

Australian law distinguishes between volunteers and Good Samaritans. I will firstly examine how volunteers are addressed by statute.

'Volunteers'

The term volunteer encapsulates those persons who work for a community organisation without fee or reward. This may be with the local football club or an international organisation such as the Royal Life Saving Society.

The States and Territories of Australia have enacted legislation that indemnifies volunteers from personal liability for negligence.[20] However the provisions differ markedly. For example, the Northern Territory and Australian Capital Territory stipulate that a volunteer escapes liability provided they are not 'reckless'; whereas the test elsewhere pertains to acting in 'good faith' or 'honestly'.[21]

The provisions of the Australian Capital Territory are a combination of the two, stating:

> *A volunteer does not incur personal civil liability for an act done, or omission made, honestly and without recklessness, while carrying out community work, for a community organization, on a voluntary basis.*[22]

The Act further specifies that where liability would have otherwise attached to the volunteer, the community organization will attract liability.[23]

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[19] Ibid.
[20] Excepting South Australia and Western Australia.
[21] For further discussion see Tibballs, above n 12, 266.

It is important to note that the law does not protect a volunteer in every circumstance. For example, a volunteer is not indemnified if impaired by a recreational drug; or they engage in an activity that involves acts or threats of violence, or creates a risk to public health or safety. Further, a volunteer must not act beyond authority or contrary to instructions.[24]

'Good Samaritans'

Those citizens who respond to an emergency of their own volition and not out of any obligation to do so are known as Good Samaritans, as in the well-known parable of Luke's Gospel. A Good Samaritan is a person who responds to an emergency situation and acts without expectation of payment.

I pause here to note that the phrase Good Samaritan is duplicitous in meaning. In parts of Europe and in some American States, and in the Northern Territory, the term refers to a positive duty to rescue.

The relevant Northern Territory provision is contained in the *Criminal Code* and imposes a penalty of 7 years imprisonment upon

> *Any person who, being able to provide rescue, resuscitation, medical treatment, first aid or succour of any kind to a person urgently in need of it and whose life may be endangered if it is not provided,* ***callously*** *fails to do so...*[emphasis added].[25]

Such legislation is unique to the Northern Territory.

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[22] *Civil Law (Wrongs) Act 2002* (ACT), s8(1).
[23] s9(1). A 'community organisation' is defined as a corporation that directs or coordinates the carrying out of community work by volunteers (s6).
[24] ss7 and 8.
[25] s155. See also *Andrew John Salmon v R* (1994) 70 A Crim R 536 per Kearney J wherein a conviction under s155 was overturned on appeal.

The Good Samaritan laws in the remaining Australian jurisdictions were borne out of a fear of rescuers being sued for a failed attempt at rescue that resulted in further injury or death.

For our purposes today, it is necessary to consider where 'professional' rescuers, such as trained lifeguards, fit into this legislative spectrum. It would seem that a distinction is firstly drawn depending whether a person is a volunteer or employee, with the volunteers being specifically addressed by legislation.

Secondly, whether the lifeguard or first aider or 'professional' rescuer is on duty or off duty also appears relevant. Ambulance officers, doctors, nurses and paramedics are trained for the very purpose of saving lives and in this sense they do have a 'duty to rescue'. Thus, 'professional' rescuers differ from a Good Samaritan who happens across a person in need of emergency aid and assists them as best they can.

Yet what of a rescuer who is 'off duty'? Off duty, they are arguably not a volunteer, for the ACT legislation at least, stipulates that they must be in the course of carrying out community work. Are they then a Good Samaritan?

This is a moot point and one not adequately addressed by the legislation.

The ACT definition of Good Samaritan distinguishes between 'a person' acting voluntarily and a 'medically qualified person' acting voluntarily.[26] Is a first aider or lifesaver a 'medically qualified person acting voluntarily'?

The term 'medically qualified person' is defined in the Act and includes: a doctor; a person with professional qualifications in a field of health care; and a person who works, or has worked, as a member of the ambulance service *or in another paramedical capacity*. We are again left to question whether a trained lifeguard or first aider, who does volunteer for a community organization, but is 'off duty' at the relevant time, falls within the class 'another paramedical capacity'.[27]

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[26] *Civil Law (Wrongs) Act 2002* (ACT), s5(3).
[27] Paramedical is defined in the Macquarie Dictionary (3rd ed) as: related to the medical profession in a supplementary capacity, as an ambulance officer, etc.

It is interesting to note the context in which the legislation indemnifying volunteers and Good Samaritans has evolved.

A comprehensive review of the law of negligence in Australia was completed in 2002. The Ipp Report, as it is known, noted a 'sense of anxiety about the possibility of legal liability for negligence arising from the giving of assistance in emergency situations'.[28] Nevertheless, it did not recommend Legislatures enact statute to indemnify rescuers. Rather, the Committee was satisfied that the common law already took into account the relevant experience of the rescuer and the circumstances of the emergency situation.

This recommendation was also made with the knowledge that there is no case law justifying the prevalent fear - a Good Samaritan has not been sued in Australia for a rescue attempt on the basis of negligence.[29] The conclusion of the Committee was that it was 'unnecessary and indeed undesirable'[30] to legislate on the issue as it 'would tip the scales of personal responsibility too heavily in favour of interveners and against the interests of those requiring assistance.'[31]

In spite of this recommendation, each State and Territory now has legislation indemnifying volunteers and / or Good Samaritans or both under differing circumstances.[32] The introduction of these laws has not successfully clarified the position of a rescuer under law. As I noted earlier, the provisions vary markedly. For example, the Queensland Good Samaritan laws are limited to medical practitioners or nurses,[33] not the ordinary passerby as elsewhere. And in Victoria, a Good Samaritan is protected even where they caused the emergency and then rendered assistance, which is expressly excluded in New South Wales[34] and not addressed elsewhere.

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28 Commonwealth of Australia, *Review of the Law of* Negligence (2002) 7.21.
29 Ibid.
30 Ibid. 7.24.
31 Ibid.
32 Tibballs, above n 12, 266.
33 s16 *Law Reform Act 1995* (Qld) specifies 'medical practitioner, nurse or other person specified under a regulation'.
34 M Eburn, 'Protecting Volunteers?' (2003) 18(4) *Australian Journal of Emergency Management* 7, 8.

Indeed, the New South Wales legislation has been accused of fostering 'two, mutually inconsistent objectives'.[35] This is evidenced by the Second Reading Speech wherein the then Premier Bob Carr claimed the Bill would 'mean no liability for voluntary rescue organizations, such as surf life saving clubs' within a sentence wherein it was stated that the Bill 'is not intended to alter the potential liability of a community organization by providing the individual members with immunity.'[36]

Therefore, the status of the 'professional' rescuer, be they an employee or volunteer of a community organization; on or off duty, remains ambiguous.

THE STANDARD OF CARE

Once rescue is attempted, a duty of care arises and is owed by the rescuer to the injured person. Rescuers, be they a volunteer or Good Samaritan or 'professional' rescuer are required to take reasonable care whilst attempting rescue.

Whether or not the would be rescuer has any training or skills is relevant to the standard of care that is expected of them. A Royal Lifesaving volunteer may have a bronze medallion and therefore be skilled in first aid methods, whereas an unskilled Good Samaritan, who happens across an emergency, can only draw from their common sense. By the same token, the Good Samaritan may be a nurse who is off duty and is therefore equipped with knowledge of first aid and medical procedure.

In each case, the rescuer should be guided by reasonable care and skill. The law will assess the situation from the view of the reasonable person with the training and knowledge of the rescuer, operating in the same situation. Therefore it is an objective test, founded upon concepts such as reasonableness and reasonable foreseeability, yet balanced by the vicissitudes of life and the given situation.

If you cast your mind about to think of the many stories of rescue that make headlines world wide, it is easy to recognise that such 'facts' make every rescue story unique. The challenges faced by a rescuer operating at high altitude in the Himalayas are

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35 Ibid.10.

36 Second Reading Speech, Civil Liability Amendment (Personal Responsibility) Bill, 23 Oct 2002.

vastly different to those incumbent upon the rescuers in Beaconsfield, Tasmania who worked for 14 days to rescue two miners trapped 1km below the ground.

A rescuer who possesses some skill or expertise, such as first aid training will be required to act reasonably and within the bounds of their skill and knowledge; but because of their training, they will be in a position to provide more expert care.

Under English case law the standard of care has been described as 'a duty to the patient to use diligence, care, knowledge, skill and caution in administering treatment.'[37]

The High Court of Australia has described the standard as follows:

> *…the standard of care to be observed by a person with some special skill or competence is that of the ordinary skilled person exercising and professing to have that special skill…*[38]

Further complexity arises where there is some division in medical opinion of best practice. A rescuer, with some training or qualifications will draw upon that knowledge in an emergency situation. But what if the accepted method of dealing with the injury has changed since the rescuer underwent training?

If the rescuer is an ongoing volunteer or employee of an organisation such as Royal Lifesaving, then one would assume they will receive updates in their qualifications. If their training and affiliation with any rescue organisation is long in the past, the rescuer may well be in the same position as a Good Samaritan, drawing on their common sense and general knowledge.

Nevertheless, a foreseeable problem arises where there has been a considerable change in accepted practice, for example accepted treatment for resuscitation of the unconscious or choking.

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[37] *R v Bateman* (1925) 94 LJKB 791 at 794 per Lord Hewart.
[38] *Rogers v Whitaker* (1992) 175 CLR 479 at 487 per Mason CJ, Brennan, Dawson, Toohey and McHugh JJ.

It is not uncommon to have a divergence in opinion on the best method of treatment for specific injuries or illnesses. In medical negligence cases, medical opinion is regularly divided along party lines with the plaintiff's medical expert claiming the opposite of the defendant's medical expert. This leaves rescuers and their parent organisations in somewhat of a bind when trying to implement best practice in their training and guidelines.

In England, the common law standard of care is determined 'in accordance with a practice accepted as proper by a responsible body of medical men skilled in that particular art'.[39] This is known as the *Bolam* principle, deriving its title from a case of that name, decided in 1957.

In Australia, the Courts have reserved the right 'to adjudicate on what is the appropriate standard of care'[40] and as such have declined to follow the *Bolam* principle. For our purposes today, I will not delve further into this debate, suffice to say that it is important that rescue organisations keep abreast of current standards and discussions regarding first aid and rescue procedure.

THE DUTY OF CARE OWED TO RESCUERS

It is equally important to note that a duty of care is owed to the rescuer who renders assistance to a would-be plaintiff. A negligent defendant owes a duty to their injured plaintiff and to any good citizen who comes to their aid and in the course of rescue, are themselves injured.[41]

Rescuers were once legally unprotected from injury or loss arising out of a rescue attempt. The law took the view that any such risk was 'voluntarily assumed' by the rescuer who chose to place themselves in a potentially dangerous or injurious situation.

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[39] *Bolam v Friern Hospital Management Committee* [1957] 2 All ER 118 at 188 per McNair J.
[40] *Rogers v Whitaker* (1992) 175 CLR 479 at 487 per Mason CJ, Brennan, Dawson, Toohey and McHugh JJ.

The shift in the law was aptly described by Lord Denning, who stated that '[w]hoever comes to the rescue, the law should see that he does not suffer for it'.[42]

If a person puts another, such as a rescuer, in a situation of peril, they owe a duty of care to the rescuer who suffers injury.[43] This duty arises where a rescue attempt is reasonably foreseeable from the situation of peril created by the defendant's negligence; and where injury to the rescuer is also reasonably foreseeable.[44]

This duty of care is owed even if the rescuer voluntarily comes to the aid of the victim, and were under no legal obligation to assist. And the duty remains even if it turns out that the rescuer mistook the situation as one of peril, though it was only apparently so.

Finally, the House of Lords have expressly rejected what is known as the 'firefighters rule'.[45] This doctrine, adopted in certain American jurisdictions, precludes claims in negligence by injured firefighters on the basis that their very purpose is to operate in the dangerous circumstances from which the claim resulted. The Court found no reason why the firefighters should be held 'at a disadvantage as compared to the layman'.[46]

The law maintains this protection for rescuers so as to hold people accountable for their actions – so that the foolish, reckless or negligent actions of one are not free of responsibility when they endanger or harm another, such as a rescuer.

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[41] *Haynes v Harwood* [1935] 1 KB 146 (CA). Note also that a duty of care to a rescuer was established where the defendant did not owe a duty of care to the imperilled person (a trespasser): *Videan v British Transport Commission* [1963] 2 All ER 860 (CA).
[42] *Videan v British Transport Co* [1963] 2 All ER 860 (CA).
[43] *Chapman v Hearse* (1961) 106 CLR 112.
[44] *Harrison v British Railways Board* [1981] 3 All ER 679.
[45] *Ogwo v Taylor* [1987] All ER 961 at 966.
[46] Ibid. 965.

CONCLUSION

In spite of any moral expectation that may exist, the law does not require the random passerby to stop and render assistance to an injured stranger. The law instead requires an additional reason why it is fair and reasonable to burden someone with a positive duty to act. Rescuers, voluntarily fill that void between the law, morality and social expectation. By undertaking training, and in holding themselves out to the world as a rescuer, life guards and life savers along with paramedics, and volunteer firefighters put their skills and potentially their own safety on the line for the benefit of others.

Despite the uncertainties I have highlighted today, the law does acknowledge the important work of those engaged in rescuing. In Australia, statute indemnifies rescuers who act with due skill and care, should there be a failed rescue attempt. Similarly the common law relies upon reasonableness as a guide and takes into account the circumstances of each case, including the relevant experience and training of the rescuer. Finally, the law recognizes a duty of care owed to rescuers, and in doing so acknowledges this act of service and the risks inherent in rescuing.

Let me pause here to commend the very important work of lifesavers and lifeguards. Be they a volunteer or an employee, those who dedicate their time and efforts to the Life Saving cause are providing an invaluable service to the community. They are also part of a long and admirable history, starting in 1891 in England, and expanding to Australia in 1894. It is a cause of which I am very proud.

Astrid Horsley and Richard J. Horsley, Lawrence A. Horsley, Michael A. Horsley, all infants by their next friend Thomas Robertson (*Plaintiffs*) *Appellants*;

and

Kenneth W. MacLaren and the ship "Ogopogo", and Richard J. Jones (*Defendants*) *Respondents.*

1971: May 5, 6; 1971: October 5.

Present: Judson, Ritchie, Hall, Spence and Laskin JJ.

ON APPEAL FROM THE COURT OF APPEAL FOR ONTARIO

Negligence—Invited guest on cabin cruiser accidentally falling overboard—Duty of owner-operator to attempt rescue—Another invited guest diving into water in attempt to effect rescue—Dying from shock sustained on contact with icy water—Whether owner-operator negligent in rescue attempt—Whether liable for death of second passenger.

M, an invited guest on a cabin cruiser, which was owned and was being operated by the respondent K, accidentally fell overboard. In the course of rescue operations, another invited guest, H, dived into the water to help him. The effort was without avail. The rescuer was pulled from the water by others on board, could not be resuscitated and was later pronounced dead. The body of the rescuee was never recovered.

K was first alerted to M's fall when the body was only about a boat-length and half behind him. Instead of following the recommended method of effecting a rescue, *i.e.,* to circle and bring the boat bow on towards the body, he reversed, after putting the engines momentarily in neutral, and backed up to within four or five feet of the body, where he shut off the engines. M, who had been in the water for approximately two minutes, was apparently unconscious and attempts to rescue him with a pike pole and a life-belt were unsuccessful. The boat having begun to drift away, K restarted the engines and again backed towards M. Three or four minutes had now passed since the fall overboard, and it was then that H dived into the water from the stern, coming up about ten feet from M. The latter was seen to fall forward, face and head in the water, and

Astrid Horsley et Richard J. Horsley, Lawrence A. Horsley, Michael A. Horsley, tous mineurs et représentés par leur représentant *ad litem* **Thomas Robertson** (*Demandeurs*) *Appelants;*

et

Kenneth W. MacLaren et le navire "Ogopogo", et Richard J. Jones (*Défendeurs*) *Intimés.*

1971: les 5 et 6 mai; 1971: le 5 octobre.

Présents: Les Juges Judson, Ritchie, Hall, Spence et Laskin.

EN APPEL DE LA COUR D'APPEL DE L'ONTARIO

Négligence—Invité à bord d'un yatch de croisière tombe accidentellement par-dessus bord—Devoir du propriétaire-exploitant de tenter d'effectuer le sauvetage—Un autre invité plonge à l'eau pour tenter d'effectuer le sauvetage—Mort des suites du choc subi au contact de l'eau glacée—Négligence du propriétaire-exploitant au cours de sa tentative de sauvetage—Responsabilité pour la mort du second passager.

M, qui était un invité à bord d'un yatch de croisière dont K était le propriétaire et l'exploitant, est tombé accidentellement par-dessus bord. Au cours des opérations de sauvetage, H, un autre invité, a plongé à l'eau pour l'aider. Ses efforts se sont avérés inutiles. Le sauveteur a été tiré de l'eau par d'autres personnes qui se trouvaient à bord; il a été impossible de le ranimer et on a par la suite constaté la mort.

K a d'abord été averti de la chute de M lorsque celui-ci ne se trouvait qu'à une longueur de bateau et demie environ sur l'arrière. Au lieu de suivre la méthode de sauvetage recommandée, soit de décrire un cercle et de se diriger droit devant vers la personne, il a mis les moteurs en marche arrière, après les avoir momentanément mis au point mort, et a reculé le bateau jusqu'à quatre ou cinq pieds du corps, alors qu'il a stoppé les moteurs. M, qui était dans l'eau depuis environ deux minutes, était apparemment évanoui et les tentatives de sauvetage avec une perche pointue et un gilet de sauvetage n'ont pas eu de succès. Le bateau ayant dérivé, K a remis les moteurs en marche et a de nouveau reculé vers M. Trois ou quatre minutes s'étaient écoulées depuis que celui-ci était tombé par-dessus bord. C'est à ce moment-là que H a plongé à l'arrière du another passenger, J, jumped in, one foot away, to hold up his head but M disappeared beneath the boat. J's husband grabbed the boat controls which K yielded, swung the boat around bow on, and approached J on the starboard side where she was pulled in. K then resumed control and went forward towards H who was then also pulled in but in unconscious condition. Attempts at resuscitation failed. Medical evidence established that H died from shock sustained on contact with the icy water.

Two fatal accident actions were brought against K for the benefit of the widows and dependants of the two deceased. H's family succeeded at the trial but their claim was dismissed on appeal, and they then sought restoration by this Court of the favourable trial judgment. The other claim failed at trial and was not pursued farther.

Held (Hall and Laskin JJ. dissenting): The appeal should be dismissed.

Per Curiam: There was a duty on the part of the respondent K in his capacity as a host and as the owner and operator of the cabin cruiser to do the best he could to effect the rescue of M.

Per Judson, Ritchie and Spence JJ.: There was no suggestion that there was any negligence in the rescue of H and for K to be held liable to the appellants it was necessary that such liability stem from a finding that the situation of peril brought about by M falling into the water was thereafter, within the next three or four minutes, so aggravated by the negligence of K in attempting his rescue as to induce H to risk his life by diving in after him. Although the procedure followed by K was not the most highly recommended one, the evidence did not justify a finding that any fault of his induced H to risk his life by diving as he did. If K erred in backing instead of turning the cruiser and proceeding "bow on", the error was one of judgment and not negligence, and in the circumstances ought to be excused.

Per Hall and Laskin JJ., *dissenting*: The view that K had been merely guilty of an error of judgment was not accepted. This was not a case where K had failed to execute the required manoeuvre properly, but rather one where he had not followed the

bateau, remontant à la surface à dix pieds de M environ. On a vu ce dernier tomber par en avant, le visage et la tête dans l'eau. J, une autre passagère, a sauté dans l'eau, à un pied de lui, afin de soulever sa tête, mais M est disparu sous le bateau. Le mari de J s'est emparé des commandes du bateau, que K lui a cédées; il a fait virer le yatch et s'est dirigé droit devant vers son épouse, l'approchant sur tribord; elle fut tirée de l'eau. K a alors repris les commandes et a avancé vers H, qui a également été tiré de l'eau; il était sans connaissance. On a tenté sans succès de le ranimer. L'expertise médicale a établi que H était mort des suites du choc subi au contact de l'eau glacée.

Deux actions ont été intentées à la suite de l'accident mortel contre K pour le compte de la veuve et des personnes à charge de chacun des deux défunts. La demande de la famille de H a été accueillie en première instance mais rejetée en appel. La famille demande maintenant à cette Cour de rétablir le jugement de première instance en sa faveur. L'autre demande a été rejetée en première instance et l'affaire en est restée là.

Arrêt: L'appel doit être rejeté, les Juges Hall et Laskin étant dissidents.

La Cour: L'intimé K, en sa qualité d'hôte, de propriétaire et d'exploitant du yatch de croisière, avait le devoir de faire tout ce qui était en son pouvoir pour sauver M.

Les Juges Judson, Ritchie et Spence: On n'a pas soutenu qu'il y avait eu négligence dans le sauvetage de H; si K doit être tenu responsable envers les appelants, cette responsabilité doit découler d'une conclusion que la situation périlleuse créée par la chute de M a par la suite, dans les trois ou quatre minutes qui ont suivi, été aggravée par la négligence commise par K au cours de sa tentative de sauvetage, à un point tel que H a été incité à risquer sa vie en plongeant au secours de M. Bien que la méthode qu'a suivie K n'est pas celle que l'on recommande le plus, la preuve ne nous permet pas de conclure qu'une faute de K a amené H à risquer sa vie en plongeant comme il l'a fait. Si K a commis une erreur en reculant plutôt qu'en faisant virer le bateau et en se dirigeant «droit devant», c'est une erreur de jugement et non pas de la négligence, et, vu les circonstances, on doit excuser cette erreur.

Les Juges Hall et Laskin, *dissidents*: La conclusion que K était simplement coupable d'une erreur de jugement, ne peut pas être acceptée. Il ne s'agit pas d'un cas où K n'a pas bien exécuté la manœuvre requise, mais plutôt d'un cas où il n'a pas method of rescue which, on the uncontradictory evidence, was the proper one to employ in an emergency, and there was no external reason for his failure to do so. This breach of duty to M could properly be regarded as prompting H to attempt a rescue. He was not wanton or foolhardy and his action was not unforeseeable. In the concern of the occasion, and having regard to K's breach of duty, H could not be charged with contributory negligence in acting as he did.

[*Vanvalkenburg v. Northern Navigation Co.* (1913), 30 O.L.R. 142, overruled; *Videan v. British Transport Commission*, [1963] 2 Q.B. 650, referred to.]

APPEAL from a judgment of the Court of Appeal for Ontario[1], allowing an appeal from a judgment of Lacourciere J. Appeal dismissed, Hall and Laskin JJ. dissenting.

W. R. Maxwell and *S. M. Malach*, for the plaintiffs, appellants.

B. L. Eastman and *J. A. B. Macdonald*, for the defendants, respondents.

The judgment of Judson, Ritchie and Spence JJ. was delivered by

RITCHIE J.—I have had the opportunity of reading the reasons for judgment of my brother Laskin and I agree with him that the case of *Vanvalkenburg v. Northern Navigation Co.*[2] should no longer be considered as good law and that a duty rested upon the respondent MacLaren in his capacity as a host and as the owner and operator of the *Ogopogo*, to do the best he could to effect the rescue of one of his guests who had accidentally fallen overboard.

The learned trial judge recognized the existence of such a duty, but Mr. Justice Schroeder made no finding in this regard since he found that the duty owed by MacLaren in the present case was born of his having already embarked on the rescue of Matthews and being therefore bound to carry it through without negligence. I agree with the learned trial judge and Laskin J. that the duty

[1] [1970] 2 O.R. 487, 11 D.L.R. (3d) 277.
[2] (1913), 30 O.L.R. 142, 19 D.L.R. 649.

suivi la méthode de sauvetage qu'il convient d'employer, comme l'a établi la preuve demeurée incontestée, en cas d'urgence. Il n'existe aucune raison apparente pour laquelle il ne l'a pas fait. Il est à juste titre possible de considérer que le manquement à l'obligation envers M a amené H à tenter d'effectuer le sauvetage. H n'a pas été téméraire et irréfléchi, et son geste n'était pas imprévisible. Vu la gravité de la situation et eu égard au fait que K a manqué à son devoir, on ne peut accuser H de négligence commune du fait qu'il a plongé comme il l'a fait.

[Arrêt mis de côté: *Vanvalkenburg v. Northern Navigation Co.* (1913), 30 O.L.R. 142. Arrêt cité: *Videan v. British Transport Commission*, [1963] 2 Q.B. 650.]

APPEL d'un jugement de la Cour d'appel de l'Ontario[1], infirmant un jugement du Juge Lacourcière. Appel rejeté, les Juges Hall et Laskin étant dissidents.

W. R. Maxwell et *S. M. Malach*, pour les demandeurs, appelants.

B. L. Eastman et *J. A. B. Macdonald*, pour les défendeurs, intimés.

Le jugement des Juges Judson, Ritchie et Spence a été rendu par

LE JUGE RITCHIE—J'ai eu l'occasion de lire les motifs de mon collègue le Juge Laskin; comme lui, je crois que l'arrêt *Vanvalkenburg v. Northern Navigation Co.*[1] ne devrait plus être considéré comme faisant état du droit, et que l'intimé MacLaren, en sa qualité d'hôte, de propriétaire et d'exploitant (utilisateur) du *Ogopogo*, avait le devoir de faire tout ce qui était en son pouvoir pour sauver l'un de ses invités accidentellement tombé par-dessus bord.

Le savant juge de première instance a reconnu l'existence de ce devoir, mais M. le Juge Schroeder n'a tiré aucune conclusion à ce sujet puisqu'il a conclu que l'obligation de MacLaren en l'espèce découlait du fait que celui-ci avait déjà entrepris de sauver Matthews et était donc tenu de le faire sans commettre de négligence. Je partage l'avis du savant juge de première instance et du Juge

[1] [1970] 2 O.R. 487, 11 D.L.R. (3d) 277.
[2] (1913), 30 O.L.R. 142, 19 D.L.R. 649.

was a pre-existing one arising out of Matthews' position as a guest and passenger.

Whatever the origins of this duty may be, the finding of the learned trial judge that no breach of such duty either caused or contributed to the death of Matthews has not been questioned.

The duty, if any, owing to the late Mr. Horsley stands on an entirely different footing. If, upon Matthews falling overboard, Horsley had immediately dived to his rescue and lost his life, as he ultimately did upon contact with the icy water, then I can see no conceivable basis on which the respondent could have been held responsible for his death.

There is, however, no suggestion that there was any negligence in the rescue of Horsley and if the respondent is to be held liable to the appellants, such liability must in my view stem from a finding that the situation of peril brought about by Matthews falling into the water was thereafter, within the next three or four minutes, so aggravated by the negligence of MacLaren in attempting his rescue as to induce Horsley to risk his life by diving in after him.

I think that the best description of the circumstances giving rise to the liability to a second rescuer such as Horsley is contained in the reasons for judgment of Lord Denning in *Videan v. British Transport Commission*[3], where he said, at p. 669:

It seems to me that, if a person *by his fault* creates a situation of peril, he must answer for it to any person who attempts to rescue the person who is in danger. He owes a duty to such a person above all others. The rescuer may act instinctively out of humanity or deliberately out of courage. But whichever it is, so long as it is not wanton interference, if the rescuer is killed or injured in the attempt, he can recover damages *from the one whose fault has been the cause of it.*

The italics are my own.

In the present case a situation of peril was created when Matthews fell overboard, but it was

[3] [1963] 2 Q.B. 650.

Laskin que c'était là une obligation préexistante découlant du fait que Matthews était invité et passager.

Quel que soit le fondement de ce devoir, la conclusion du savant juge de première instance qu'aucun manquement à un tel devoir n'avait causé la mort de Matthews ni n'y avait contribué n'a pas été contestée.

Le devoir, s'il en est, qui existait envers feu M. Horsley, repose sur une base entièrement différente. Si, lorsque Matthews est tombé par-dessus bord, Horsley avait immédiatement plongé pour le sauver et avait perdu la vie, ce qui est finalement arrivé lorsqu'il s'est trouvé dans l'eau glacée, je ne pourrais concevoir aucun fondement qui eût permis de déclarer l'intimé responsable de sa mort.

Toutefois, on n'a pas soutenu qu'il y avait eu négligence dans le sauvetage de Horsley; à mon avis, si l'intimé doit être tenu responsable envers les appelants, cette responsabilité doit découler d'une conclusion que la situation périlleuse créée par la chute de Matthews a par la suite, dans les trois ou quatre minutes qui ont suivi, été aggravée par la négligence commise par MacLaren au cours de sa tentative de sauvetage, à un point tel que Horsley a été incité à risquer sa vie en plongeant au secours de Matthews.

Je crois que la meilleure description des circonstances qui entraînent une responsabilité envers un second sauveteur tel que Horsley se trouve dans les motifs de Lord Denning dans l'affaire *Videan v. British Transport Commission*[3]; il a dit, p. 669:

[TRADUCTION] Il me semble que si, *par sa faute*, une personne crée une situation périlleuse, elle doit en répondre à quiconque tente de sauver la personne en danger. Elle a un devoir envers lui plus qu'envers tout autre. Le sauveteur peut agir instinctivement, par esprit d'humanité, ou de façon, délibérée, par courage. Mais, de toute façon pour autant que son intervention n'est pas téméraire, si le sauveteur est tué ou blessé au cours de la tentative, il peut obtenir des dommages-intérêts *de la personne dont la faute en a été la cause.*

J'ai mis des mots en italique.

En l'espèce, une situation périlleuse a été créée lorsque Matthews est tombé par-dessus bord,

[3] [1963] 2 Q.B. 650.

not created by any fault on the part of MacLaren, and before MacLaren can be found to have been in any way responsible for Horsley's death, it must be found that there was such negligence in his method of rescue as to place Matthews in an apparent position of increased danger subsequent to and distinct from the danger to which he had been initially exposed by his accidental fall. In other words, any duty owing to Horsley must stem from the fact that a new situation of peril was created by MacLaren's negligence which induced Horsley to act as he did.

In assessing MacLaren's conduct in attempting to rescue Matthews, I think it should be recognized that he was not under a duty to do more than take all reasonable steps which would have been likely to effect the rescue of a man who was alive and could take some action to assist himself. While there is no express finding that Matthews died upon contact with the icy water because his body was never found, there is nevertheless unanimous agreement amongst all those who saw him that he was from the moment he entered the water, inert and rigid with his torso out of the water, his arms outstretched and his eyes staring, and the learned trial judge reached the conclusion on the balance of probabilities that it had not been shown that his life could have been saved. The added difficulties in rescuing an inert body from the water as opposed to the body of a man who was alive and could assist himself do not need to be stressed, but as will hereafter appear, the difficulties entailed in retrieving a dead body undoubtedly increase the time involved in effecting its rescue.

When the respondent's boat, the *Ogopogo,* left the dock at the Port Credit Yacht Club at about 6:30 p.m. on May 7, 1966, the only three passengers on deck were the late Mr. Matthews, who had been casting off the bow line and was seated on the port side of the foredeck, Richard Jones who was in the pilot's cockpit, and the respondent MacLaren who was at the helm. The weather was cool and a northwest wind was creating a light chop on Lake Ontario. As the boat proceeded away from the dock and after it had travelled

mais non pas par quelque faute qu'aurait commise MacLaren. Avant de pouvoir déclarer MacLaren responsable de quelque façon que ce soit en ce qui concerne la mort de Horsley, il faut décider si en procédant suivant la méthode qu'il a choisie pour effectuer le sauvetage, MacLaren a fait preuve d'une négligence telle que Matthews a été placé dans une situation apparente de danger accru, postérieure à la situation dangereuse dans laquelle il s'était trouvé en tombant accidentellement et distincte de celle-ci. En d'autres termes, toute obligation envers Horsley doit découler du fait que la négligence de MacLaren a entraîné une nouvelle situation périlleuse qui a amené Horsley à agir comme il l'a fait.

En appréciant la conduite de MacLaren lorsqu'il a tenté de sauver Matthews, je crois qu'il faut reconnaître qu'il n'était aucunement tenu de faire plus que de prendre toutes les mesures raisonnables susceptibles de sauver un homme en vie et capable de faire quelque chose pour s'aider. Il n'existe aucune conclusion expresse que Matthews est mort au contact de l'eau glacée, parce que son corps n'a jamais été retrouvé, mais néanmoins tous ceux qui l'ont vu s'entendent pour dire que, dès qu'il fut dans l'eau, il a été inerte et rigide, le torse sorti de l'eau, les bras écartés et les yeux fixes; le savant juge de première instance en est venu à la conclusion que, selon la balance des probabilités, il n'avait pas été démontré qu'on aurait pu lui sauver la vie. Les difficultés additionnelles qui se présentent lorsqu'on tente de tirer de l'eau un corps inerte et non un homme vivant pouvant s'aider n'ont pas à être soulignées, mais comme nous le verrons plus loin, les difficultés que comporte le repêchage d'un cadavre prolongent certainement la durée du sauvetage.

Lorsque le bateau de l'intimé, le *Ogopogo,* a quitté le quai du Port Credit Yacht Club vers 6 h 30 de l'après-midi le 7 mai 1966, il y avait trois passagers sur le pont: le défunt, M. Matthews, qui avait largué l'amarre de bout et était assis sur le pont avant, côté bâbord, Richard Jones qui se trouvait dans le cockpit de pilotage, et l'intimé MacLaren qui était à la barre. Le temps était frais; un vent nord-ouest rendait le lac Ontario légèrement clapoteux. Comme le bateau s'éloignait du quai, et après qu'il eut parcouru about a mile into the broader waters of the lake, the wind increased and Matthews got up from his position in the bow and started to walk along the cat-walk on the port side of the vessel. As he did so he was holding onto a rail on the port side of the cabin top and in so doing he toppled over into the water. The clearest description of Matthews' fall is in my opinion that which was given by Jones who was called as a witness by the plaintiff and whose evidence appears to me to constitute the fullest account of the whole incident. Upon seeing the fall, Jones at once raised the cry: "Roly is overboard" and in describing the events which immediately followed he said:

Q. Yes. And where was his body when you next observed it?
A. It was on the starboard side possibly ten feet behind the stern, and—
Q. Yes?
A. —he seemed to be, you know, feet down, or at least he seemed to be up in the water.

Q. And what if anything did MacLaren do with your words, 'Roly is overboard', or words to that effect; what did the boat do?

A. Well, I didn't of course watch MacLaren, I was watching Mr. Matthews in the water. But MacLaren did put it into reverse. Now by that time Mr. Matthews would have been considerably further astern than when I first saw him.
Q. How far astern?
A. Well, I would say fifty feet.
Q. Did Mr. MacLaren stop the engines at any time?
A. Turn the key off?
Q. Yes?
A. No, no, he certainly didn't do it then.

Q. No, I'm speaking to this particular point?
A. No. . .
Q. At that particular point in location, did Mr. MacLaren turn the Ogopogo in any way, either to left or right, port or starboard?

A. Not to any appreciable degree that I noticed. He didn't like, try to turn around or anything.

environ un mille sur le lac, au large, le vent s'est élevé. Matthews, qui se trouvait à l'avant, s'est levé et s'est mis à marcher le long du passavant, côté bâbord. Ce faisant, il se tenait à une main courante, côté bâbord, au haut de la cabine, et c'est alors qu'il est tombé à la renverse dans l'eau. A mon avis, la description la plus claire de la chute de Matthews a été donnée par Jones, qui a été appelé à témoigner par le demandeur et dont le témoignage me semble constituer la narration la plus détaillée de tout l'incident. En le voyant tomber, Jones a tout de suite crié: [TRADUCTION] «Roly est à la mer». Relatant les événements qui ont suivi immédiatement, il a dit:

[TRADUCTION] Q. Oui. Où était son corps lorsque vous l'avez observé par la suite?
R. Côté tribord, peut-être à dix pieds derrière le bateau, et . . .
Q. Oui?
R. —il semblait être, comment dire, les pieds en bas, ou du moins il semblait se tenir à la verticale dans l'eau.
Q. Qu'a fait MacLaren, si toutefois il a fait quelque chose, lorsque vous avez crié: «Roly est à la mer» ou quelque chose du genre; qu'est-ce qui est arrivé au bateau?
R. Évidemment, je n'ai pas surveillé MacLaren, je surveillais M. Matthews dans l'eau. Mais MacLaren a fait marche arrière. Dans cet intervalle, M. Matthews s'était considérablement éloigné sur l'arrière, beaucoup plus que lorsque je l'ai d'abord aperçu.
Q. A quelle distance sur l'arrière?
R. Je dirai à cinquante pieds.
Q. M. MacLaren a-t-il arrêté les moteurs à un moment donné?
R. En tournant la clé?
Q. Oui.
R. Non, non, il ne l'a sûrement pas fait, à ce moment-là.
Q. Non, je veux dire à ce point précis.
R. Non . . .
Q. A ce point précis, en parlant du lieu, M. MacLaren a-t-il fait virer le *Ogopogo* de quelque façon que ce soit, à droite ou à gauche, à bâbord ou à tribord?
R. Du moins pas de façon assez prononcée pour que je m'en aperçoive. Il n'a pas, pour ainsi dire, essayé de tourner ou de faire quelque chose du genre.

Q. Yes. What did he do?
A. Well, he reversed his motors and backed up on Mr. Matthews.
Q. Yes. And could you describe how the boat approached Matthews in the water?
A. Well, MacLaren was backing and reversing it on the two engines, which would be the normal—it was a twin engine boat.
Q. Yes?
A. And he would be backing up on him, and he would be swerving the boat one way and another, I don't—it would be quite choppy to take it straight as a die. And I threw a life-ring to Mr. Matthews just as soon as I could.

On cross-examination Mr. Jones continued:

Q. And you said that you threw a life-ring at him, is that correct?
A. I threw the life-ring when we were about, oh, maybe thirty feet away from him, which landed in front. I think I couldn't throw it far enough.
Q. Had the boat stopped at that time?
A. No, no, no, but my—
Q. Was Mr. MacLaren backing it up?
A. He was backing it up, and then when we got much closer, I threw one of the life-jackets and it was right in front of him.
Q. Right in front of him?
A. Yes, under his nose almost.
Q. Was it touching him?
A. Oh no, I didn't aim to hit him, I just wanted to put it close and very definitely it landed right in front of his face, right in front of his body.
Q. Well, how many inches or feet?
A. Well no more than six inches or a foot.
Q. Six inches or a foot away?
A. Yes.
Q. And is it your opinion that it was within his reach?
A. Yes, most assuredly, yes.
Q. And he didn't grab it?
A. No.

When Jones cried out "Roly is overboard" those in the cabin were immediately alerted. Mr. Marck, who was one of the guests, rushed to the stern and picked up a pike pole, Mrs. MacLaren started to pass up the life-jackets and

Q. Oui. Qu'a-t-il fait?
R. Bien, il a mis les moteurs en marche arrière et a reculé vers M. Matthews.
Q. Oui. Et pourriez-vous décrire comment le bateau s'est approché de Matthews dans l'eau?
R. Bien, MacLaren reculait et mettait les deux moteurs en marche arrière, ce qui était normal . . . c'était un bateau bimoteur.
Q. Oui?
R. Et il reculait dans sa direction; il faisait faire au bateau des embardées d'un côté et de l'autre, je ne—les eaux étaient passablement agitées pour le conduire droit comme une flèche. J'ai jeté une bouée de sauvetage à M. Matthews, dès que j'ai pu.

Lors du contre-interrogatoire, M. Jones a ajouté:

[TRADUCTION] Q. Vous avez dit que vous lui aviez jeté une bouée de sauvetage, n'est-ce pas?
R. J'ai jeté la bouée de sauvetage lorsque nous étions à environ, oh, peut-être à trente pieds de lui; elle a été projetée devant lui. Je crois que je n'ai pas pu la lancer assez loin.
Q. Le bateau était-il arrêté à ce moment-là?
R. Non, non, non mais mon . . .
Q. M. MacLaren le faisait-il reculer?
R. Il le faisait reculer, puis lorsque nous sommes parvenus beaucoup plus près, j'ai jeté l'un des gilets de sauvetage, il était juste devant lui.
Q. Juste devant lui?
R. Oui, presque sous son nez.
Q. Le touchait-il?
R. Oh non, je ne voulais pas le frapper, je voulais juste lancer le gilet près de lui; à coup sûr, il est tombé juste en face de son visage, juste devant son corps.
Q. A combien de pouces ou de pieds?
R. A pas plus de six pouces ou un pied.
Q. A six pouces ou un pied?
R. Oui.
Q. Et vous croyez qu'il était à sa portée?
R. Oui, c'est bien sûr, oui.
Q. Et il ne l'a pas saisi?
R. Non.

Lorsque Jones a crié: «Roly est à la mer», les personnes qui se trouvaient dans la cabine ont tout de suite été averties. M. Marck, l'un des invités, s'est précipité à l'arrière et a ramassé une perche pointue; M[me] MacLaren s'est mise à dis-

Horsley and Mrs. Jones came up and were standing by in the cockpit.

Reconstructing the events from the evidence of those who were actually at the scene, it appears to me that MacLaren was first alerted to Matthews' fall when the body was only about a boat-length and a half behind him. He put the engines momentarily in neutral and as soon as he saw the body he reversed, almost immediately after which Jones threw a life-ring within ten feet of the man in the water. As the boat got closer to the body, the side of the transom astern obscured MacLaren's view and when he was within four or five feet of the body he says that he turned the engines off, although Jones' evidence is that he shifted to neutral. In any event, this action was obviously taken to obviate the possibility of the propellers contacting the body and the effect was that the boat at first drifted closer to Matthews and was then carried away by the wind to a distance which is estimated at ten feet. Just before the gust of wind carried the boat to port, Marck had the pike pole within Matthews' reach if he had been able to grab it.

This latter incident is described by MacLaren where he says:

Q. When you shut the engines off, did you consider the weather at that time?
A. No, I thought I had enough way on that I would drift on to him.
Q. How far did you—you drifted away?
A. We drifted up somewhat until she ran out of way, and Don almost got a hook on him.
Q. Yes?
A. Had Roly been able to help himself, he certainly—he could have grabbed it, it was so close to him.
Q. Yes?
A. Then the boat pivoted.

Having considered the evidence of Jones, MacLaren, Marck and Mrs. Jones, I am satisfied that Matthews' body had been in the water for a little less than two minutes when Marck first had the

tribuer les gilets de sauvetage et Horsley et Mme Jones sont montés et se sont postés dans le cockpit.

Si je reconstitue les événements d'après le témoignage de ceux qui se trouvaient là, il me paraît que MacLaren a d'abord été averti de la chute de Matthews lorsque celui-ci ne se trouvait qu'à environ une longueur de bateau et demie sur l'arrière. Il a momentanément mis les moteurs au point mort; dès qu'il a vu le corps, il les a mis en marche arrière, après quoi Jones a lancé, presque immédiatement, une bouée de sauvetage à moins de dix pieds de l'homme qui se trouvait dans l'eau. A mesure que le bateau se rapprochait du corps, le côté du tableau arrière masquait la vue à MacLaren; lorsqu'il s'est trouvé à quatre ou cinq pieds du corps, il a stoppé les moteurs, dit-il, bien que, selon Jones, il les ait plutôt mis au point mort. De toute façon, il a sûrement fait cela en vue d'éviter que les hélices ne viennent en contact avec le corps, mais cela a tout d'abord fait dériver le bateau encore plus près de Matthews, et le bateau a par la suite été entraîné par le vent à une distance estimée à dix pieds. Juste avant que le coup de vent ne pousse le bateau à bâbord, Marck avait tendu la perche pointue à portée de la main de Matthews si celui-ci avait pu la saisir.

Ce dernier incident est décrit par MacLaren dans les termes suivants:

[TRADUCTION] Q. Lorsque vous avez stoppé les moteurs avez-vous tenu compte du temps?
R. Non, je croyais avoir assez d'erre pour dériver vers lui.
Q. A quelle distance vous êtes-vous . . . vous avez dérivé?
R. Nous avons dérivé quelque jeu jusqu'à ce que le bateau n'ait plus d'erre; Don a presque réussi à le toucher de la perche.
Q. Oui?
R. Si Roly avait pu s'aider, il aurait sûrement—il aurait pu la saisir, elle était si près de lui.
Q. Oui?
R. Puis le bateau a pivoté.

Après avoir examiné les témoignages de Jones, de MacLaren, de Marck et de Mme Jones, je suis convaincu que Matthews était dans l'eau depuis un peu moins de deux minutes lorsque Marck a, pike pole within his grasp and a life-jacket thrown by Jones was within six inches of him. After the boat started to drift away, the subsequent efforts to rescue Matthews by reversing engines and coming stern on towards him had been in progress for another minute or two and the boat was within two or three feet when Horsley dove in surfacing about ten feet beyond the body. Horsley's dive was followed almost immediately by that of Mrs. Jones, but as she hit the water the body of Matthews disappeared. The medical evidence established that Horsley, after his body had been recovered had no sign of water in his lungs, and that he did not die by drowning but rather from shock sustained on contact with the icy water. Mrs. Jones was rescued after her husband had taken the helm and brought the boat bow on towards her.

The finding of the learned trial judge that MacLaren was negligent in the rescue of Matthews is really twofold. On the one hand he finds that there was a failure to comply with the "man overboard" rescue procedure recommended by two experts called for the plaintiff, and on the other hand he concludes that MacLaren "was unable to exercise proper judgment in the emergency created because of his excessive consumption of alcohol." In the course of his reasons for judgment in the Court of Appeal, Mr. Justice Schroeder expressly found that there was nothing in the evidence to support the view that MacLaren was incapable of proper management and control owing to the consumption of liquor, the question was not seriously argued in this Court, and like my brother Laskin, I do not think there is any ground for saying that intoxicants had anything to do with the fatal occurrences. Mr. Justice Lacourciere's finding as to failure to follow the procedure recommended by experts was phrased as follows[4]:

I can only conclude that the defendant's adoption of the wrong procedure in the circumstances was negligent, being a failure to exercise the reasonable

[4] [1969] 2 O.R. 137 at p. 145, 4 D.L.R. (3d) 557.

pour la première fois, réussi à mettre la perche pointue à portée de sa main et qu'un gilet de sauvetage lancé par Jones s'est trouvé à moins de six pouces de lui. Après que le bateau a commencé à dériver, une ou deux minutes de plus furent consacrées à de nouvelles tentatives de sauver Matthews en mettant les moteurs en marche arrière et en s'approchant de lui droit derrière et, lorsque le bateau s'est trouvé à moins de deux ou trois pieds, Horsley a plongé, remontant à la surface à quelque dix pieds passé le corps. Presque immédiatement après, c'est M^me^ Jones qui s'est jetée à l'eau, mais au moment où elle touchait l'eau, Matthews a disparu. L'expertise médicale a établi que le corps de Horsley, lorsqu'il a été repêché, n'avait aucune trace d'eau dans les poumons et que Horsley ne s'était pas noyé mais était plutôt mort des suites du choc subi au contact de l'eau glacée. On a sauvé M^me^ Jones après que son mari eut pris la barre et amené le bateau droit sur elle.

La conclusion du savant juge de première instance que MacLaren a été négligent en effectuant le sauvetage de Matthews est double en réalité. D'une part, le juge conclut que MacLaren a omis de se conformer à la méthode de sauvetage prônée par deux experts appelés par le demandeur, lorsqu'un homme est «à la mer», d'autre part, il conclut que MacLaren: [TRADUCTION] «n'a pas pu faire preuve de jugement dans cette situation d'urgence parce qu'il avait consommé trop d'alcool». Dans les motifs qu'il a rendus en Cour d'appel, M. le Juge Schroeder a expressément conclu que rien dans la preuve ne permet de dire que MacLaren ne pouvait, à cause de la consommation d'alcool, exercer la surveillance et le contrôle requis. En cette Cour, cette question n'a pas vraiment fait l'objet de discussions et comme mon collègue le Juge Laskin, je ne crois pas qu'il y ait de motif d'affirmer que l'alcool a été relié aux événements fatals qui sont survenus. La conclusion de M. le Juge Lacourcière sur le défaut de suivre la méthode recommandée par les experts est exprimée en ces termes[4]:

[TRADUCTION] Je puis uniquement conclure qu'en adoptant la mauvaise méthode dans ces circonstances, le défendeur s'est montré négligent, car

[4] [1969] 2 O.R. 137, p. 145, 4 D.L.R. (3d) 557.

care that the ordinary, prudent, reasonable operator would have shown in effecting the "man overboard" rescue. The defendant in his evidence admitted that he made what he described as an error of judgment and did not attempt to justify the rescue procedure adopted.

The procedure recommended by the experts in such circumstances was to bring the boat bow on towards the body and the witness Mumford, who had written a "boating course" for the Canadian Boating Federation and had considerable experience in small boats, testified that "it would take about two minutes to turn the boat around and come back on him and have him alongside, and possibly another twenty-five, thirty seconds to get him on the boat." The other expert, Livingstone, took the view that by using the bow-on procedure it would take a maximum of two minutes to effect the rescue. Neither of these experts was present at the time of the accident nor, as far as the record speaks, had either of them been at the helm of a twin-engine motor-cruiser when a cry was raised that a man was overboard, and it was seen that his body was only a boat-length and a half astern. In fact it does not appear from the record that either expert had ever had the experience of being faced with the sudden responsibility to which this circumstance gave rise, and although they no doubt gave an accurate account of the most highly recommended method of effecting a rescue, their evidence appears to me to be unrelated to the critical position in which MacLaren found himself. In this regard I am in complete agreement with the finding of Mr. Justice Schroeder where he says[5]:

In my respectful opinion the evidence of the two experts spells out a standard of text-book perfection given at a time when all the evidence had been sifted and all the facts ascertained in the calm and deliberate atmosphere of a judicial investigation. It is ever so easy to be wise after the event and to state *ex post facto* that the conduct of the appellant, who had to rely upon the co-operation of the other passengers in effecting the rescue of Matthews, fell

[5] [1970] 2 O.R. 487 at p. 494, 11 D.L.R. (3d) 277.

c'était là une omission d'agir avec la diligence raisonnable dont aurait fait preuve le navigateur ordinaire, prudent et raisonnable en effectuant le sauvetage «d'un homme à la mer». Dans son témoignage, le défendeur a admis qu'il a fait ce qu'il a appelé une erreur de jugement; il n'a pas tenté de justifier la méthode de sauvetage qu'il a adoptée.

La méthode recommandée par les experts en pareilles circonstances consiste à se diriger droit devant vers la personne; le témoin Mumford, qui a rédigé un «manuel sur la navigation de plaisance», pour la Canadian Boating Federation et qui a beaucoup d'expérience en ce qui concerne les petites embarcations, a témoigné que [TRADUCTION] «il faudrait environ deux minutes pour faire virer le bateau et pour retourner en direction de la personne de façon que celle-ci se trouve à côté du bateau, et peut-être vingt-cinq, ou trente, secondes de plus pour la hisser à bord». L'autre expert, Livingstone, est d'avis qu'en utilisant la méthode qui consiste à se diriger droit devant, il faudrait tout au plus deux minutes pour effectuer le sauvetage. Aucun de ces témoins n'était présent au moment de l'accident; pour autant que le dossier le montre, aucun des deux ne s'était déjà trouvé à la barre d'un yacht de plaisance bimoteur sur lequel on avait crié qu'un homme était tombé par-dessus bord, et constaté qu'il ne se trouvait qu'à une longueur de bateau et demie sur l'arrière. De fait, le dossier ne montre pas que l'un de ces témoins ait déjà eu à faire face à la responsabilité soudaine qu'il faut assumer en pareilles circonstances. Sans doute donnent-ils un exposé exact de la méthode la plus recommandée pour effectuer un sauvetage, mais leur témoignage me semble n'avoir aucun rapport avec la situation critique dans laquelle MacLaren s'est trouvé. A cet égard, je souscris entièrement à la conclusion du Juge Schroeder[5]:

[TRADUCTION] A mon humble avis, dans leur témoignage, les deux experts énoncent une norme théorique de perfection établie à un moment où toute la preuve a été étudiée à fond et où tous les faits ont été établis dans l'atmosphère calme et l'ordre d'une enquête judiciaire. Il est toujours facile d'être sage après coup et d'affirmer *ex post facto* qu'en se conduisant ainsi, l'appelant, qui d'ailleurs devait se fier à la coopération des autres passagers

[5] [1970] 2 O.R. 487, p. 494, 11 D.L.R. (3d) 277.

short of the standard of reasonableness. He is surely entitled to be judged in the light of the situation as it appeared to him at the time and in the context of immediate and pressing emergency, even if a duty of using reasonable care in effecting the rescue of Matthews was properly cast upon him. The learned trial Judge excused the conduct of Horsley in the light of the emergency but failed to apply the same test to the appellant whose problems and responsibilities were much greater and more complex. The excitement created by the cry "Roly's overboard", the fact that the appellant had to act immediately, the confusion attendant upon the suddenness of the tragic occurrence, the lack of time and opportunity for mature consideration, all these circumstances must be taken into account in approaching a determination of whether the appellant was guilty of negligence in backing the vessel towards Matthews instead of proceeding towards him "bow on", assuming that the standard contended for is applicable.

It is true that on cross-examination Mr. MacLaren agreed that the first recommended method of rescue is to come around in a circle and put the man on your lee, but he also says that it is possible to come stern on towards the body with a twin-screw boat and that he had practised this method and thought it would be the best under the circumstances which faced him.

He says quite frankly: "... I felt the quickest way out of it—I had my eye on him—I felt the quickest way was straight back. This could have been an error in judgment, I don't know. But I thought this was the best way."

I am also in agreement with Mr. Justice Schroeder's comments on the procedure followed by MacLaren when he says, at p. 495:

Of even greater significance is the question as to whether it has been proven that the manoeuvre undertaken by MacLaren actually prolonged the time within which the point was reached where a successful attempt could have been made. The manoeuvre recommended by the experts would have taken two minutes or more, whereas the approximate time from the moment that Matthews fell over-

pour effectuer le sauvetage de Matthews, ne s'est pas conformé à la norme de la diligence raisonnable. Il a sûrement le droit d'être jugé dans le contexte de la situation telle qu'elle lui est apparue à ce moment-là et dans le contexte d'un état d'urgence immédiate et pressante, même s'il s'est trouvé à juste titre obligé d'exercer une diligence raisonnable en effectuant le sauvetage de Matthews. Le savant juge de première instance a excusé la conduite de Horsley étant donné l'urgence de la situation mais il n'a pas appliqué le même critère à l'appelant, dont les problèmes et les responsabilités étaient beaucoup plus graves et beaucoup plus complexes. L'excitation créée par le cri: «Roly est à la mer» le fait que l'appelant devait agir sur-le-champ, la confusion due au caractère soudain de l'événement tragique, le fait que l'on n'a pas eu le temps ni l'occasion de réfléchir à fond, tout cela doit entrer en ligne de compte lorsqu'on veut déterminer si l'appelant s'est rendu coupable de négligence pour avoir fait reculer le bateau en direction de Matthews au lieu, à supposer que la norme invoquée s'applique, de le diriger «droit devant» sur lui.

Il est vrai que lors du contre-interrogatoire, M. MacLaren a admis que la principale méthode de sauvetage recommandée consiste à décrire un cercle de façon que la personne se trouve du côté qui est sous le vent, mais il a également dit qu'il est possible de se diriger droit derrière vers la personne, s'il s'agit d'un yacht à hélices jumelles, qu'il avait déjà employé cette méthode et qu'il croyait que c'était la meilleure méthode à suivre dans les circonstances auxquelles il avait à faire face.

Il dit très franchement: [TRADUCTION] « ... J'ai cru que la façon la plus rapide de s'en tirer —Je gardais les yeux sur lui—J'ai cru que la façon la plus rapide consistait à reculer. C'était peut-être une erreur de jugement, je l'ignore. Mais j'ai cru que c'était la meilleure façon».

Je souscris également aux commentaires suivants du Juge Schroeder en ce qui concerne la méthode qu'a suivie MacLaren, p. 495:

[TRADUCTION] Il importe encore plus de se demander s'il a été prouvé que la manœuvre qu'a effectuée MacLaren a réellement demandé plus de temps pour rejoindre l'endroit d'où une tentative de sauvetage pouvait réussir. La manœuvre recommandée par les experts aurait pris deux minutes ou plus, alors qu'entre le moment où Matthews est tombé par-dessus bord et celui où il est disparu sous board until his body disappeared beneath the boat was three or four minutes. Whatever may be said in criticism of MacLaren's conduct, his efforts at rescue cannot be said to have worsened Matthews' condition. Moreover, when the boat was first reversed and brought to a stop, a lifejacket was thrown to Matthews who could have grasped it had he not then lost consciousness.

As I have indicated, the evidence discloses that the boat was first brought to a stop in a maximum of two minutes after the body was sighted and at that time there was not only a life-jacket but a pike pole within Matthews' grasp had he been conscious.

I share the view expressed by my brother Laskin when he says, in the course of his reasons for judgment, that:

> Encouragement by the common law of the rescue of persons in danger would, in my opinion, go beyond reasonable bounds if it involved liability of one rescuer to a succeeding one where the former has not been guilty of any fault which could be said to have induced a second rescue attempt.

In the present case, however, although the procedure followed by MacLaren was not the most highly recommended one, I do not think that the evidence justifies the finding that any fault of his induced Horsley to risk his life by diving as he did. In this regard I adopt the conclusion reached by Mr. Justice Schroeder in the penultimate paragraph of his reasons for judgment where he says:

> ...if the appellant erred in backing instead of turning the cruiser and proceeding towards Matthews "bow on", the error was one of judgment and not negligence, and in the existing circumstances of emergency ought fairly to be excused.

I think it should be made clear that in my opinion the duty to rescue a man who has fallen accidentally overboard is a common law duty the existence of which is in no way dependent upon the provisions of s. 526(1) of the *Canada Shipping Act,* R.S.C. 1952, c. 29.

I should also say that, unlike Mr. Justice Jessup, the failure of Horsley to heed MacLaren's

le bateau il s'est écoulé à peu près trois ou quatre minutes. Quelque critique que l'on puisse faire au sujet de la conduite de MacLaren, on ne peut pas dire que ses efforts ont aggravé la situation dans laquelle se trouvait Matthews. De plus, lorsqu'on a d'abord renversé les moteurs, puis fait stopper le bateau un gilet de sauvetage a été lancé à Matthews qui aurait pu le saisir, s'il n'avait pas perdu connaissance.

Comme je l'ai signalé, la preuve fait voir que l'on a fait stopper le bateau pour la première fois deux minutes au plus après que l'on a vu Matthews; à ce moment-là, Matthews aurait pu saisir non seulement un gilet de sauvetage mais également une perche pointue, s'il n'avait pas perdu connaissance.

Je partage l'avis suivant exprimé par mon collègue le Juge Laskin dans ses motifs:

> [TRADUCTION] A mon avis, l'encouragement de la common law au sauvetage de personnes en danger dépasserait les bornes raisonnables s'il rendait un sauveteur responsable envers un second sauveteur alors que le premier n'a commis aucune faute de laquelle on puisse dire qu'elle a été une incitation à une seconde tentative de sauvetage.

En l'espèce, toutefois, bien que la méthode qu'a suivie MacLaren n'est pas celle que l'on recommande le plus, je ne crois pas que la preuve nous permette de conclure qu'une faute de MacLaren a amené Horsley à risquer sa vie en plongeant comme il l'a fait. A cet égard, j'adopte la conclusion à laquelle M. le Juge Schroeder est arrivé dans l'avant-dernier paragraphe de ses motifs:

> [TRADUCTION] ...si l'appelant a commis une erreur en reculant plutôt qu'en faisant virer le bateau et en se dirigeant «droit devant» vers Matthews, c'est une erreur de jugement et non pas de la négligence et, vu les circonstances de la situation d'urgence qui existait, on doit pour être juste excuser cette erreur.

Je crois qu'il faudrait souligner qu'à mon avis, le devoir de sauver une personne accidentellement tombée par-dessus bord existe en vertu de la common law et ne dépend aucunement de l'art. 526(1) de la *Loi sur la marine marchande du Canada,* S.R.C. 1952, c. 29.

Je dois également dire qu'au contraire de M. le Juge Jessup, le fait que Horsley ne s'est pas warning to remain in the cockpit or cabin plays no part in my reasoning.

For all these reasons I would dismiss this appeal with costs.

The judgment of Hall and Laskin JJ. was delivered by

LASKIN J. (*dissenting*)—On a cool evening in early May, 1966, an invited guest on board a cabin cruiser, which was on its way to its home port, Oakville, from Port Credit, accidentally fell into the lake. In the course of rescue operations, another invited guest dived into the water to help him. The effort was without avail. The rescuer was pulled from the water by others on board, could not be resuscitated and was later pronounced dead. The body of the rescuee was never recovered. These are the bare bones of two fatal accident actions brought against the boat owner, who was in charge of his craft at the time, for the benefit of the widows and dependants of the two deceased. The rescuer's family succeeded at the trial but their claim was dismissed on appeal, and they now seek restoration by this Court of the favourable trial judgment. The other claim failed at trial and was not pursued farther.

Various theories of the liability of the boat owner MacLaren were explored at trial and on appeal. Lacourciere J. founded himself on the following conclusions: (1) MacLaren was under a duty to aid the passenger Matthews who had accidentally fallen overboard and, in any event, he had affirmatively undertaken to effect a rescue; (2) he was negligent in the way in which he attempted the rescue; (3) he thus induced the rescuer Horsley to court the danger of effecting a rescue and was, accordingly, liable for the resulting injury and damage; (4) there was no contributory negligence on Horsley's part, nor any voluntary assumption of the risk created by MacLaren's negligence.

conformé à l'avertissement de MacLaren de demeurer dans le cockpit ou dans la cabine n'entre pas dans mon raisonnement.

Pour tous ces motifs, je suis d'avis de rejeter l'appel avec dépens.

Le jugement des Juges Hall et Laskin a été rendu par

LE JUGE LASKIN (*dissident*)—Par une soirée fraîche du début de mai 1966, un invité à bord d'un yacht de croisière qui se dirigeait de Port Credit à son port d'attache, situé à Oakville, est accidentellement tombé dans les eaux du lac. Au cours des opérations de sauvetage, un autre invité a plongé à l'eau pour l'aider. Les efforts de celui-ci se sont avérés inutiles. Le sauveteur a été tiré de l'eau par d'autres personnes qui se trouvaient à bord; il a été impossible de le ranimer et on a par la suite constaté la mort. Le corps du passager qu'il avait voulu sauver n'a jamais été retrouvé. C'est là la substance de deux actions intentées à la suite de l'accident mortel contre le propriétaire du yacht, qui avait la direction de l'embarcation à ce moment-là, pour le compte de la veuve et des personnes à charge de chacun des deux défunts. La demande de la famille du sauveteur a été accueillie en première instance mais rejetée en appel. La famille demande maintenant à cette Cour de rétablir le jugement de première instance en sa faveur. L'autre demande a été rejetée en première instance et l'affaire en est restée là.

En première instance et en appel, diverses théories ont été étudiées en ce qui concerne la responsabilité du propriétaire du bateau, M. MacLaren. Le Juge Lacourcière s'est fondé sur les conclusions suivantes: (1) MacLaren avait le devoir d'aider le passager Matthews, accidentellement tombé par-dessus bord, et, en tout état de cause, il avait entrepris de façon positive d'effectuer le sauvetage; (2) il a été négligent dans la façon dont il a tenté d'effectuer le sauvetage; (3) il a ainsi amené le sauveteur Horsley à s'exposer au danger d'effectuer le sauvetage et est donc responsable des dommages qui en résultent; (4) Horsley n'a commis aucune négligence commune et n'a aucunement assumé volontairement le risque qu'avait créé la négligence de MacLaren.

In the Ontario Court of Appeal, Schroeder J.A., with whom McGillivray J.A. agreed, took as his starting point that whether or not there was a legal duty on MacLaren to come to the aid of Matthews, he did take steps to effect a rescue. The learned justice went on to say that even if, in these circumstances, a duty of using reasonable care rested on MacLaren the standard must be fixed in the light of the "immediate and pressing emergency"; and, moreover, the applicable principle was that liability would not be visited upon MacLaren if his efforts at rescue, although falling short of the required standard of care, did not worsen Matthews condition so as to induce Horsley to attempt a rescue. Schroeder J.A. concluded that MacLaren's efforts at rescue did not worsen Matthews' condition. He rejected the contention that there could be any liability upon MacLaren in respect of Horsley, arising out of the failure to carry out with due care a supposed duty to rescue Matthews, when he did not originally imperil Matthews. To charge MacLaren with foreseeability of Horsley's intervention in such circumstances would be, according to Schroeder J.A., an unwarranted extension of the principles found in the rescue cases. Returning to his starting point, the learned justice concluded that the evidence did not support a finding that anything done or left undone by MacLaren caused his rescue efforts to fail; and if he erred in the procedures he followed, the error was an excusable error of judgment and did not amount to negligence.

Jessup J.A. came to the same exonerating result but on quite a narrow ground. He endorsed the view of the trial judge that there was a legal duty upon the master of a ship to aid a passenger who had fallen overboard, as being a duty of aid against perils of the sea. Again, there was a legal duty to avoid frustrating rescue by negligence in rendering assistance. MacLaren should have foreseen that by reason of his negligence in prolonging Matthews exposure to drowning, a rescue would be attempted by one of those on board. However, MacLaren had earlier warned Horsley to stay in the cockpit or cabin, and

En Cour d'appel de l'Ontario, le Juge Schroeder, avec qui le Juge McGillivray était d'accord, est parti de la prémisse suivante: que MacLaren ait eu ou non, en droit, le devoir de venir en aide à Matthews, il a pris les mesures pour effectuer le sauvetage. Le savant juge a ajouté que même si, dans ces circonstances, MacLaren avait le devoir d'user de diligence raisonnable, la norme applicable devait être établie en tenant compte de l'«urgence immédiate et pressante» de la situation; de plus, le principe applicable était que MacLaren n'était pas responsable si ses efforts en vue du sauvetage, même en-deçà du degré de diligence requis, n'avaient pas aggravé la situation dans laquelle se trouvait Matthews de façon à amener Horsley à tenter d'effectuer lui-même le sauvetage. Le Juge d'appel Schroeder a conclu que les efforts de MacLaren n'avaient pas aggravé la situation de Matthews. Le juge a rejeté la prétention que MacLaren pouvait être responsable à l'égard de Horsley en raison de l'omission de remplir avec la diligence requise un présumé devoir de sauver Matthews, alors qu'il n'avait pas initialement mis Matthews en danger. En pareilles circonstances, selon le Juge d'appel Schroeder, on étendrait la portée des principes établis dans les arrêts en matière de sauvetage de façon injustifiable si l'on décidait que MacLaren aurait dû prévoir l'intervention de Horsley. Revenant à son point de départ, le savant juge a décidé que la preuve ne permettait pas de conclure que par un acte ou une omission quelconque, MacLaren a fait échouer sa tentative de sauvetage; s'il n'a pas pris les mesures qu'il aurait dû prendre, ce n'est là qu'une erreur de jugement excusable, n'équivalant pas à une négligence.

Le Juge d'appel Jessup a lui aussi conclu à l'absence de responsabilité mais pour un motif assez restreint. Il a souscrit à l'avis du juge de première instance que le capitaine d'un navire a, en droit, le devoir d'aider un passager tombé pardessus bord, soit un devoir d'assistance contre les périls de la mer. Il a également, en droit, le devoir d'éviter que le sauvetage n'échoue par suite de négligence commise en prêtant son assistance. MacLaren aurait dû prévoir que, à cause de sa négligence qui prolongeait le risque de noyade auquel était exposé Matthews, l'une des personnes à bord tenterait d'effectuer le sauvehence, in the opinion of Jessup J.A., he could not reasonably contemplate that Horsley would be a rescuer. Consequently, MacLaren was not under any liability for the death of Horsley.

tage elle-même. Toutefois, MacLaren avait déjà averti Horsley de rester dans le cockpit ou dans la cabine; par conséquent, selon le Juge d'appel Jessup, il ne pouvait pas raisonnablement prévoir que Horsley tenterait d'effectuer le sauvetage. MacLaren n'était donc pas responsable de la mort de Horsley.

It is evident that the trial judge and Jessup J.A. see the law, as it is reflected in the rescue cases, differently from Schroeder and McGillivray JJ.A. But it is also apparent that, on the law as propounded both by the trial judge and by Jessup J.A., Schroeder J.A. (McGillivray J.A. agreeing) could find no breach of legal duty to inculpate MacLaren. I do not read the learned Justice of Appeal as saying that if there was a breach of legal duty, the ensuing death of Horsley did not result from that breach.

Il est évident que le juge de première instance et le Juge d'appel Jessup n'interprètent pas les règles de droit en la matière, telles qu'elles se reflètent dans les affaires de sauvetage, de la même façon que les Juges d'appel Schroeder et McGillivray. Mais il est également évident qu'en se fondant sur les règles énoncées tant par le juge de première instance que par le Juge d'appel Jessup, le Juge d'appel Schroeder (le Juge d'appel McGillivray souscrivant à son avis) ne pouvait constater aucun manquement à un devoir légal permettant d'inculper MacLaren. Je n'interprète pas les paroles du savant juge d'appel comme voulant dire que s'il y a eu manquement à un devoir légal, la mort subséquente de Horsley ne découle pas de ce manquement.

The facts, as found by the trial judge and as repeated with some variations by the Court of Appeal, are, with some additions from the record, as follows. MacLaren was the owner of a 30-foot six inch cabin cruiser, powered by two inboard 100 h.p. engines driving two propellers. On May 7, the day of the double tragedy, he had his wife on board and five guests, including Matthews and Horsley, one Donald Marck and Mr. and Mrs. Richard Jones. The party had left Oakville in the afternoon and the boat was apparently the first to dock at the Port Credit Yacht Club that season. There was beer aboard the boat and some champagne was drunk at the Port Credit Yacht Club but there is no ground for saying that intoxicants had anything to do with the fatal occurrences. The boat left Port Credit at about 6.30 p.m. to return to Oakville and the defendant was at the helm, proceeding at a speed of 10 to 12 knots in cool weather and with a northwest wind which created a light chop on Lake Ontario.

Les faits constatés par le juge de première instance et, avec certaines modifications, par la Cour d'appel sont, avec certaines additions faites à partir du dossier, les suivants: MacLaren était propriétaire d'un yacht de plaisance long de 30 pieds 6 pouces, mû par deux moteurs internes de cent chevaux-vapeur actionnant deux hélices. Le 7 mai, soit le jour de la double tragédie, l'épouse de celui-ci et cinq invités, Matthews, Horsley, un dénommé Donald Marck et M. et M[me] Richard Jones, se trouvaient à bord. Le groupe avait quitté Oakville au cours de l'après-midi; apparemment, le bateau a été le premier à accoster au Port Credit Yacht Club cette saison-là. Il y avait de la bière sur le bateau; on a bu du champagne au Port Credit Yacht Club mais il n'y a pas lieu de croire que des boissons enivrantes aient été reliées aux accidents mortels. Le yacht a quitté Port Credit vers 6 h 30 de l'après-midi pour retourner à Oakville. Le défendeur était à la barre; le yacht filait à 10 ou 12 nœuds, par temps frais, avec un vent nord-ouest qui rendait le lac Ontario légèrement clapoteux.

Matthews had looked after the bow line when the boat left Port Credit, and was sitting on the port side of the foredeck. Jones was in the pilot's

Matthews s'occupait de l'amarre de bout lorsque le navire a quitté Port Credit; il était assis sur le pont avant, côté bâbord. Jones était dans cockpit, and the other four passengers were in the cabin below. Jones saw Matthews rise and proceed toward the stern along a narrow cat-walk on the port side, holding on to the rail with his back to the water. On reaching the windscreen in front of the cockpit he toppled over backwards into the water. Jones immediately shouted "Roly's overboard".

MacLaren, who was then going about 11 knots per hour, put the controls into neutral, and, leaning back, he could see Matthews about 40 to 50 feet astern to starboard, floating with head and shoulders out of the water. He put the boat in reverse, backing towards Matthews after pinning the control wheel with his stomach. He lost sight of Matthews because of the height and angle of the transom, and shut off the engines. He believed he had drifted to four or five feet of Matthews and wished to manoeuvre to get him at the rear gate on the starboard side. Jones had, in the meantime, thrown a life-ring from the stern which landed about ten feet in front of Matthews, and Marck who was also at the stern tried to hook Matthews with a six-foot pike pole. He could not succeed because, with the engines shut down, the boat drifted away to a distance of ten to twenty feet. Matthews was seen at the time still floating, but with eyes open and staring and apparently unconscious. Jones threw a second life-jacket which fell on top of Matthews or near him but he made no effort to seize it. The water that day was extremely cold, with a surface temperature of about 44 degrees or less.

MacLaren restarted his engines and again backed his boat towards Matthews. Three or four minutes had passed since the fall overboard, and it was then, with the boat moving, that Horsley, after taking off his shoes and trousers, dived into the water from the stern, coming up about ten feet from Matthews. According to Jones, the boat was drifting on to Matthews or Matthews was drifting towards the boat, and they were about three feet from each other when Horsley began to take off his shoes and trousers and then dived

le cockpit de pilotage et les quatre autres passagers se trouvaient au-dessous, dans la cabine. Jones a vu Matthews se lever et se diriger vers l'arrière par un étroit passavant, côté bâbord; il tenait la rampe et tournait le dos à l'eau. En atteignant l'abrivent, à l'avant du cockpit, il a culbuté par en arrière, dans l'eau. Jones a immédiatement crié: [TRADUCTION] «Roly est à la mer».

MacLaren, qui filait alors à 11 nœuds à l'heure environ, a mis les commandes au point mort; en se penchant par en arrière, il pouvait voir Matthews à quelque 40 ou 50 pieds sur l'arrière à tribord; ce dernier flottait, la tête et les épaules sorties de l'eau. Il a fait marche arrière, reculant vers Matthews, après voir bloqué la roue du gouvernail à l'aide de sa poitrine. Il a perdu Matthews de vue à cause de l'élévation du tableau et de l'angle que celui-ci formait; puis il a arrêté les moteurs. Il croyait avoir dérivé à quatre ou cinq pieds de Matthews et voulait manœuvrer de façon que ce dernier se trouve près de l'entrée arrière, côté tribord. Dans l'intervalle, Jones avait lancé une bouée de sauvetage depuis l'arrière du bateau; celle-ci a été projetée à dix pieds environ devant Matthews. Marck, qui se trouvait également à l'arrière, a essayé de retenir Matthews à l'aide d'une perche pointue de six pieds. Il n'a pas pu réussir parce que, les moteurs étant arrêtés, le bateau a dérivé sur une distance de dix à vingt pieds. A ce moment-là, on a vu Matthews qui flottait encore, mais il avait les yeux ouverts et fixes et était apparemment évanoui. Jones a lancé un second gilet de sauvetage, lequel est tombé sur Matthews ou près de lui, mais ce dernier n'a aucunement tenté de le saisir. Ce jour-là, l'eau était extrêmement froide, la température à la surface étant de quelque 44 degrés ou moins.

MacLaren a remis les moteurs en marche et a de nouveau reculé le yacht vers Matthews. Trois ou quatre minutes s'étaient écoulées depuis que celui-ci était tombé par-dessus bord. C'est à ce moment-là, alors que le yacht se déplaçait, que Horsley, après avoir enlevé ses souliers et ses pantalons, a plongé de l'arrière du yacht, remontant à la surface à dix pieds de Matthews environ. Selon Jones, le bateau dérivait en direction de Matthews ou Matthews dérivait en direction du yacht; ils étaient à quel-in to effect a rescue. Matthews was seen to fall forward, face and head in the water, and Mrs. Jones jumped in, one foot away, to hold up his head but Matthews disappeared under the starboard side of the boat. Jones, having seen his wife in the water, grabbed the boat controls which MacLaren yielded, swung the boat around bow on, and approached his wife on the starboard side where MacLaren and Marck, with Jones assisting, pulled her in. MacLaren then resumed control and went forward towards Horsley who was then also pulled in but in unconscious condition. Attempts at resuscitation failed. Medical opinion ascribed his death to sudden shock as a result of the immersion.

The passengers who were in the cabin came up when MacLaren began to back up after the shout of "Roly's overboard". Jones went to the stern where he was joined by Marck and Horsley. In answer to a question whether he was in a panic, MacLaren said he thought he was in control of the situation. He had cut his engines after backing up towards Matthews because he knew of the danger to Matthews from the propellers. However, in allowing the boat to drift, there was the effect of the wind to contend with.

MacLaren testified that he had had a lifelong interest in boats. He was 48 years of age when the accident happened, had built a sail boat when he was aged 16, had bought a small outboard cruiser in the late fifties, and later bought a larger 42-foot twin-engined cruiser which he traded in 1964 for the boat on which the fatal cruise was taken. It was an easily manoeuvrable boat which could be turned almost in its own length. MacLaren said he operated it "quite a bit—it's my hobby". He had practised rescue operations and was aware that the first recommended method was to come bow on in a circle and approach the person in the water on the lee. In the present case, although he knew that he could not back up very fast if he was to control his boat, he felt that backing up would be the quickest way to

que trois pieds l'un de l'autre lorsque Horsley s'est mis à enlever ses souliers et ses pantalons et a plongé pour effectuer le sauvetage. On a vu Matthews tomber par en avant, le visage et la tête dans l'eau; M^{me} Jones a sauté dans l'eau, à un pied de lui, afin de soutenir sa tête mais il est disparu sous le yacht, côté tribord. Voyant son épouse dans l'eau, Jones s'est emparé des commandes du bateau, que MacLaren lui a cédées; il a fait virer le yacht et s'est dirigé droit devant vers son épouse, l'approchant sur tribord; c'est alors que MacLaren et Marck ont tiré celle-ci de l'eau, avec l'aide de Jones. MacLaren a alors repris les commandes et a avancé vers Horsley, qui a également été tiré de l'eau; il était sans connaissance. On a tenté sans succès de le ranimer. D'après l'opinion d'un médecin expert, il est mort par suite du choc soudain qu'il a subi en tombant à l'eau.

Les passagers qui se trouvaient dans la cabine sont montés lorsque MacLaren s'est mis à reculer, après qu'on eut crié: [TRADUCTION] «Roly est à la mer». Jones s'est rendu à l'arrière où Marck et Horsley l'ont rejoint. Lorsqu'on lui a demandé s'il avait été pris de panique, MacLaren a répondu qu'à ce moment-là, il croyait avoir la maîtrise de la situation. Il avait coupé la marche des moteurs, après avoir reculé vers Matthews, parce qu'il savait que les hélices constituaient un danger pour ce dernier. Toutefois, en laissant le yacht dériver, il avait à lutter contre l'action du vent.

MacLaren a témoigné s'être toujours intéressé aux bateaux. Lorsque l'accident est arrivé, il avait 48 ans; il avait construit un bateau à voile lorsqu'il avait 16 ans, avait acheté un petit hors-bord de croisière à la fin des années cinquante, puis, il avait acheté un yacht plus gros, long de quarante-deux pieds, équipé de deux moteurs, qu'il a échangé en 1964 contre le yacht sur lequel la funeste excursion a eu lieu. C'était un bateau facile à manœuvrer, qui pouvait virer complètement sur une distance presque égale à sa longueur. MacLaren a dit qu'il le conduisait: [TRADUCTION] «Assez souvent—c'est mon passe-temps». Il s'était exercé à faire des opérations de sauvetage et savait que la principale méthode recommandée est celle qui consiste à décrire un cercle et à se diriger droit devant vers la personne qui se trouve reach Matthews. However, it took him about two minutes to get near to Matthews on his first try.

Evidence on proper rescue procedures to reach a person overboard was given by one Captain Livingstone, a qualified sea captain who was in charge of a marine school which trained persons in seamanship, and by a Captain Mumford, also so qualified, who was with the Toronto Harbour Commission as its communications officer. Their testimony was that the quickest and safest way to effect a rescue was to circle if necessary and come bow on to the person in the water. There was more control over the boat in this way, both in respect of manoeuvrability and speed, and danger from propellers was avoided. The witnesses agreed that there could be circumstances, such as being obliged to manoeuvre in a crowded area, when backing up would be appropriate. It was their opinion, however, that coming bow on was standard procedure for boat operators. There was no evidence to contradict this testimony, and, indeed, MacLaren himself confirmed that "bow on" was the preferred rescue procedure.

Jones, who had boating experience, testified on this point in relation to the rescue of his wife. It was his evidence that he took the controls from MacLaren because he felt that the backing-up procedure would not be effective; hence he came towards his wife bow on.

In this Court, counsel for the appellants relied on three alternative bases of liability. There was, first, the submission that in going to the aid of Matthews, as he did, MacLaren came under a duty to carry out the rescue with due care in the circumstances, and his failure to employ standard rescue procedures foreseeably brought Horsley into the picture with the ensuing fatal result. The second basis of liability was doubly founded as resting (a) on a common law duty of care of a private carrier to his passengers, involving a duty to come to the aid of a passenger

dans l'eau, sous le vent. En l'espèce, même s'il savait qu'il ne pouvait pas reculer très vite et conserver la maîtrise de son yacht, il a pensé qu'en reculant il rejoindrait Matthews plus rapidement. Toutefois, il lui a fallu quelque deux minutes pour se rapprocher de Matthews à sa première tentative.

Un capitaine au long cours, le capitaine Livingstone, qui dirigeait une école de navigation, et un autre capitaine au long cours, le capitaine Mumford, qui travaillait à la Commission du port de Toronto en qualité de fonctionnaire chargé des communications, ont témoigné sur les mesures à prendre en cas de sauvetage pour rejoindre une personne tombée par-dessus bord. Selon eux, la façon la plus rapide et la plus sûre d'effectuer un sauvetage consiste à décrire un cercle si cela s'avère nécessaire et à se diriger droit devant sur la personne qui se trouve dans l'eau. De cette façon, le bateau est mieux maîtrisé, à la fois du point de vue de la facilité à manœuvrer et du point de vue de la vitesse, et le danger créé par les hélices est évité. Les témoins ont convenu que dans certains cas, par exemple lorsqu'on est obligé de manœuvrer dans une zone encombrée, il serait judicieux de reculer. Toutefois, ils sont d'avis que les pilotes procèdent habituellement en rapprochant le bateau droit devant sur la personne. Aucune preuve n'a été produite pour contredire leurs témoignages; de fait, MacLaren lui-même a confirmé que c'est là la méthode préférée en cas de sauvetage.

Jones, qui a de l'expérience dans la navigation, a témoigné sur ce point lorsqu'on a parlé du sauvetage de son épouse. Il affirme avoir pris les commandes des mains de MacLaren parce qu'il croyait qu'il ne servirait à rien de reculer; il s'est donc dirigé droit devant vers son épouse.

En cette Cour, l'avocat des appelants s'est appuyé sur trois bases distinctes de responsabilité. D'abord, il a soutenu qu'en venant en aide à Matthews ainsi qu'il l'avait fait, MacLaren est devenu obligé d'effectuer le sauvetage avec la diligence requise dans les circonstances, et que c'est parce que MacLaren n'a pas suivi la méthode habituelle que Horsley, comme on pouvait le prévoir et avec les funestes conséquences que l'on sait, s'est trouvé impliqué. La deuxième base de responsabilité repose sur deux points: *a*) une obligation de diligence, en common law, du transwho has accidentally fallen overboard, or (b) on a statutory duty under s. 526(1) of the *Canada Shipping Act,* R.S.C. 1952, c. 29, to come to the aid of a passenger who has fallen overboard. There was failure, so the allegation was, to act reasonably in carrying out these duties or either of them, with the foreseeable consequence of Horsley's encounter of danger. The third contention was the broadest, to the effect that where a situation of peril, albeit not brought about originally by the defendant's negligence, arises by reason of the defendant's attempt at rescue, he is liable to a second rescuer for ensuing damage on the ground that the latter's intervention is reasonably foreseeable.

None of the bases of liability advanced by the appellants is strictly within the original principle on which the "rescue" cases were founded. That was the recognition of a duty by a negligent defendant to a rescuer coming to the aid of the person imperilled by the defendant's negligence. The evolution of the law on this subject, originating in the moral approbation of assistance to a person in peril, involved a break with the "mind your own business" philosophy. Legal protection is now afforded to one who risks injury to himself in going to the rescue of another who has been foreseeably exposed to danger by the unreasonable conduct of a third person. The latter is now subject to liability at the suit of the rescuer as well as at the suit of the emperilled person, provided, in the case of the rescuer, that his intervention was not so utterly foolhardy as to be outside of any accountable risk and thus beyond even contributory negligence.

Moreover, the liability to the rescuer, although founded on the concept of duty, is now seen as stemming from an independent and not a derivative duty of the negligent person. As *Fleming on Torts,* 3rd ed., 1965, has put it (at p. 166), the cause of action of the rescuer in arising out of

porteur privé envers ses passagers, y compris le devoir de prêter son assistance au passager accidentellement tombé par-dessus bord, ou *b*) le devoir légal, en vertu de l'art. 526 (1) de la *Loi sur la marine marchande du Canada,* S.R.C. 1952, c. 29, de prêter assistance au passager tombé par-dessus bord. On a allégué qu'il y avait eu omission d'agir de façon avisée dans l'exécution de ces devoirs, ou de l'un de ces devoirs, ce qui avait entraîné les conséquences qu'il fallait prévoir, soit que Horsley s'expose lui-même au danger. La troisième prétention, de portée plus large, est la suivante: lorsqu'une situation périlleuse, même si elle n'est pas due initialement à la négligence du défendeur, est créée par suite des tentatives de sauvetage de celui-ci, le défendeur est responsable envers un deuxième sauveteur des dommages en découlant parce que l'intervention de ce dernier était raisonnablement prévisible.

Aucune des bases de responsabilité invoquées par les appelants n'est à proprement parler visée par le principe sur lequel les causes «de sauvetage» étaient fondées à l'origine. Ce principe consistait à reconnaître l'existence d'un devoir du défendeur négligent envers le sauveteur venant à l'aide d'une personne mise en danger par la négligence du défendeur. L'évolution du droit en la matière, ayant pour origine l'approbation morale donnée à l'aide aux personnes en danger, a entraîné une rupture avec la philosophie qui consiste à «se mêler de ses propres affaires». Une protection légale est maintenant accordée à celui qui risque de se blesser en se portant au secours d'une autre personne qui a été exposée à un danger de façon prévisible par le comportement déraisonnable d'un tiers. Ce dernier est maintenant sujet à la responsabilité aussi bien lorsque c'est le sauveteur qui poursuit que lorsque c'est la personne mise en danger, mais, en ce qui concerne le sauveteur, il faut que son intervention n'ait pas été téméraire à un point tel qu'il n'est plus question de risque justifié ni même, par conséquent, de négligence commune.

De plus, même si elle se fonde sur la notion de devoir, on considère maintenant que la responsabilité envers le sauveteur découle d'un devoir indépendant, et qui n'est pas dérivé d'un autre, incombant à la personne négligente. Comme il est dit dans *Fleming on Torts,* 3e éd., 1965, the defendant's negligence, is based "not in its tendency to imperil the person rescued, but in its tendency to induce the rescuer to encounter the danger. Thus viewed, the duty to the rescuer is clearly independent . . .". This explanation of principle was put forward as early as 1924 by Professor Bohlen (see his *Studies in the Law of Torts,* at p. 569) in recognition of the difficulty of straining the notion of foreseeability to embrace a rescuer of a person imperilled by another's negligence. Under this explanation of the basis of liability, it is immaterial that the imperilled person does not in fact suffer any injury or that, as it turns out, the negligent person was under no liability to him either because the injury was not caused by the negligence or the damage was outside the foreseeable risk of harm to him: cf. *Videan v. British Transport Commission*[6]. It is a further consequence of the recognition of an independent duty that a person who imperils himself by his carelessness may be as fully liable to a rescuer as a third person would be who imperils another. In my opinion, therefore, *Dupuis v. New Regina Trading Co. Ltd.*[7], ought no longer to be taken as a statement of the common law in Canada in so far as it denies recovery because the rescuer was injured in going to the aid of a person who imperilled himself. The doctrinal issues are sufficiently canvassed by the late Dean Wright in (1943), 21 *Can. Bar Rev.* 758; and see also *Ward v. T. E. Hopkins & Son, Ltd.; Baker v. T. E. Hopkins & Son, Ltd.*[8]

I realize that this statement of the law invites the conclusion that Horsley's estate might succeed against that of Matthews if it was proved that Matthews acted without proper care for his own safety so that Horsley was prompted to come to his rescue. This issue does not, however, have to be canvassed in these proceedings

[6] [1963] 2 Q.B. 650.
[7] [1943] 2 W.W.R., 593, [1943] 4 D.L.R. 275.
[8] [1959] 3 All E.R. 225.

p. 166, la cause d'action du sauveteur, quand elle découle de la négligence du défendeur, se fonde: [TRADUCTION] «non pas sur le fait qu'elle tend à mettre en danger la personne qui doit être sauvée, mais sur le fait qu'elle amène le sauveteur à s'exposer lui-même au danger. Sous cet angle, le devoir envers le sauveteur est clairement indépendant . . .». L'explication de ce principe a été avancée dès 1924 par le professeur Bohlen (voir ses *Studies in the Law of Torts,* p. 569), qui a reconnu qu'il est difficile d'étendre la notion de la prévisibilité de façon à viser le sauveteur d'une personne mise en danger par la négligence d'un tiers. Selon cette explication de la base de responsabilité, il est sans importance que la personne mise en danger n'ait subi en réalité aucun dommage, ou qu'il se soit avéré que la personne négligente n'est aucunement responsable envers elle pour le motif que le préjudice n'a pas été causé par la négligence ou était au-delà du risque prévisible: cf. *Videan v. British Transport Commission*[6]. La reconnaissance de l'existence d'un devoir indépendant entraîne une autre conséquence: la personne qui s'expose elle-même à un danger par imprudence peut être tout aussi responsable envers un sauveteur que le serait un tiers mettant en danger une autre personne. A mon avis, par conséquent, l'arrêt *Dupuis v. New Regina Trading Co. Ltd.*[7] ne devrait plus être considéré comme énonçant la common law s'appliquant au Canada, dans la mesure où il empêche l'indemnisation parce que le sauveteur a été blessé en prêtant son assistance à une personne qui s'est elle-même exposée à un danger. Les points de doctrine sont suffisamment étudiés par le doyen Wright, décédé, dans (1943), 21 *Rev. du Bar. Can.* 758; voir également *Ward v. T. E. Hopkins & Son, Ltd.; Baker v. T. E. Hopkins & Son Ltd.*[8]

Je sais que cet exposé du droit porte à conclure que la succession Horsley pourrait faire valoir ses droits à l'encontre de celle de Matthews s'il était prouvé que ce dernier avait agi sans prendre les précautions requises pour sa propre sécurité, amenant ainsi Horsley à lui prêter son assistance. Toutefois, il n'est pas nécessaire d'exa-

[6] [1963] 2 Q.B. 650.
[7] [1943] 2 W.W.R. 593, [1943] 4 D.L.R. 275.
[8] [1959] 3 All E.R. 225.

since the estate of Matthews was not joined as a co-defendant.

The thinking behind the rescue cases, in so far as they have translated a moral impulse into a legally protectible interest, suggests that liability to a rescuer should not depend on whether there was original negligence which created the peril and which, therefore, prompted the rescue effort. It would appear that the principle should be equally applicable if, at any stage of the perilous situation, there was negligence on the defendant's part which induced the rescuer to attempt the rescue or which operated against him after he had made the attempt. If this be so, it indicates the possibility of an action by a second rescuer against a first. On one view of the present case, this is what we have here. It is not, however, a view upon which, under the facts herein, the present case falls to be decided.

The reason is obvious. MacLaren was not a random rescuer. As owner and operator of a boat on which he was carrying invited guests, he was under a legal duty to take reasonable care for their safety. This was a duty which did not depend on the existence of a contract of carriage, nor on whether he was a common carrier or a private carrier of passengers. Having brought his guests into a relationship with him as passengers on his boat, albeit as social or gratuitous passengers, he was obliged to exercise reasonable care for their safety. That obligation extends, in my opinion, to rescue from perils of the sea where this is consistent with his duty to see to the safety of his other passengers and with concern for his own safety. The duty exists whether the passenger falls overboard accidentally or by reason of his own carelessness.

I would hold that *Vanvalkenburg v. Northern Navigation Co.*[9] should no longer be considered as good law in so far as it declared that operators

[9] (1913), 30 O.L.R. 142, 19 D.L.R. 649.

miner ce point en l'espèce puisque la succession Matthews n'a pas été jointe en qualité de codéfenderesse.

Dans la mesure où elles ont transformé une impulsion morale en un droit protégé par la loi, les causes de sauvetage font penser, de par le raisonnement qui s'y retrouve, que la responsabilité envers le sauveteur ne devrait pas dépendre de la question de savoir s'il y a initialement eu une négligence qui a créé le danger et, partant, incité à la tentative de sauvetage. Il semble que ce principe devrait également s'appliquer si, à un moment donné dans une situation périlleuse, le défendeur commet une négligence qui induit le sauveteur à tenter d'effectuer le sauvetage ou qui tourne à son désavantage après qu'il a effectué la tentative. S'il en est ainsi, il y a là une indication qu'un deuxième sauveteur serait donc recevable à intenter une action contre le premier. Selon un certain point de vue, c'est le cas qui se présente en l'espèce. Toutefois, suivant les faits du présent litige, ce n'est pas là le point de vue qui doit servir de fondement à la décision à rendre.

La raison est évidente. Il découle de ces considérations que MacLaren ne peut être vu comme étant simplement un sauveteur fortuit. En sa qualité de propriétaire et d'exploitant ou utilisateur d'un yacht sur lequel il transportait des invités, il avait le devoir légal de voir avec une diligence raisonnable à leur sécurité. C'est là un devoir qui ne dépend pas de l'existence d'un contrat de transport, ni de la question de savoir s'il était transporteur public ou transporteur privé. Puisqu'il avait établi des liens entre lui-même et ses invités par leur présence sur son yacht en tant que passagers, fussent-ils des passagers en plaisance ou bénévoles, il était tenu de voir avec une diligence raisonnable à leur sécurité. A mon avis, cette obligation va jusqu'à devoir les sauver des périls de la mer pour autant qu'il puisse le faire, eu égard à son obligation de voir à la sécurité des autres passagers et eu égard à sa propre sécurité. Ce devoir existe, que le passager tombe par-dessus bord accidentellement ou par suite de sa propre négligence.

Je crois que l'arrêt *Vanvalkenburg v. Northern Navigation Co.*[9] ne devrait plus être considéré comme faisant état du droit, pour autant qu'il y

[9] (1913), 30 O.L.R. 142, 19 D.L.R. 649.

of a ship were not under any legal duty to a seaman in their employ to go to his rescue when he fell overboard through his own carelessness. The Ontario Appellate Division in that case saw the facts through the classification of nonfeasance and misfeasance, and was not prepared to read the contract of hiring as imposing an affirmative obligation to protect the drowning seaman from the consequences of his own carelessness. Since the ship operators did not create any unreasonable risk of harm, the Appellate Division could not find any ground for holding them liable.

I do not accept this reasoning, based as it was on the state of the law of torts that did not yet know even *M'Alister* (*or Donoghue*) *v. Stevenson*[10]. Affirmative duties of care arise out of the relationship of employer and employee and out of the relationship of carrier and passenger, to take two examples. Where these relationships occur on board a ship at sea, the employee or passenger, who falls overboard from whatever cause, should be entitled to look for succour to the operators of the ship because of necessary dependency on them for return to shore. Such a duty of rescue was recognized in *Harris v. Pennsylvania Railroad Co.*[11] and in *Hutchinson v. Dickie*[12], a case to which I will return because it is so strikingly similar on its facts to the present case.

I do not rest the duty to which I would hold MacLaren in this case on s. 526(1) of the *Canada Shipping Act*, even assuming that its terms are broad enough to embrace the facts herein. That provision, a penal one, is as follows:

> The master or person in charge of a vessel shall, so far as he can do so without serious danger to his own vessel, her crew and passengers, if any, render assistance to every person, even if that person be a subject of a foreign state at war with Her Majesty, who is found at sea and in danger of being

[10] [1932] A.C. 562.
[11] (1931), 50 F. 2d 866.
[12] (1947), 162 F. 2d 103; cert. denied, 332 U.S. 830.

a été déclaré que l'exploitant d'un navire n'a aucun devoir légal de prêter assistance au marin à son emploi, lorsque ce dernier tombe par-dessus bord par suite de sa propre négligence. Dans cette cause-là, la Chambre d'appel de l'Ontario a considéré les faits de l'espèce comme ressortissant aux catégories de la faute par omission (nonfeasance) et de la négligence dans l'accomplissement d'un acte licite (misfeasance); elle n'était pas disposée à voir dans le contrat de louage une obligation affirmative de protéger le marin qui se noie des conséquences de sa propre négligence. Étant donné que les exploitants du navire n'avaient créé aucun risque injustifié, la Chambre d'appel n'a pu trouver aucun motif pour les déclarer responsables.

Je n'accepte pas ce raisonnement, qui est fondé sur l'état du droit en matière de responsabilité civile tel qu'il existait même avant l'arrêt *M'Alister* (*or Donoghue*) *v. Stevenson*[10]. L'obligation affirmative de diligence naît par exemple des relations employeur-employé ou encore, des relations transporteur-passager. Lorsque ces relations apparaissent en mer, à bord d'un navire, l'employé ou le passager qui tombe par-dessus bord pour quelque raison que ce soit devrait avoir le droit de s'attendre à être secouru par les exploitants du navire parce que, pour atteindre le rivage, il dépend nécessairement d'eux. Ce devoir d'assistance a été reconnu dans *Harris v. Pennsylvania Railroad Co.*[11] et dans *Hutchinson v. Dickie*[12], cause sur laquelle je reviendrai parce que les faits en jeu alors ressemblent de façon frappante à ceux de la présente espèce.

En l'espèce, pour mettre une telle obligation à la charge de MacLaren, je ne me fonde pas sur l'art. 526(1) de la *Loi sur la marine marchande du Canada*, même en présumant que cet article est de portée assez large pour viser les faits en jeu ici. Voici le texte de cette disposition, qui est de nature pénale:

> Le capitaine ou la personne ayant la direction d'un bâtiment doit, autant qu'il lui est possible de le faire sans grave danger pour le bâtiment, son équipage et ses passagers, s'il en est, prêter assistance à toute personne, même si elle est sujet d'un État étranger en guerre avec Sa Majesté, qui est trouvée

[10] [1932] A.C. 562.
[11] (1931), 50 F. 2d 866.
[12] (1947), 162 F. 2d 103; cert. refusé, 332 U.S. 830.

lost, and if he fails to do so he is liable to a fine not exceeding one thousand dollars.

I do not find it necessary in this case to consider whether s. 526(1), taken alone, entails civil consequences for failure to perform a statutory duty; or, even, whether it fixes a standard of conduct upon which the common law may operate to found liability. There is an independent basis for a common law duty of care in the relationship of carrier to passenger, but the legislative declaration of policy in s. 526(1) is a fortifying element in the recognition of that duty, being in harmony with it in a comparable situation.

It follows from this assessment that MacLaren cannot be regarded as simply a good samaritan. Rather it is Horsley who was in that role, exposing himself to danger upon the alleged failure of MacLaren properly to carry out his duty to effect Matthews' rescue. The present case is, therefore, not one to which the principles propounded in *East Suffolk Rivers Catchment Board v. Kent*[13] are applicable. In the Court of Appeal, both Schroeder J.A. and Jessup J.A. referred to this case with approval. The former relied on it to support his rejection of the trial judge's holding that MacLaren was liable when, having undertaken to rescue Matthews, he failed to use reasonable care in the rescue operation. In the opinion of Schroeder J.A., as noted earlier in these reasons, there was no basis for holding that MacLaren's rescue efforts, even if improperly carried out, worsened Matthews' condition and thus induced Horsley to come to his rescue. Jessup J.A. would have applied this test of liability if the case, for him, had turned on the voluntary undertaking by MacLaren of rescue operations. Since, on the view taken by Jessup J.A., MacLaren had an antecedent or original duty to render assistance, the *East Suffolk Rivers Catchment Board* case did not apply.

[13] [1941] A.C. 74.

en mer et en danger de se perdre en cas d'omission, il ou elle est passible d'une amende de mille dollars au maximum.

En l'espèce, je ne crois pas qu'il faille examiner si l'art. 526(1), considéré isolément, entraîne des conséquences, du point de vue civil, en cas d'omission de remplir le devoir créé par la loi, ou même si cet article établit une norme, quant à la conduite à suivre, en vertu de laquelle la common law pourrait jouer de façon à retenir la responsabilité. Il existe un fondement distinct à l'obligation de diligence imposée par la common law dans les relations transporteur-passager, mais la déclaration de principes que fait le législateur à l'art. 526(1) constitue un élément à l'appui de la reconnaissance de cette obligation car elle est en harmonie avec la common law dans une situation comparable.

Par conséquent, MacLaren ne peut pas être considéré simplement comme un bon samaritain. C'est plutôt Horsley qui l'était puisqu'il s'est exposé au danger après que MacLaren, comme on l'a allégué, eut omis de s'acquitter convenablement de son devoir d'assistance envers Matthews. Par conséquent, en l'espèce, les principes énoncés dans *East Suffolk Rivers Catchment Board v. Kent*[13] ne s'appliquent pas. En Cour d'appel, les Juges Schroeder et Jessup se sont tous deux reportés à cet arrêt en l'approuvant. Le premier s'est fondé sur cet arrêt pour infirmer la décision du juge de première instance que MacLaren est devenu responsable lorsque, après avoir entrepris de sauver Matthews, il a omis d'effectuer l'opération de sauvetage avec une diligence raisonnable. Selon le Juge d'appel Schroeder, comme je l'ai fait remarquer plus haut dans les présents motifs, il n'y a aucune raison de décider que, même si elle a été mal effectuée, la tentative de sauvetage de MacLaren a aggravé la situation dans laquelle se trouvait Matthews et amené ainsi Horsley à lui porter secours. Le Juge d'appel Jessup aurait adopté ce critère de responsabilité s'il avait été d'avis qu'aux fins du litige il s'agissait de savoir si MacLaren avait volontairement entrepris l'opération de sauvetage. Selon le Juge d'appel Jessup, puisque MacLaren avait préalablement ou à l'origine l'obligation de prêter assistance, l'arrêt *East Suffolk Rivers Catchment Board* ne s'applique pas.

[13] [1941] A.C. 74.

Whether a case involving the exercise of statutory powers (but not duties) by a public authority should govern the issue of liability or non-liability to an injured rescuer is a question that need not be answered here. It has been widely noted that there is some incongruity in imposing liability upon a good samaritan when he who passes by does not attract it. Legislation has been called in aid in some jurisdictions: see Note, (1964), 64 *Col. L. Rev.* 1301. However, the problem raised by the rescue cases with respect to the *East Suffolk Rivers Catchment Board* principles is the more ramified if the issue thereunder is one of liability to a rescuer as well as to a rescuee, and if it turns on an independent rather than on a derivative duty to the rescuer by the volunteer defendant. There is, hence, all the more reason to leave the problem to be considered on facts which raise it squarely.

On the view that I take of the issues in this case and, having regard to the facts, the appellants cannot succeed on the first of their alternative submissions on liability if they cannot succeed on the second ground of an existing common law duty of care. Their third contention was not clearly anchored in any original or supervening duty of care and breach of that duty; and, if that be so, I do not see how their counsel's submission on the foreseeability of a second rescuer, even if accepted, can saddle a non-negligent first rescuer with liability either to the rescuee or to a second rescuer. Encouragement by the common law of the rescue of persons in danger would, in my opinion, go beyond reasonable bounds if it involved liability of one rescuer to a succeeding one where the former has not been guilty of any fault which could be said to have induced a second rescue attempt.

If the appellants' third contention was based on any element of fault, it could only be fault in carrying out the attempt at rescue; and, moreover, it would have to be founded on a wide

La question de savoir si un arrêt mettant en jeu l'exercice par un organisme public de pouvoirs (mais non pas de devoirs) créés par la loi devrait régir la question de la responsabilité ou de la non-responsabilité envers un sauveteur blessé n'a pas à être déterminée ici. On a fait remarquer à maintes reprises qu'il est quelque peu étrange d'imposer une responsabilité au bon samaritain alors que celui qui ne s'arrête pas en est exempt. En certains endroits, on a eu recours à la législation: voir Note, (1964), 64 *Col. L. Rev.* 1301. Toutefois, le problème soulevé par les affaires de sauvetage à l'égard des principes énoncés dans l'arrêt *East Suffolk Rivers Catchment Board* peut se ramifier encore plus s'il s'agit là d'une question de responsabilité aussi bien envers le sauveteur qu'envers le secouru, et qui repose sur un devoir indépendant, et non dérivé, envers le sauveteur, incombant au défendeur qui s'est porté volontaire. Ainsi, il vaut d'autant mieux attendre, pour résoudre ce problème, que le cas se présente carrément.

Étant donné mon opinion sur les questions en litige, et compte tenu des faits, la première des prétentions distinctes des appelants au sujet de la responsabilité doit être rejetée si le second moyen, soit celui qui met en jeu l'existence d'une obligation de diligence en vertu de la common law, est rejeté. Leur troisième prétention n'est pas nettement fondée sur l'existence d'une obligation initiale ou subséquente de diligence et d'un manquement à cette obligation; s'il en est ainsi, je ne vois pas comment la prétention de leur avocat au sujet de la possibilité de prévoir qu'il y aurait un second sauveteur, même si on l'accepte, peut rendre le premier sauveteur, qui n'a commis aucune négligence, responsable soit envers la personne secourue soit envers le second sauveteur. A mon avis, l'encouragement de la common law au sauvetage de personnes en danger dépasserait les bornes s'il rendait un sauveteur responsable envers un second sauveteur alors que le premier n'a commis aucune faute de laquelle on puisse dire qu'elle a été une incitation à une seconde tentative de sauvetage.

Si la troisième prétention des appelants était fondée sur quelque élément de faute, il ne pourrait s'agir que d'une faute dans la façon d'effectuer la tentative de sauvetage. De plus, elle de-view of Lord Denning's statement in the *Videan* case, *supra,* at p. 669 where he said that "if a person by his fault creates a situation of peril, he must answer for it to any person who attempts to rescue the person who is in danger". There is no factual basis upon which to consider the extension of Lord Denning's proposition which underlies the appellants' third submission in the alternative view of it that I have taken. In so far as it rests on an allegation that fault arose only in the bungling of the rescue attempt (there being no anterior duty), no such finding is warranted. Beyond this, it invites a return to the principles of the *East Suffolk Rivers Catchment Board* case, and I do not wish to repeat what I have already said with respect to them.

The present case is thus reduced to the question of liability on the basis of (1) an alleged breach of a duty of care originating in the relationship of carrier and passenger; (2) whether the breach, if there was one, could be said to have prompted Horsley to go to Matthews' rescue; and (3) whether Horsley's conduct, if not so rash in the circumstances as to be unforeseeable, none the less exhibited want of care so as to make him guilty of contributory negligence.

Whether MacLaren was in breach of his duty of care to Matthews was a question of fact on which the trial judge's affirmative finding is entitled to considerable weight. That finding was, of course, essential to the further question of a consequential duty to Horsley. Lacourcière J. came to his conclusion of fact on the evidence, after putting to himself the following question: "What would the reasonable boat operator do in the circumstances, attributing to such person the reasonable skill and experience required of the master of a cabin cruiser who is responsible for the safety and rescue of his passengers?" (see [1969] 2 O.R. 137 at p. 144). It was the trial judge's finding that MacLaren, as he himself admitted, had adopted the wrong procedure for rescuing a pas-

vrait se fonder sur une interprétation large de la déclaration de Lord Denning dans l'arrêt *Videan,* précité, p. 669: [TRADUCTION] «Si, par sa faute, une personne crée une situation périlleuse, elle doit en répondre à quiconque tente de sauver la personne en danger». Il n'existe rien dans les faits qui pourrait servir de base à l'extension donnée à la portée de la proposition de Lord Denning, et qui est sous-jacente à la troisième prétention des appelants, considérée d'après les points de vue successifs que j'ai adoptés. Dans la mesure où elle repose sur l'allégation que la faute découle seulement du fait d'avoir compromis le succès de la tentative de sauvetage (en l'absence d'un devoir préalable), pareille conclusion n'est aucunement justifiée. Dépassé cela, elle nous pousse à revenir aux principes énoncés dans l'arrêt *East Suffolk Rivers Catchment Board,* et je ne veux pas reprendre ce que j'ai déjà dit à leur sujet.

En l'espèce, il ne reste donc qu'à considérer la responsabilité du point de vue de (1) l'allégation d'un manquement à une obligation de diligence née du lien de droit établi entre le transporteur et le passager, (2), de la question de savoir si l'on peut considérer que tel manquement, s'il en est, a amené Horsley à porter secours à Matthews, et (3), de la question de savoir si la conduite de Horsley, si elle n'était pas, dans les circonstances, téméraire à un point tel qu'elle était imprévisible, témoigne néanmoins d'un manque de diligence le rendant coupable de faute commune.

La question de savoir si MacLaren a manqué à son obligation de diligence envers Matthews est une question de fait, et à cet égard, on peut accorder beaucoup de poids à la conclusion affirmative du juge de première instance. Évidemment, cette conclusion est essentielle pour déterminer la question qui se pose ensuite, soit celle de l'obligation conséquente envers Horsley. Le Juge Lacourcière en est arrivé à cette conclusion de fait en se fondant sur la preuve, après s'être posé la question suivante: [TRADUCTION] «Dans ces circonstances, que ferait un exploitant avisé, pour autant qu'il ait la compétence et l'expérience raisonnablement requises d'un capitaine de yacht de croisière responsable de la sécurité et du sauvetage de ses passagers?» (voir [1969] senger who had fallen overboard. He knew the proper procedure, and had practised it. Coming bow on to effect a rescue was the standard procedure and was taught as such.

MacLaren's answer to the allegation of a breach of duty was that he had been guilty merely of an error of judgment. This was the view taken by the majority in the Ontario Court of Appeal who were moved by the element of emergency. What makes this view vulnerable is that this was not a case where MacLaren had failed to execute the required manoeuvre properly, but rather one where he had not followed the method of rescue which, on the uncontradicted evidence, was the proper one to employ in an emergency. There was no external reason for his failure to do so. Jones demonstrated that in the rescue of his wife. Further, after MacLaren's first abortive attempt at rescue, over a period of time which the evidence indicated would have been sufficient to effect a bow on rescue, he made a second attempt with the wrong procedure. It was only then, with the lapse of three or four minutes after Matthews had fallen overboard, that Horsley went to his rescue. I note also that after MacLaren resumed control of his boat from Jones he went bow on to rescue Horsley.

I do not see how it can be said that the trial judge's finding against MacLaren on the issue of breach of duty is untenable. In relation to Horsley's intervention, the finding stands unembarrassed by any question of causation in relation to Matthews. This, at least, distinguishes the present case from *Hutchinson v. Dickie, supra.*

There, as here, an invited guest on a cabin cruiser fell overboard and drowned during a lake cruise. The owner and operator of the boat was blameless in respect of the fall overboard, but the trial judge founded liability for wrongful death on breach of duty to act reasonably to effect a

2 O.R. 137, p. 144). Le juge de première instance a conclu que McLaren, comme ce dernier l'a lui-même admis, a suivi la mauvaise méthode pour sauver un passager tombé par-dessus bord. Il connaissait la méthode à suivre, et s'y était déjà entraîné. La méthode de sauvetage habituelle consiste à avancer droit devant sur la personne; c'est ce qui est enseigné.

A l'allégation qu'il avait manqué à son obligation, MacLaren a répondu qu'il était simplement coupable d'une erreur de jugement. C'est ce qu'a décidé la majorité de la Cour d'appel de l'Ontario, qui avait tenu compte de l'urgence de la situation. Le reproche qu'on peut faire à propos de cette décision, c'est qu'il ne s'agit pas d'un cas où MacLaren n'a pas bien exécuté la manœuvre requise, mais plutôt d'un cas où il n'a pas suivi la méthode de sauvetage qu'il convient d'employer, comme l'a établi la preuve demeurée incontestée, en cas d'urgence. Il n'existe aucune raison apparente pour laquelle il ne l'a pas fait. Jones l'a démontré en sauvant son épouse. De plus, après l'échec de sa première tentative de sauvetage, dans un intervalle qui, selon la preuve, aurait été suffisant pour virer de façon à effectuer le sauvetage en avançant droit devant, MacLaren a fait une seconde tentative en suivant la mauvaise méthode. Ce n'est qu'alors, trois ou quatre minutes s'étant écoulées depuis la chute de Matthews par-dessus bord, que Horsley s'est porté au secours de celui-ci. Je remarque également qu'après avoir repris de Jones le contrôle de son yacht, MacLaren s'est approché droit devant sur Horsley pour sauver ce dernier.

Je ne puis voir comment on peut dire que la conclusion qu'a tirée le juge de première instance contre MacLaren sur la question du manquement à l'obligation est insoutenable. En ce qui concerne l'intervention de Horsley, cette conclusion n'est gênée par aucune question de causalité, relativement à Matthews. C'est au moins là ce qui distingue la présente espèce de l'arrêt *Hutchinson v. Dickie,* précité.

Dans cette cause-là, comme dans la présente, une personne qui avait été invitée sur un yacht de croisère est tombée par-dessus bord et s'est noyée au cours d'une excursion sur un lac. Le propriétaire, qui conduisait le yacht, n'était aucunement à blâmer pour la chute par-dessus bord, rescue. There, as here, the owner-operator, on hearing the cry "man overboard", reversed and backed astern towards the drowning man. He was then about 75 feet away from the boat. Two life-rings were thrown to Dickie, the drowning man, one falling within 20 feet and the other within 6 feet of him, but he paid no attention to them. A boat hook was then made ready for use, but Dickie disappeared when the boat was 20 to 25 feet away. The trial judge found negligence, *inter alia,* in the failure to turn the boat and come bow on. On appeal the action was dismissed on several grounds. The appellate Court held that there was "an entire lack of evidence that anything appellant did or left undone caused his efforts at rescue to fail". This was enough to dispose of the case, as it was enough to dispose of the Matthews' action. On a question more germane to the present case, the Court agreed that there was a duty of rescue owed to Dickie, but held that a breach was not established by the backing-up procedure that was employed; and, if there was an error, it was one of judgment only in dealing with an emergency. The Court noted that there was a conflict of evidence on the issue of coming bow on or backing up, and this too distinguishes *Hutchinson v. Dickie* (which, moreover, was not an action by a rescuer's estate) from the present case which was decided more than twenty years later.

I turn to the question whether the breach of duty to Matthews could properly be regarded in this case as prompting Horsley to attempt a rescue. Like the trial judge, I am content to adopt and apply analogically on this point the reasoning of Cardozo J., as he then was, in *Wagner v. Inter-*

mais le juge de première instance a conclu qu'il était responsable d'avoir illicitement causé la mort parce qu'il avait manqué à son obligation d'effectuer le sauvetage avec diligence raisonnable. Dans cette cause-là comme dans celle-ci, le propriétaire-utilisateur, en entendant: «Un homme à la mer», a fait marche arrière et a reculé vers l'homme qui se noyait. Ce dernier se trouvait alors à quelque 75 pieds du yacht. Deux bouées de sauvetage ont été lancées à Dickie, l'homme qui était en train de se noyer; l'une est tombée à moins de 20 pieds de lui et l'autre à moins de 6 pieds, mais il ne s'en est pas préoccupé. On s'est alors emparé d'une gaffe, mais Dickie est disparu au moment où le yacht ne se trouvait plus qu'à 20 à 25 pieds de lui. Le juge de première instance a conclu qu'il y avait négligence parce que, entre autres motifs, on n'avait pas fait virer le yacht pour s'approcher droit devant sur lui. En appel, la demande a été rejetée pour plusieurs motifs. La Cour d'appel a décidé qu'il y avait: [TRADUCTION] «Une absence totale de preuve que l'échec des tentatives de sauvetage de l'appelant était dû à quelque acte ou omission de sa part.» Cela était suffisant pour décider du litige, tout comme cela a suffi pour rejeter l'action de Matthews. Quant à la question qui s'apparente davantage à la présente cause, la Cour a convenu qu'il existait une obligation d'assistance envers Dickie, mais elle a décidé que le fait que la méthode qui consiste à reculer avait été employée ne permettait pas de dire qu'il y avait eu manquement à cette obligation. S'il y avait eu erreur, ce n'était qu'une erreur de jugement dans la façon dont on avait fait face à la situation d'urgence. La Cour a fait remarquer qu'il existait des preuves contradictoires quant à la question de savoir s'il faut s'approcher par l'avant ou bien reculer, ce qui donne lieu à des distinctions entre l'arrêt *Hutchinson v. Dickie* (dans lequel de plus, il ne s'agit pas d'une action intentée par la succession du sauveteur) et la présente cause, qui a été entendue plus de vingt ans plus tard.

J'aborde maintenant la question de savoir si, en l'espèce, il est à juste titre possible de considérer que le manquement à l'obligation envers Matthews a amené Horsley à tenter d'effectuer le sauvetage. Comme le juge de première instance, sur ce point, je suis disposé à adopter et *national Railway Co.*[14], and of Lord Denning M.R. in *Videan v. British Transport Commission, supra.* To use Judge Cardozo's phrase, Horsley's conduct in the circumstances was "within the range of the natural and probable". The fact, moreover, that Horsley's sacrifice was futile is no more a disabling ground here than it was in the *Wagner* case, where the passenger thrown off the train was dead when the plaintiff went to help him, unless it be the case that the rescuer acted wantonly.

In the Ontario Court of Appeal, Schroeder J.A., as previously noted, took the view that Horsley was not justified in going to the rescue of Matthews unless MacLaren worsened Matthews' situation through want of reasonable care. I need say no more on this view than that it proceeds on the basis of the *East Suffolk Rivers Catchment Board* principles which are not applicable to the facts of the present case.

Of more concern here is the position taken by Jessup J.A. which, to put it again and briefly, was that whoever MacLaren should have foreseen as a rescuer, it could not be Horsley. I cannot agree with this ground of exoneration of MacLaren when it is founded merely on his having told Horsley to confine himself to the cabin and cockpit. MacLaren's evidence on this matter was that he had not previously met Horsley, he did not know his experience with boating and with water, and hence he did not want him on deck. In my opinion, this evidence is no more telling against Horsley as a rescuer than it would be against Horsley as a rescuee if he had come on deck and had then fallen overboard. Moreover, the considerations which underlie a duty to a rescuer do not justify ruling out a particular rescuer if it be not wanton of him to intervene. The implication of Jessup J.A.'s position is that Horsley required MacLaren's consent to go to Matthews' rescue. This is not, in my view, a sufficient answer in the circumstances which existed by reason of MacLaren's breach of duty.

[14] (1921), 133 N.E. 437.

à appliquer par analogie le raisonnement du Juge Cardozo, alors juge puîné, dant l'arrêt *Wagner v. International Railway Co.*[14], et celui dé Lord Denning M.R., dans l'arrêt *Videan v. British Transport Commission,* précité. Me servant des termes du Juge Cardozo, la conduite de Horsley était en l'occurrence: [TRADUCTION] «naturelle et probable». De plus, le fait que le sacrifice de Horsley s'est avéré futile n'est, dans ce cas-ci, pas plus un motif valable de rejet qu'il ne l'a été dans l'affaire *Wagner,* dans laquelle le passager projeté hors du train était mort au moment où le demandeur s'est porté à son secours, à moins qu'il s'agisse d'un cas où le sauveteur a agi de façon téméraire.

Comme je l'ai fait remarquer, en Cour d'appel de l'Ontario le Juge Schroeder était d'avis que Horsley n'aurait eu raison d'aller au secours de Matthews que si MacLaren avait aggravé la situation dans laquelle se trouvait celui-ci en n'agissant pas avec une diligence raisonnable. Je n'ai rien d'autre à ajouter, si ce n'est que cet avis est fondé sur les principes énoncés dans l'arrêt *East Suffolk Rivers Catchment Board,* lesquels ne s'appliquent pas aux faits de la présente cause.

La position prise par le Juge d'appel Jessup, soit, pour l'exposer de nouveau brièvement, que si MacLaren avait pu prévoir que quelqu'un se risquerait comme sauveteur, il n'aurait sûrement pas pensé à Horsley, a plus d'importance ici. Je ne puis accepter ce motif d'exonérer MacLaren, lorsqu'il a pour unique fondement le fait que MacLaren avait dit à Horsley de rester dans la cabine ou dans le cockpit. A ce sujet, MacLaren a témoigné qu'il n'avait jamais rencontré Horsley auparavant, qu'il ne savait pas l'expérience que ce dernier avait de la navigation et de l'eau et qu'il ne voulait donc pas le voir sur le pont. A mon avis, ce témoignage ne nuit pas plus à Horsley en sa qualité de sauveteur qu'il ne lui nuirait s'il avait été, après être venu sur le pont et être tombé par-dessus bord, la personne secourue. De plus, les considérations qui motivent l'existence d'une obligation envers un sauveteur ne permettent pas d'exclure un sauveteur particulier, s'il n'est pas téméraire pour lui d'intervenir. La position qu'a prise le juge d'appel Jessup implique que Horsley devait avoir l'assen-

[14] (1921), 133 N.E. 437.

To quote again Judge Cardozo in the *Wagner* case, "the law does not discriminate between the rescuer oblivious of peril and the one who counts the cost. It is enough that the act whether impulsive or deliberate is the child of the occasion" (133 N.E. 437 at p. 438).

In responding as he did, and in circumstances where only hindsight made it doubtful that Matthews could be saved, Horsley was not wanton or foolhardy. Like the trial judge, I do not think that his action passed the point of brave acceptance of a serious risk and became a futile exhibition of recklessness for which there can be no recourse. There is, however, the question whether Horsley was guilty of contributory negligence. This was an alternative plea of the respondent based, *inter alia,* on Horsley's failure to put on a life-jacket or secure himself to the boat by a rope or call on the other passengers to stand by, especially in the light of the difficulties of Matthews in the cold water. The trial judge rejected the contentions of contributory negligence, holding that although "wearing a life-jacket or securing himself to a lifeline would have been more prudent... Horsley's impulsive act without such precautions was the result of the excitement, haste and confusion of the moment, and cannot be said to constitute contributory negligence" (see [1969] 2 O.R. at p. 149). In view of its conclusions on the main issue of MacLaren's liability, the Ontario Court of Appeal did not canvass the question of contributory negligence.

The matter is not free from difficulty. About two minutes passed after Matthews had fallen overboard and MacLaren made his first abortive attempt at rescue by proceeding astern. Two life-jackets had been successively thrown towards Matthews without any visible effort on his part

timent de MacLaren avant d'aller au secours de Matthews. A mon avis, ce n'est pas là un argument valable dans les circonstances, lesquelles ont existé du fait que MacLaren a manqué à son obligation. Je cite encore le Juge Cardozo dans l'arrêt *Wagner*: [TRADUCTION] «La loi ne fait aucune distinction entre le sauveteur oubliant le risque qu'il court et celui qui le pèse. Il suffit que l'intervention, qu'elle ait été faite sous le coup d'une impulsion ou qu'elle soit délibérée, naisse de la situation». (133 N.E. 437, p. 438).

En agissant comme il l'a fait, dans des circonstances où seuls les événements subséquents ont permis de douter qu'il fût possible de sauver Matthews, Horsley n'a pas été téméraire et irréfléchi. Comme le juge de première instance, je ne crois pas que par son geste il a fait plus qu'assumer bravement un risque grave, et fait preuve futilement d'une insouciance à l'égard de laquelle il ne peut y avoir aucun recours. Toutefois, Horsley est-il coupable de négligence commune? C'est un moyen que l'intimé a invoqué comme moyen distinct; il est fondé, entre autres, sur le fait que Horsley n'a pas mis de gilet de sauvetage, ne s'est pas attaché au bateau à l'aide d'une corde, ou encore n'a pas fait appel aux autres passagers pour que ces derniers se tiennent prêts, eu égard, particulièrement, aux difficultés auxquelles faisait face Matthews dans l'eau glacée. Le juge de première instance a rejeté la prétention qu'il y avait négligence commune, décidant que bien que: [TRADUCTION] «il aurait été plus prudent de porter un gilet de sauvetage ou de s'attacher à une ligne de sauvetage... l'action impulsive de Horsley, faite sans qu'il ait pris pareilles précautions, est due à l'excitation, à la hâte et à la confusion qui régnaient à ce moment-là, et on ne peut pas dire que cela constitue de la négligence commune» (voir [1969] 2 O.R., p. 149). Vu les conclusions qu'elle a tirées sur la question principale de la responsabilité de MacLaren, la Cour d'appel de l'Ontario n'a pas traité de la question de la négligence commune.

La question comporte des difficultés. Quelque deux minutes s'étaient écoulées depuis que Matthews était tombé par-dessus bord et que MacLaren avait d'abord tenté sans succès d'effectuer le sauvetage en reculant. Deux gilets de sauvetage avaient été lancés l'un après l'autre en direction to seize them. Then came the second attempt at rescue by backing the boat, and it was in progress when Horsley dived in. Horsley had come on deck at the shout of "Roly's overboard" and was at the stern during MacLaren's first attempt at rescue, and must have been there when the life-jackets were thrown towards Matthews. However, in the concern of the occasion, and having regard to MacLaren's breach of duty, I do not think that Horsley can be charged with contributory negligence in diving to the rescue of Matthews as he did. I point out as well that the evidence does not indicate that the failure to put on a life-jacket or secure himself to a life-line played any part in Horsley's death.

The trial judge assessed damages of $70,300 for Horsley's widow and three children. Counsel for MacLaren argued for a limitation of liability to $66,318.42, pursuant to ss. 657, 659 and 661 of the *Canada Shipping Act,* R.S.C. 1952, c. 29, as enacted by 1960-61, c. 32, ss. 32 and 34; 1964-65, c. 39, s. 36, if it should be found that MacLaren was liable in respect of Horsley's death. The statutory limitation of liability of a shipowner applies if, *inter alia,* the loss or injury is without his actual fault or privity. That is not this case, and the trial judge rejected the claim of limitation accordingly. It was contended, however, that MacLaren was sued as master rather than as owner, and was hence entitled to limit his liability in accordance with s. 659 aforementioned, which so provides whether the specified loss or injury occurs with or without his actual fault or privity. Counsel for the appellants conceded that the statutory limitation applies in this case if MacLaren is liable, and I need not therefore pursue this question further. However, the quantum of the limited amount may be spoken to if the sum of $66,318.42, which was challenged by the appellants, is not correct.

de Matthews et, apparemment, il n'avait pas tenté de les saisir. Puis il y a eu la seconde tentative de sauvetage, lorsqu'on a fait reculer le bateau; c'est au cours de cette tentative que Horsley a plongé. Horsley s'est rendu sur le pont au cri de «Roly est à la mer»; et il se trouvait à l'arrière du bateau au cours de la première tentative de sauvetage effectuée par MacLaren, c'est là qu'il devait être lorsque les gilets de sauvetage ont été lancés en direction de Matthews. Toutefois, vu la gravité de la situation et eu égard au fait que MacLaren a manqué à son devoir, je ne crois pas que l'on puisse accuser Horsley de négligence commune du fait qu'il a plongé comme il l'a fait pour sauver Matthews. Je signale également que la preuve n'indique pas que le fait que Horsley n'a pas mis de gilet de sauvetage ou ne s'est pas attaché à une ligne de sauvetage ait été un facteur en ce qui concerne sa mort.

Le juge de première instance a évalué les dommages à $70,300, en ce qui concerne la veuve et les trois enfants de Horsley. L'avocat de MacLaren a soutenu que la responsabilité devait être limitée à $66,318.42, en conformité des art. 657, 659 et 661 de la *Loi sur la marine marchande du Canada,* S.R.C. 1952, c. 29, adoptés par 1960-61, c. 32, art. 32 et 34, et par 1964-65, c. 39, art. 36, si l'on concluait que MacLaren était responsable de la mort de Horsley. La limitation de la responsabilité du propriétaire d'un navire créée par la loi s'applique, entre autres, si la mort ou les blessures surviennent sans qu'il y ait faute ou complicité réelle de sa part. Ce n'est pas le cas ici; par conséquent, le juge de première instance a rejeté la requête en limitation. Toutefois, on a soutenu que MacLaren était poursuivi en qualité de capitaine plutôt qu'en qualité de propriétaire et qu'il avait donc le droit de faire limiter sa responsabilité en conformité de l'art. 659 précité, lequel prévoit pareille limitation que la mort ou les blessures soient dues ou non à une faute ou complicité réelle de sa part. L'avocat des appelants a convenu que la limitation créée par la loi s'applique si MacLaren est responsable; je n'ai donc pas à en parler davantage. Toutefois, le montant de la limitation peut être examiné si la somme de $66,318.42, que les appelants ont contestée, n'est pas exacte.

Subject to this, I would allow the appeal, set aside the judgment of the Ontario Court of Appeal and restore the judgment of the trial judge but vary the damages to take account of the limitation of liability. On this basis, the appellants are entitled to judgment for $66,318.42, which should be appropriated to the widow and children on the proportions fixed by the trial judge. The appellants are entitled to costs here and in the Court of Appeal as well as to costs of the trial.

Appeal dismissed with costs, HALL *and* LASKIN JJ. *dissenting.*

Solicitors for the plaintiffs, appellants: Levinter, Dryden, Bliss, Maxwell, Levitt & Hart, Toronto.

Solicitors for the defendant, respondent, Kenneth W. MacLaren: Du Vernet, Carruthers, Beard & Eastman, Toronto.

Sous cette réserve, je suis d'avis d'accueillir l'appel, d'infirmer le jugement de la Cour d'appel de l'Ontario et de rétablir la décision du juge de première instance, mais en modifiant le montant des dommages de façon à tenir compte de la limitation de responsabilité. Sur cette base, les appelants ont droit à un jugement en leur faveur pour la somme de $66,318.42, laquelle doit être attribuée à la veuve et aux enfants d'après les proportions fixées par le juge de première instance. Les appelants ont droit aux dépens en cette Cour et en Cour d'appel ainsi qu'aux dépens en première instance.

Appel rejeté avec dépens, LES JUGES HALL *et* LASKIN *étant dissidents.*

Procureurs des demandeurs, appelants: Levinter, Dryden, Bliss, Maxwell, Levitt & Hart, Toronto.

Procureurs du défendeur, intimé, Kenneth W. McLaren: Du Vernet, Carruthers, Beard & Eastman, Toronto.

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JISCBAILII_CASE_TORT

Judgments - Tomlinson (FC) (Original Respondent and Cross-appellant) v. Congleton Borough Council and others (Original Appellants and Cross-respondents)

HOUSE OF LORDS

SESSION 2002-03
[2003] UKHL 47
on appeal from: *[2002] EWCA Civ 309*

OPINIONS

OF THE LORDS OF APPEAL

FOR JUDGMENT IN THE CAUSE

Tomlinson (FC) (Original Respondent and Cross-appellant) v. Congleton Borough Council and others (Original Appellants and Cross-respondents)

ON

THURSDAY 31 JULY 2003

The Appellate Committee comprised:

Lord Nicholls of Birkenhead

Lord Hoffmann

Lord Hutton

Lord Hobhouse of Woodborough

Lord Scott of Foscote

HOUSE OF LORDS

OPINIONS OF THE LORDS OF APPEAL FOR JUDGMENT

IN THE CAUSE

Tomlinson (FC) (Original Respondent and Cross-appellant) v. Congleton Borough Council and others (Original Appellants and Cross-respondents)

[2003] UKHL 47

LORD NICHOLLS OF BIRKENHEAD My Lords,

1. I have had the advantage of reading in draft the speech of my noble and learned friend Lord Hoffmann. For the reasons he gives, with which I agree, I would allow this appeal.

LORD HOFFMANN

My Lords,

The accident

2. In rural south-east Cheshire the early May Bank Holiday week-end in 1995 was unseasonably hot. John Tomlinson, aged 18, had to work until midday on Saturday 6 May but then met some of his friends and drove them to Brereton Heath Country Park, between Holmes Chapel and Congleton. The Park covers about 80 acres. In about 1980 Congleton Borough Council acquired the land, surrounding what was then a derelict sand quarry, and laid it out as a country park. Paths now run through woods of silver birch and in summer bright yellow brimstone butterflies flutter in grassy meadows. But the attraction of the Park for John Tomlinson and his young friends was a 14 acre lake which had been created by flooding the old sand quarry. The sandy banks provided some attractive beaches and in hot weather many people, including families with children, went there to play in the sand, sunbathe and paddle in the water. A beach at the far end of the lake from the car park was where in fine weather groups of teenagers like John Tomlinson would regularly hang out. He had been going there since he was a child.

3. After sitting in the hot sun for a couple of hours, John Tomlinson decided that he wanted to cool off. So he ran out into the water and dived. He had done the same thing many times before. But this time the dive was badly executed because he struck his head hard on the sandy bottom. So hard that he broke his neck at the fifth vertebra. He is now a tetraplegic and unable to walk.

4. It is a terrible tragedy to suffer such dreadful injury in consequence of a relatively minor act of carelessness. It came nowhere near the stupidity of Luke Ratcliff, a student who climbed a fence at 2.30 am on a December morning to take a running dive into the shallow end of a swimming pool (see *Ratcliff v McConnell* [1999] 1 WLR 670) or John Donoghue, who dived into Folkestone Harbour from a slipway at midnight on 27 December after an evening in the pub (*Donoghue v Folkestone Properties Ltd* [2003] 2 WLR 1138). John Tomlinson's mind must often recur to that hot day which irretrievably changed his life. He may feel, not unreasonably, that fate has dealt with him unfairly. And so in these proceedings he seeks financial compensation: for the loss of his earning capacity, for the expense of the care he will need, for the loss of the ability to lead an ordinary life. But the law does not provide such compensation simply on

the basis that the injury was disproportionately severe in relation to one's own fault or even not one's own fault at all. Perhaps it should, but society might not be able to afford to compensate everyone on that principle, certainly at the level at which such compensation is now paid. The law provides compensation only when the injury was someone else's fault. In order to succeed in his claim, that is what Mr Tomlinson has to prove.

Occupiers' liability

5. In these proceedings Mr Tomlinson sues the Congleton Borough Council and the Cheshire County Council, claiming that as occupiers of the Park they were in breach of their duties under the Occupiers' Liability Acts 1957 and 1984. If one had to decide which of the two councils was the occupier, it might not be easy. Although the Park belongs to the Borough Council, it is managed on their behalf by the Countryside Management Service of the County Council. The Borough Council provides the funds to enable the Countryside Management Service to maintain the Park. It is the County which employs the Rangers who look after it. But the two Councils very sensibly agreed that one or other or both was the occupier. Unless it is necessary to distinguish between the County Council and the Borough Council for the purpose of telling the story, I shall call them both the Council.

Visitor or trespasser?

6. The 1957 Act was passed to amend and codify the common law duties of occupiers to certain persons who came upon their land. The common law had distinguished between invitees, in whose visit the occupier had some material interest, and licensees, who came simply by express or implied permission. Different duties were owed to each class. The Act, on the recommendation of the Law Reform Committee (Third Report: *Occupiers' Liability to Invitees, Licensees and Trespassers*, Cmd. 9305 (1954)), amalgamated (without redefining) the two common law categories, designated the combined class "visitors" (section 1(2)) and provided that (subject to contrary agreement) all visitors should be owed a "common duty of care". That duty is set out in section 2(2), as refined by subsections 2(3) to (5):

> "2 (2) The common duty of care is a duty to take such care as in all the circumstances of the case is reasonable to see that the visitor will be reasonably safe in using the premises for the purposes for which he is invited or permitted by the occupier to be there.
>
> (3) The circumstances relevant for the present purpose include the degree of care, and of want of care, which would ordinarily be looked for in such a visitor, so that (for example) in proper cases—
>
> (*a*) an occupier must be prepared for children to be less careful than adults; and
>
> (*b*) an occupier may expect that a person, in the exercise of his calling, will appreciate and guard against any special risks ordinarily incident to it, so far as the occupier leaves him free to do so.
>
> (4) In determining whether the occupier of premises has discharged the common duty of care to a visitor, regard is to be had to all the circumstances, so that (for example)—
>
> (*a*) where damage is caused to a visitor by a danger of which he had been warned by the occupier, the warning is not to be treated without more as absolving the occupier from liability, unless in all the circumstances it was enough to enable the visitor to be reasonably safe; and
>
> (*b*) where damage is caused to a visitor by a danger due to the faulty execution of any work of construction, maintenance or repair by an independent contractor employed by the occupier, the occupier is not to be treated without more as answerable for the danger if in all the circumstances he had acted reasonably in entrusting the work to an independent contractor and had taken such steps (if any) as he reasonably ought in order to satisfy himself that the contractor was competent and that the work had been properly done.

(5) The common duty of care does not impose on an occupier any obligation to a visitor in respect of risks willingly accepted as his by the visitor (the question whether a risk was so accepted to be decided on the same principles as in other cases in which one person owes a duty of care to another)."

7. At first Mr Tomlinson claimed that the Council was in breach of its common duty of care under section 2(2). His complaint was that the premises were not reasonably safe because diving into the water was dangerous and the Council had not given adequate warning of this fact or taken sufficient steps to prevent or discourage him from doing it. But then a difficulty emerged. The County Council, as manager of the Park, had for many years pursued a policy of prohibiting swimming or the use of inflatable dinghies or mattresses. Canoeing and windsurfing were allowed in one area of the lake and angling in another. But not swimming; except, I suppose, by capsized canoeists or windsurfers. Notices had been erected at the entrance and elsewhere saying "Dangerous Water. No Swimming". The policy had not been altogether effective because many people, particularly rowdy teenagers, ignored the notices. They were sometimes rude to the Rangers who tried to get them out of the water. Nevertheless, it was hard to say that swimming or diving was, in the language of section 2(2), one of the purposes "for which [Mr Tomlinson was] invited or permitted by the occupier to be there". The Council went further and said that once he entered the lake to swim, he was no longer a "visitor" at all. He became a trespasser, to whom no duty under the 1957 Act is owed. The Council cited a famous *bon mot* of Scrutton LJ in *The Calgarth* [1927] P. 93, 110: "When you invite a person into your house to use the staircase, you do not invite him to slide down the banisters". This quip was used by Lord Atkin in *Hillen v ICI (Alkali) Ltd* [1936] AC 65, 69 to explain why stevedores who were lawfully on a barge for the purpose of discharging it nevertheless became trespassers when they went onto an inadequately supported hatch cover in order to unload some of the cargo. They knew, said Lord Atkin (at pp. 69-70) that they ought not to use the covered hatch for this purpose; "for them for such a purpose it was out of bounds; they were trespassers". So the stevedores could not complain that the barge owners should have warned them that the hatch cover was not adequately supported. Similarly, says the Council, Mr Tomlinson became a trespasser and took himself outside the 1957 Act when he entered the water to swim.

8. Mr Tomlinson's advisers, having reflected on the matter, decided to concede that he was indeed a trespasser when he went into the water. Although that took him outside the 1957 Act, it did not necessarily mean that the Council owed him no duty. At common law the only duty to trespassers was not to cause them deliberate or reckless injury, but after an inconclusive attempt by the House of Lords to modify this rule in *British Railways Board v Herrington* [1972] AC 877, the Law Commission recommended the creation of a statutory duty to trespassers: see its *Report on Liability for Damage or Injury to Trespassers and Related Questions of Occupiers' Liability* (1976) Cmnd. 6428. The recommendation was given effect by the Occupiers' Liability Act 1984. Section 1(1) describes the purpose of the Act:

"1. (1) The rules enacted by this section shall have effect, in place of the rules of the common law, to determine—

(*a*) whether any duty is owed by a person as occupier of premises to persons other than his visitors in respect of any risk of their suffering injury on the premises by reason of any danger due to the state of the premises or to things done or omitted to be done on them; and

(*b*) if so, what that duty is."

9. The circumstances in which a duty may arise are then defined in sub-section (3) and the content of the duty is described in subsections (4) to (6):

"(3) An occupier of premises owes a duty to another (not being his visitor) in respect of any such risk as is referred to in subsection (1) above if—

(*a*) he is aware of the danger or has reasonable grounds to believe that it exists;

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(*b*) he knows or has reasonable grounds to believe that the other is in the vicinity of the danger concerned or that he may come into the vicinity of the danger (in either case, whether he has lawful authority for being in that vicinity or not); and

(*c*) the risk is one against which, in all the circumstances of the case, he may reasonably be expected to offer the other some protection.

(4) Where, by virtue of this section, an occupier of premises owes a duty to another in respect of such a risk, the duty is to take such care as is reasonable in all the circumstances of the case to see that he does not suffer injury on the premises by reason of the danger concerned.

(5) Any duty owed by virtue of this section in respect of a risk may, in an appropriate case, be discharged by taking such steps as are reasonable in all the circumstances of the case to give warning of the danger concerned or to discourage persons from incurring the risk.

(6) No duty is owed by virtue of this section to any person in respect of risks willingly accepted as his by that person (the question whether a risk was so accepted to be decided on the same principles as in other cases in which one person owes a duty of care to another)."

10. Mr Tomlinson says that the conditions set out in sub-section (3) were satisfied. The Council was therefore under a duty under subsection (4) to take reasonable care to see that he did not suffer injury by reason of the danger from diving. Subsection (5) shows that although in appropriate circumstances it may be sufficient to warn or discourage, the notices in the present case had been patently ineffectual and therefore it was necessary to take more drastic measures to prevent people like himself from going into the water. Such measures, as I shall later recount in detail, had already been considered by the Council.

11. The case has therefore proceeded upon a concession that the relevant duty, if any, is that to a trespasser under section 1(4) of the 1984 Act and not to a lawful visitor under section 2(2) of the 1957 Act. On one analysis, this is a rather odd hypothesis. Mr Tomlinson's complaint is that he should have been prevented or discouraged from going into the water, that is to say, from turning himself into a trespasser. Logically, it can be said, that duty must have been owed to him (if at all) while he was still a lawful visitor. Once he had become a trespasser, it could not have meaningful effect. In the Court of Appeal, Longmore LJ was puzzled by this paradox:

"At what point does he become a trespasser? When he starts to paddle, intending thereafter to swim? There was no evidence that Mr Tomlinson in fact swam at all. He dived from a position in which swimming was difficult, if not impossible. I would be troubled if the respondents' duty of care differed depending on the precise moment when a swim could be said to have begun."

12. In the later case of *Donoghue v Folkestone Properties Ltd* [2003] 2 WLR 1138, 1150 Lord Phillips of Worth Matravers MR said that he shared these reservations about the concession:

"What was at issue in the case was whether the Council should have taken steps which would have prevented Mr Tomlinson from entering the lake, that is, whether a duty of care was owed to him before he did the unauthorised act."

13. As a matter of logic, I see the force of these observations. But I have nevertheless come to the conclusion that the concession was rightly made. The duty under the 1984 Act was intended to be a lesser duty, as to both incidence and scope, than the duty to a lawful visitor under the 1957 Act. That was because Parliament recognised that it would often be unduly burdensome to require landowners to take steps to protect the safety of people who came upon their land without invitation or permission. They should not ordinarily be able to force duties upon unwilling hosts. In the application of that principle, I can see no difference between a person who comes upon land without permission and one who, having come with permission, does something which he has not been given permission to do. In both cases, the entrant would be imposing upon the landowner a duty of care which he has not expressly or impliedly accepted. The 1984 Act provides that even in such cases a duty may exist, based simply upon occupation of land and

knowledge or foresight that unauthorised persons may come upon the land or authorised persons may use it for unauthorised purposes. But that duty is rarer and different in quality from the duty which arises from express or implied invitation or permission to come upon the land and use it.

14. In addition, I think that the concession is supported by the high authority of Lord Atkin in *Hillen v ICI (Alkali) Ltd* [1936] AC 65. There too, it could be said that the stevedores' complaint was that they should have been warned not to go upon the hatch cover and that logically this duty was owed to them, if at all, when they were lawfully on the barge.

15. I would certainly agree with Longmore LJ that the incidence and content of the duty should not depend on the precise moment at which Mr Tomlinson crossed the line between the status of lawful visitor and that of trespasser. But there is no dispute that the act in respect of which Mr Tomlinson says that he was owed a duty, namely, diving into the water, was to his knowledge prohibited by the terms upon which he had been admitted to the Park. It is, I think, for this reason that the Council owed him no duty under the 1957 Act and that the incidence and content of any duty they may have owed was governed by the 1984 Act. But I shall later return to the question of whether it would have made any difference if swimming had not been prohibited and the 1957 Act had applied.

16. It is therefore necessary to consider the conditions which section 1(3) of the 1984 Act requires to be satisfied in order that any duty under section 1(4) should exist. But before looking at the statutory requirements, I must say something more about the history of the lake, upon which Mr Braithwaite QC, who appeared for Mr Tomlinson, placed great reliance in support of his submission that the Council owed him a duty with which it failed to comply.

The history of the lake

17. The working of the sand quarry ceased in about 1975 and for some years thereafter the land lay derelict. People went there for barbecues, camp fires, open air parties and swimming. The Borough Council bought the land in 1980 and most of the work of landscaping and planting was finished by 1983. The land was reclaimed for municipal recreation. But the traditions established in the previous anarchic state of nature were hard to eradicate. From the beginning, the County Council's Management Plan treated swimming as an "unacceptable water activity". The minutes of the County Council's Advisory Group of interested organisations (anglers, windsurfers and so forth) record that on 21 November 1983 the managers proposed to put up more signs to dissuade swimmers: "The risk of a fatality to swimmers was stressed and agreed by all". The windsurfers in particular were concerned about swimmers getting in their way; perhaps being injured by a fast-moving board. The chairman summed up by saying that although the lake with its sandy beaches was a great attraction to visitors, it was also a management problem because of misuse and dangerous activities on the water.

18. In the following year, 1984, the management reported that larger notice boards had prevented the swimming problem from getting any worse: "Every reasonable precaution had now been taken, but it was recognised that some foolhardy persons would continue to put their lives at risk."

19. The management report for 1988 stated that a major concern was?

> "the unauthorised use of the lake and the increasing possibility of an accident; this is swimming and the use of rubber boats. Warnings are ignored by large numbers who see Brereton as easy, free access to open water. On busy days the overwhelming numbers make it impossible to control this use of the lake, and it is difficult to see how the situation can change unless the whole concept of managing the park and the lake is revised."

20. In 1990 there was an inspection by Mr Victor Tyler-Jones, the County Council's Water Safety Officer. He reported that the swimming problem continued, due to the ease of access, the grassy lakeside picnic areas and the beaches and the long history of swimming in the lake. His recommendation was to reduce the beach areas by planting them with reeds. His guidelines for the entire county said that swimming in lakes, rivers and ponds should be discouraged:

"We do not recommend swimming as a suitable activity for any of our managed sites. Potential swimmers could be dissuaded by noticeboard reference to less pleasant features e.g. soft muddy bottom, danger of contracting Weil's Disease, presence of blue-green algae."

If this did not have the desired effect, ballast should be dumped on beaches and banks to make them muddy and unattractive and reeds and shrubs should be planted.

21. The money to implement these recommendations had to be provided by the Borough Council, which was under some financial pressure. But impetus was provided in the summer of 1992 by a number of incidents. Over Whitsuntide there were three cases of "near drowning resulting in hospital visits". The only such incident of which more details are available concerned a man who "was swimming in lake, after drinking, and got into difficulty". He was rescued by a relative, resuscitated by an off-duty paramedic and taken to hospital. Two men cut their heads by hitting them on something when diving into the lake; there is no information about where they dived. Mr Kitching, the County Council's Countryside Manager, prepared a paper for the Borough Council at the end of the first week in June. He said that the Park had become very popular:

"The total number of visitors now exceeds 160,000 per annum...The lake acts as a magnet to the public and has become heavily used for swimming in spite of a no swimming policy due to safety considerations...Advice has been sought from the County Council's Water Safety Officer as to how the problem should be addressed and this has been carefully followed. Notices are posted warning of the dangers and leaflets are handed to visitors to emphasise the situation. Life belts and throwing lines are provided for use in emergencies.

In spite of these actions the public continue to ignore the advice and the requests of the rangers not to swim. The attitude is that they will do what they want to do and that rangers should not interfere with their enjoyment. There have been several occasions when small children have been out in the middle of the lake and their parents have been extremely rude to staff when approached about this.

As a result of the general flaunting of the policy there have been a number of near fatalities in the lake with three incidents requiring hospital treatment in the week around Whitsun. Whilst the rangers are doing all they can to protect the public it is likely to be only a matter of time before someone drowns."

22. In July 1992 the Borough Council's Leisure Officer visited the Park and concluded that the notices and leaflets were not having the desired effect. On 23 July 1992 he proposed to other officers the preparation of a report to the Borough Council recommending the adoption of Mr Tyler-Jones's scheme for making the beaches less hospitable to visitors:

"I want the water's edge to be far less accessible, desirable and inviting than it currently is for children's beach/water's edge type of play activities. I personally find this course of action a regrettable one but I have to remind myself that Council policy was to establish a Country Park and not specifically to provide a swimming facility, no matter how popular this may have become in consequence. To provide a facility that is open to the public and which contains beach and water areas is, in my view, an open invitation and temptation to swim and engage in other water's edge activities despite the cautionary note that is struck by deterrent notices etc., and in that type of situation accidents become inevitable. We must therefore do everything that is reasonably possible to deter, discourage and prevent people from swimming or paddling in the lake or diving into the lake...Work should be prepared for the report with a view to implementation of a scheme at the earliest opportunity, bearing in mind that we shall require a supplementary estimate for the exercise."

23. As a result of this proposal, the Borough Leisure Officer was asked to prepare a feasibility report with costings. £5,000 was provided in the draft estimates for the Borough's Amenities and Leisure Services Committee, but it was one of many items deleted at the Committee's meeting on 1 March 1993 to achieve a total saving of £200,000. In 1994, the officers tried again. It was listed as a "desirable" growth bid in the

budget (below "essential" and "highly desirable"). But the bid failed. When it came to the 1995 budget round, the officers presented a strongly-worded proposal:

> "Cheshire Countryside Management Service has now taken all reasonable steps with regard to providing information and attempting to educate the public about the dangers of bathing in the lake. This has had a limited effect on the numbers entering the water for short periods but there are still numbers of people, including young children, swimming, paddling and using inflatable rafts and dinghies whenever the weather is warm and sunny. We have on average three or four near drownings every year and it is only a matter of time before someone dies.
>
> The recommendation from the National Safety Water Committee, endorsed by County Councils, is that something must now be done to reduce the 'beach areas' both in size and attractiveness. If nothing is done about this and someone dies the Borough Council is likely to be held liable and would have to accept responsibility."

24. The Borough Council found this persuasive and in 1995 £5,000 was allocated to the scheme. But the work had not yet begun when Mr Tomlinson had his accident. At that time, the beach to which he and his friends had been accustomed to go since childhood was still there. The diggers, graders and planters arrived to destroy it a few months later.

The scope of the duty under the 1984 Act

25. The conditions in section 1(3) of the 1984 Act determine whether or not a duty is owed to "another" in respect of "any such risk as is referred to in subsection (1)". Two conclusions follow from this language. First, the risks in respect of which the Act imposes a duty are limited to those mentioned in subsection (1) (a) - risks of injury "by reason of any danger due to the state of the premises or to things done or omitted to be done on them." The Act is not concerned with risks due to anything else. Secondly, the conditions have to be satisfied in respect of the claimant as "another"; that is to say, in respect of a class of persons which includes him and a description of risk which includes that which caused his injury.

A danger "due to the state of the premises"

26. The first question, therefore, is whether there was a risk within the scope of the statute; a danger "due to the state of the premises or to things done or omitted to be done on them". The judge found that there was "nothing about the mere at Brereton Heath which made it any more dangerous than any other ordinary stretch of open water in England". There was nothing special about its configuration; there were no hidden dangers. It was shallow in some places and deep in others, but that is the nature of lakes. Nor was the Council doing or permitting anything to be done which created a danger to persons who came to the lake. No power boats or jet skis threatened the safety of either lawful windsurfers or unlawful swimmers. So the Council submits that there was no danger attributable to the state of premises or things done or omitted on them. In *Donoghue v Folkestone Properties Ltd* [2003] 2 WLR 1138, 1153 Lord Phillips of Worth Matravers MR expressed the same opinion. He said that he had been unable to identify the "state of the premises" which carried with it the risk of the injury suffered by Mr Tomlinson:

> "It seems to me that Mr Tomlinson suffered his injury because he chose to indulge in an activity which had inherent dangers, not because the premises were in a dangerous state."

27. In making this comment, the Master of the Rolls was identifying a point which is in my opinion central to this appeal. It is relevant at a number of points in the analysis of the duties under the 1957 and 1984 Acts. Mr Tomlinson was a person of full capacity who voluntarily and without any pressure or inducement engaged in an activity which had inherent risk. The risk was that he might not execute his dive properly and so sustain injury. Likewise, a person who goes mountaineering incurs the risk that he might stumble or misjudge where to put his weight. In neither case can the risk be attributed to the state of the premises. Otherwise any premises can be said to be dangerous to someone who chooses to use them for some dangerous activity. In the present case, Mr Tomlinson knew the lake well and even if he had not, the

judge's finding was that it contained no dangers which one would not have expected. So the only risk arose out of what he chose to do and not out of the state of the premises.

28. Mr Braithwaite was inclined to accept the difficulty of establishing that the risk was due to the state of the premises. He therefore contended that it was due to "things done or omitted to be done" on the premises. When asked what these might be, he said that they consisted in the attraction of the lake and the Council's inadequate attempts to keep people out of the water. The Council, he said, were "luring people into a deathtrap". Ward LJ said that the water was "a siren call strong enough to turn stout men's minds". In my opinion this is gross hyperbole. The trouble with the island of the Sirens was not the state of the premises. It was that the Sirens held mariners spellbound until they died of hunger. The beach, give or take a fringe of human bones, was an ordinary Mediterranean beach. If Odysseus had gone ashore and accidentally drowned himself having a swim, Penelope would have had no action against the Sirens for luring him there with their songs. Likewise in this case, the water was perfectly safe for all normal activities. In my opinion "things done or omitted to be done" means activities or the lack of precautions which cause risk, like allowing speedboats among the swimmers. It is a mere circularity to say that a failure to stop people getting into the water was an omission which gave rise to a duty to take steps to stop people from getting into the water.

29. It follows that in my opinion, there was no risk to Mr Tomlinson due to the state of the premises or anything done or omitted upon the premises. That means that there was no risk of a kind which gave rise to a duty under the 1957 or 1984 Acts. I shall nevertheless go on to consider the matter on the assumption that there was.

The conditions for the existence of a duty

(i) Knowledge or foresight of the danger

30. Section 1(3) has three conditions which must be satisfied. First, under paragraph (a), the occupier must be aware of the danger or have reasonable grounds to believe that it exists. For this purpose, it is necessary to say what the relevant danger was. The judge thought it was the risk of suffering an injury through diving and said that the Council was aware of this danger because two men had suffered minor head injuries from diving in May 1992. In the Court of Appeal, Ward LJ described the relevant risk much more broadly. He regarded all the swimming incidents as indicative of the Council's knowledge that a danger existed. I am inclined to think that this is too wide a description. The risk of injury from diving off the beach was in my opinion different from the risk of drowning in the deep water. For example, the Council might have fenced off the deep water or marked it with buoys and left people to paddle in the shallows. That would have reduced the risk of drowning but would not have prevented the injury to Mr Tomlinson. We know very little about the circumstances in which two men suffered minor cuts to their heads in 1992 and I am not sure that they really provide much support for an inference that there was knowledge, or reasonable grounds to believe, that the beach posed a risk of serious diving injury. Dr Penny, a consultant occupational health and safety physician with long experience of advising organisations involved in acquatic sports (and himself a diver) said that the *Code of Safety for Beaches*, published in 1993 by the Royal Life Saving Society and the Royal Society for the Prevention of Accidents, made no mention of diving risks, no doubt assuming that, because there was little possibility of high diving from a beach, the risk of serious diving injuries was very small compared with the risk of drowning. I accept that the Council must have known that there was a possibility that some boisterous teenager would injure himself by horseplay in the shallows and I would not disturb the concurrent findings that this was sufficient to satisfy paragraph (a). But the chances of such an accident were small. I shall return later, in connection with condition (c), to the relevance of where the risk comes on the scale of probability.

(ii) Knowledge or foresight of the presence of the trespasser

31. Once it is found that the risk of a swimmer injuring himself by diving was something of which the Council knew or which they had reasonable grounds to believe to exist, paragraph (b) presents no difficulty. The Council plainly knew that swimmers came to the lake and Mr Tomlinson fell within that class.

(iii) Reasonable to expect protection

32. That leaves paragraph (c). Was the risk one against which the Council might reasonably be expected to offer the claimant some protection? The judge found that "the danger and risk of injury from diving in the lake where it was shallow were obvious." In such a case the judge held, both as a matter of common sense and following consistent authority (*Staples v West Dorset District Council* [1995] PIQR 439; *Ratcliff v McConnell* [1999] 1 WLR 670; *Darby v National Trust* [2001] PIQR 372), that there was no duty to warn against the danger. A warning would not tell a swimmer anything he did not already know. Nor was it necessary to do anything else. "I do not think", said the judge, "that the defendants' legal duty to the claimant in the circumstances required them to take the extreme measures which were completed after the accident". Even if Mr Tomlinson had been owed a duty under the 1957 Act as a lawful visitor, the Council would not have been obliged to do more than they did.

33. The Court of Appeal disagreed. Ward LJ said that the Council was obliged to do something more. The gravity of the risk, the number of people who regularly incurred it and the attractiveness of the beach created a duty. The prohibition on swimming was obviously ineffectual and therefore it was necessary to take additional steps to prevent or discourage people from getting into the water. Sedley LJ said: "It is only where the risk is so obvious that the occupier can safely assume that nobody will take it that there will be no liability." Longmore LJ dissented. The majority reduced the damages by two-thirds to reflect Mr Tomlinson's contributory negligence, although Ward LJ said that he would have been inclined to reduce them only by half. The Council appeals against the finding of liability and Mr Tomlinson appeals against the apportionment, which he says should have been in accordance with the view of Ward LJ.

The balance of risk, gravity of injury, cost and social value.

34. My Lords, the majority of the Court of Appeal appear to have proceeded on the basis that if there was a foreseeable risk of serious injury, the Council was under a duty to do what was necessary to prevent it. But this in my opinion is an oversimplification. Even in the case of the duty owed to a lawful visitor under section 2(2) of the 1957 Act and even if the risk had been attributable to the state of the premises rather than the acts of Mr Tomlinson, the question of what amounts to "such care as in all the circumstances of the case is reasonable" depends upon assessing, as in the case of common law negligence, not only the likelihood that someone may be injured and the seriousness of the injury which may occur, but also the social value of the activity which gives rise to the risk and the cost of preventative measures. These factors have to be balanced against each other.

35. For example, in *Overseas Tankship (UK) Ltd v Miller Steamship Pty Ltd (The Wagon Mound (No. 2))* [1967] 1 AC 617 , there was no social value or cost saving in the defendant's activity. Lord Reid said (at p 643):

> "In the present case there was no justification whatever for discharging the oil into Sydney Harbour. Not only was it an offence to do so, but it involved considerable loss financially. If the ship's engineer had thought about the matter, there could have been no question of balancing the advantages and disadvantages. From every point of view it was both his duty and his interest to stop the discharge immediately."

36. So the defendants were held liable for damage which was only a very remote possibility. Similarly in *Jolley v Sutton London B.C.* [2000] 1 WLR 1082 there was no social value or cost saving to the Council in creating a risk by leaving a derelict boat lying about. It was something which they ought to have removed whether it created a risk of injury or not. So they were held liable for an injury which, though foreseeable, was not particularly likely. On the other hand, in *The Wagon Mound (No. 2)* Lord Reid (at p. 642) drew a contrast with *Bolton v Stone* [1951] AC 850 in which the House of Lords held that it was not negligent for a cricket club to do nothing about the risk of someone being injured by a cricket ball hit out of the ground. The difference was that the cricket club were carrying on a lawful and socially useful activity and would have had to stop playing cricket at that ground.

37. This is the kind of balance which has to be struck even in a situation in which it is clearly fair, just and reasonable that there should in principle be a duty of care or in which Parliament, as in the 1957 Act, has decreed that there should be. And it may lead to the conclusion that even though injury is foreseeable, as it was in *Bolton v Stone*, it is still in all the circumstances reasonable to do nothing about it.

The 1957 and 1984 Acts contrasted

38. In the case of the 1984 Act, there is the additional consideration that unless in all the circumstances it is reasonable to expect the occupier to do something, that is to say, to "offer the other some protection", there is no duty at all. One may ask what difference there is between the case in which the claimant is a lawful visitor and there is in principle a duty under the 1957 Act but on the particular facts no duty to do anything, and the case in which he is a trespasser and there is on the particular facts no duty under the 1984 Act. Of course in such a case the result is the same. But Parliament has made it clear that in the case of a lawful visitor, one starts from the assumption that there is a duty whereas in the case of a trespasser one starts from the assumption that there is none.

The balance under the 1957 Act

39. My Lords, it will in the circumstances be convenient to consider first the question of what the position would have been if Mr Tomlinson had been a lawful visitor owed a duty under section 2(2) of the 1957 Act. Assume, therefore, that there had been no prohibition on swimming. What was the risk of serious injury? To some extent this depends upon what one regards as the relevant risk. As I have mentioned, the judge thought it was the risk of injury through diving while the Court of Appeal thought it was any kind of injury which could happen to people in the water. Although, as I have said, I am inclined to agree with the judge, I do not want to put the basis of my decision too narrowly. So I accept that we are concerned with the steps, if any, which should have been taken to prevent any kind of water accident. According to the Royal Society for the Prevention of Accidents, about 450 people drown while swimming in the United Kingdom every year (see *Darby v National Trust* [2001] PIQR 372, 374). About 25-35 break their necks diving and no doubt others sustain less serious injuries. So there is obviously some degree of risk in swimming and diving, as there is in climbing, cycling, fell walking and many other such activities.

40. I turn then to the cost of taking preventative measures. Ward LJ described it (£5,000) as "not excessive". Perhaps it was not, although the outlay has to be seen in the context of the other items (rated "essential" and "highly desirable") in the Borough Council budget which had taken precedence over the destruction of the beaches for the previous two years.

41. I do not however regard the financial cost as a significant item in the balancing exercise which the court has to undertake. There are two other related considerations which are far more important. The first is the social value of the activities which would have to be prohibited in order to reduce or eliminate the risk from swimming. And the second is the question of whether the Council should be entitled to allow people of full capacity to decide for themselves whether to take the risk.

42. The Court of Appeal made no reference at all to the social value of the activities which were to be prohibited. The majority of people who went to the beaches to sunbathe, paddle and play with their children were enjoying themselves in a way which gave them pleasure and caused no risk to themselves or anyone else. This must be something to be taken into account in deciding whether it was reasonable to expect the Council to destroy the beaches.

43. I have the impression that the Court of Appeal felt able to brush these matters aside because the Council had already decided to do the work. But they were held liable for having failed to do so before Mr Tomlinson's accident and the question is therefore whether they were under a legal duty to do so. Ward LJ placed much emphasis upon the fact that the Council had decided to destroy the beaches and that its officers thought that this was necessary to avoid being held liable for an accident to a swimmer. But the fact that the Council's safety officers thought that the work was necessary does not show that there was a legal duty to do it. In *Darby v National Trust* [2001] PIQR 372 the claimant's husband was tragically

drowned while swimming in a pond on the National Trust estate at Hardwick Hall. Miss Rebecca Kirkwood, the Water and Leisure Safety Consultant to the Royal Society for the Prevention of Accidents, gave uncontradicted evidence, which the judge accepted, that the pond was unsuitable for swimming because it was deep in the middle and the edges were uneven. The National Trust should have made it clear that swimming in the pond was not allowed and taken steps to enforce the prohibition. But May LJ said robustly that it was for the court, not Miss Kirkwood, to decide whether the Trust was under a legal duty to take such steps. There was no duty because the risks from swimming in the pond were perfectly obvious.

Free will

44. The second consideration, namely the question of whether people should accept responsibility for the risks they choose to run, is the point made by Lord Phillips of Worth Matravers MR in *Donoghue v Folkestone Properties Ltd* [2003] 2 WLR 1138, 1153 and which I said was central to this appeal. Mr Tomlinson was freely and voluntarily undertaking an activity which inherently involved some risk. By contrast, Miss Bessie Stone, to whom the House of Lords held that no duty was owed, was innocently standing on the pavement outside her garden gate at 10 Beckenham Road, Cheetham when she was struck by a ball hit for 6 out of the Cheetham Cricket Club ground. She was certainly not engaging in any activity which involved an inherent risk of such injury. So compared with *Bolton v Stone*, this is an a fortiori case.

45. I think it will be extremely rare for an occupier of land to be under a duty to prevent people from taking risks which are inherent in the activities they freely choose to undertake upon the land. If people want to climb mountains, go hang gliding or swim or dive in ponds or lakes, that is their affair. Of course the landowner may for his own reasons wish to prohibit such activities. He may be think that they are a danger or inconvenience to himself or others. Or he may take a paternalist view and prefer people not to undertake risky activities on his land. He is entitled to impose such conditions, as the Council did by prohibiting swimming. But the law does not require him to do so.

46. My Lords, as will be clear from what I have just said, I think that there is an important question of freedom at stake. It is unjust that the harmless recreation of responsible parents and children with buckets and spades on the beaches should be prohibited in order to comply with what is thought to be a legal duty to safeguard irresponsible visitors against dangers which are perfectly obvious. The fact that such people take no notice of warnings cannot create a duty to take other steps to protect them. I find it difficult to express with appropriate moderation my disagreement with the proposition of Sedley LJ (at para. 45) that it is "only where the risk is so obvious that the occupier can safely assume that nobody will take it that there will be no liability". A duty to protect against obvious risks or self-inflicted harm exists only in cases in which there is no genuine and informed choice, or in the case of employees, or some lack of capacity, such as the inability of children to recognise danger (*British Railways Board v Herrington* [1972] AC 877) or the despair of prisoners which may lead them to inflict injury on themselves (*Reeves v Commissioner of Police* [2000] 1 AC 360).

47. It is of course understandable that organisations like the Royal Society for the Prevention of Accidents should favour policies which require people to be prevented from taking risks. Their function is to prevent accidents and that is one way of doing so. But they do not have to consider the cost, not only in money but also in deprivation of liberty, which such restrictions entail. The courts will naturally respect the technical expertise of such organisations in drawing attention to what can be done to prevent accidents. But the balance between risk on the one hand and individual autonomy on the other is not a matter of expert opinion. It is a judgment which the courts must make and which in England reflects the individualist values of the common law.

48. As for the Council officers, they were obvious motivated by the view that it was necessary to take defensive measures to prevent the Council from being held liable to pay compensation. The Borough Leisure Officer said that he regretted the need to destroy the beaches but saw no alternative if the Council was not to be held liable for an accident to a swimmer. So this appeal gives your Lordships the opportunity to say clearly that local authorities and other occupiers of land are ordinarily under no duty to incur such social and financial costs to protect a minority (or even a majority) against obvious dangers. On

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the other hand, if the decision of the Court of Appeal were left standing, every such occupier would feel obliged to take similar defensive measures. Sedley LJ was able to say that if the logic of the Court of Appeal's decision was that other public lakes and ponds required similar precautions, "so be it". But I cannot view this prospect with the same equanimity. In my opinion it would damage the quality of many people's lives.

49. In the particular case of diving injuries, there is little evidence that such defensive measures have had much effect. Dr Penny, the Council's expert, said that over the past decade there had been little change in the rate of serious diving accidents. Each year, as I have mentioned, there are about 25-35 fracture-dislocations of the neck. Almost all those affected are males and their average age is consistently around 25 years. In spite of greatly increased safety measures, particularly in swimming pools, the numbers (when Dr Penny gave evidence) had remained the same for a decade:

> "This is probably because of the sudden, unpredictable nature of these dangerous dives, undertaken mostly by boisterous young men...hence the common description the "Macho Male Diving Syndrome."

50. My Lords, for these reasons I consider that even if swimming had not been prohibited and the Council had owed a duty under section 2(2) of the 1957, that duty would not have required them to take any steps to prevent Mr Tomlinson from diving or warning him against dangers which were perfectly obvious. If that is the case, then plainly there can have been no duty under the 1984 Act. The risk was not one against which he was entitled under section 1(3)(c) to protection. I would therefore allow the appeal and restore the decision of Jack J. It follows that the cross-appeal against the apportionment of damages must be dismissed.

LORD HUTTON

My Lords,

51. I have had the advantage of reading in draft the speech of my noble and learned friend Lord Hoffmann and I gratefully adopt his account of the background facts to the tragic injury which Mr Tomlinson suffered in the lake in Brereton Heath Country Park in Cheshire. I agree with your Lordships that the appeal brought by Congleton Borough Council and Cheshire County Council should be allowed, but as I was attracted for a considerable time during the hearing of the appeal by the respondent's argument supporting the reasoning of Ward LJ in the Court of Appeal (with which Sedley LJ agreed) that Mr Tomlinson was entitled to recover damages, I wish to add some observations of my own.

52. I approach the case on the basis that Mr Tomlinson was, in strict law, a trespasser at the time he dived and struck his head on the bottom of the lake. It is clear that he was invited by the appellants to come to the country park but it is also clear that swimming in the lake was expressly prohibited by the appellants and, as the trial judge found, Mr Tomlinson was fully aware of this prohibition. Therefore when he began to dive he became a trespasser because, as Lord Atkin stated in *Hillen and Pettigrew v ICI (Alkali) Ltd* [1936] AC 65, 69:

> "So far as he sets foot on so much of the premises as lie outside the invitation or uses them for purposes which are alien to the invitation he is not an invitee but a trespasser, and his rights must be determined accordingly."

However I agree with Lord Hoffmann that even if the respondent had not been a trespasser at the time of his dive but had been a visitor within the meaning of the Occupiers' Liability Act 1957, he would still not have been entitled to recover damages.

53. In relation to section 1(1)(a) of the Occupiers' Liability Act 1984 I recognise that there is force in the argument that the injury was not due to the state of the premises but was due to the respondent's own lack of care in diving into shallow water. But the trial judge found that Mr Tomlinson could not see the bottom of the lake and, on balance, I incline to the view that dark and murky water which prevents a person

seeing the bottom of the lake where he is diving can be viewed as "the state of the premises" and that if he sustains injury through striking his head on the bottom which he cannot see this can be viewed as a danger "due to the state of the premises". If water were allowed to become dark and murky in an indoor swimming pool provided by a local authority and a diver struck his head on the bottom I consider that the danger could be regarded as "due to the state of the premises", and whilst there is an obvious difference between such water and water in a lake which in its natural state is dark and murky, I think that the term "the state of the premises" can be applied both to the swimming pool and to the lake.

54. Section 1(3) and (4) provide:

> "(3) An occupier of premises owes a duty to another (not being his visitor) in respect of any such risk as is referred to in subsection (1) above if—
>
> (a) he is aware of the danger or has reasonable grounds to believe that it exists;
>
> (b) he knows or has reasonable grounds to believe that the other is in the vicinity of the danger concerned or that he may come into the vicinity of the danger (in either case, whether the other has lawful authority for being in that vicinity or not); and
>
> (c) the risk is one against which, in all the circumstances of the case, he may reasonably be expected to offer the other some protection.
>
> (4) Where, by virtue of this section, an occupier of premises owes a duty to another in respect of such a risk, the duty is to take such care as is reasonable in all the circumstances of the case to see that he does not suffer injury on the premises by reason of the danger concerned."

55. There is no doubt from the reports and proposals of the appellants' officials to the Borough's Amenities and Leisure Services Committee and to the Borough Council which Lord Hoffmann has described that paragraphs (a) and (b) of section 1(3) are satisfied. If section 1(3) were satisfied and the risk was one against which, in all the circumstances of the case, the appellants might reasonably be expected to offer the respondent some protection, I consider that there would be an argument of some force that they were in breach of the duty specified in section 1(4), because the minutes of the meetings showed that they knew that there were dangers to persons swimming or diving in the lake (there had been two cases of swimmers sustaining head injuries) and they knew that the dangers might lead to death or serious injury, but they had decided not to take the recommended steps such as planting reeds on the beach, which would probably have stopped swimming, because of financial constraints, although the cost of these precautionary measures would have been only in the region of £15,000.

56. Therefore I think the crucial question is whether the respondent has established that the risk was one to which section 1(3)(c) applies. On this point the reasoning of Ward LJ was contained in paragraph 29 of his judgment:

> "Here the authorities employed rangers whose duty it was to give oral warnings against swimming albeit that this met with mixed success and sometimes attracted abuse for their troubles. In addition to the oral warnings, the rangers would hand out safety leaflets which warned of the variable depth in the pond, the cold, the weeds, the absence of rescue services, waterborne diseases and the risk of accidents occurring. It seems to me that the rangers' patrols and advice and the handing out of these leaflets reinforced the ineffective message on the sign and constituted 'some protection' in fact given and reasonably expected to be offered in the circumstances of this case."

57. I thought for a time that this reasoning was persuasive, but I have concluded that it should not be accepted because I consider that it is contrary to a principle stated in the older authorities which is still good law. In *Stevenson v Glasgow Corporation* 1908 SC 1034, 1039 Lord M'Laren stated:

> "in a town, as well as in the country, there are physical features which may be productive of injury to careless persons or to young children against which it is impossible to guard by protective

measures. The situation of a town on the banks of a river is a familiar feature; and whether the stream be sluggish like the Clyde at Glasgow, or swift and variable like the Ness at Inverness, or the Tay at Perth, there is always danger to the individual who may be so unfortunate as to fall into the stream. But in none of these places has it been found necessary to fence the river to prevent children or careless persons from falling into the water. Now, as the common law is just the formal statement of the results and conclusions of the common sense of mankind, I come without difficulty to the conclusion that precautions which have been rejected by common sense as unnecessary and inconvenient are not required by the law."

58. In *Glasgow Corporation v Taylor* [1922] 1 AC 44, 61 Lord Shaw of Dunfermline stated:

"Grounds thrown open by a municipality to the public may contain objects of natural beauty, say precipitous cliffs or the banks of streams, the dangers of the resort to which are plain."

Lord Shaw then cited with approval the words of Lord M'Laren in *Stevenson* that "in a town, as well as in the country, there are physical features which may be productive of injury to careless persons or to young children against which it is impossible to guard by protective measures". I think that when Lord M'Laren referred to physical features against which "it is impossible to guard by protective measures" he was not referring to protective measures which it is physically impossible to put in place; rather he had in mind measures which the common sense of mankind indicates as being unnecessary to take. This statement echoed the observation of the Lord President in *Hastie v Magistrates of Edinburgh* 1907 SC 1102, 1106 that there are certain risks against which the law, in accordance with the dictates of common sense, does not give protection— such risks are "just one of the results of the world as we find it".

59.

Stevenson and *Hastie* (which were not concerned with trespassers) were decided almost a century ago and the judgments are couched in old-fashioned language, but I consider that they express a principle which is still valid today, namely, that it is contrary to common sense, and therefore not sound law, to expect an occupier to provide protection against an obvious danger on his land arising from a natural feature such as a lake or a cliff and to impose a duty on him to do so. In my opinion this principle, although not always explicitly stated, underlies the cases relied on by the appellants where it has been held that the occupier is not liable where a person has injured himself or drowned in an inland lake or pool or in the sea or on some natural feature.

60. In *Cotton v Derbyshire Dales District Council* (20 June, 1994, unreported) the Court of Appeal upheld the decision of the trial judge dismissing the plaintiff's claim for damages for serious injuries sustained from falling off a cliff. Applying the judgment of Lord Shaw in *Glasgow Corporation v Taylor* the Court of Appeal held that the occupiers were under no duty to provide protection against dangers which are themselves obvious.

61. In *Whyte v Redland Aggregates Ltd* [1997] EWCA Civ 2842 the appellant dived into a disused gravel pit and alleged that he had struck his head on an obstruction on the floor of the pit. The Court of Appeal dismissed his appeal against the judgment of the trial judge who held that he was not entitled to damages. Henry LJ stated:

"In my judgment, the occupier of land containing or bordered by the river, the seashore, the pond or the gravel pit, does not have to warn of uneven surfaces below the water. Such surfaces are by their nature quite likely to be uneven. Diving where you cannot see the bottom clearly enough to know that it is safe to dive is dangerous unless you have made sure, by reconnaissance or otherwise, that the diving is safe ie. that there is adequate depth at the place where you choose to dive. In those circumstances, the dangers of there being an uneven surface in an area where you cannot plainly see the bottom are too plain to require a specific warning and, accordingly, there is no such duty to warn (see Lord Shaw in *Glasgow Corporation v Taylor* [1922] 1 AC 44, 60. There was no trap here on the judge's finding. There was just an uneven surface, as one would expect to find in a disused gravel pit."

62. In *Bartrum v Hepworth Minerals & Chemicals Limited*, unreported, the claimant dived from a ledge on a cliff. In order to avoid shallow water he knew that he had to dive out into the pool but he failed to do so and fractured his neck. Turner J dismissed his claim for damages and stated:

> "So far as the Act is concerned, by section 1(3) the defendants were under a duty to those whom they had reasonable grounds to believe would be in the vicinity of the danger, that is on the cliff for the purpose of diving, and the risk was one which, in all the circumstances, [they] may be reasonably expected to offer some protection. In my judgment the danger here was so obvious to any adult that it was not reasonably to be expected of the defendants that they would offer any protection."

63. In *Darby v National Trust* [2001] PIQR 372 the claimant's husband was drowned whilst swimming in a pond on National Trust property. The Court of Appeal allowed an appeal by the National Trust against the trial judge's finding of liability and May LJ stated at p 378:

> "It cannot be the duty of the owner of every stretch of coastline to have notices warning of the dangers of swimming in the sea. If it were so, the coast would have to be littered with notices in places other than those where there are known to be special dangers which are not obvious. The same would apply to all inland lakes and reservoirs. In my judgment there was no duty on the National Trust on the facts of this case to warn against swimming in this pond where the dangers of drowning were no other or greater than those which were quite obvious to any adult such as the unfortunate deceased. That, in my view, applies as much to the risk that a swimmer might get into difficulties from the temperature of the water as to the risk that he might get into difficulties from mud or sludge on the bottom of the pond."

64. I also think that the principle stated by Lord M'Laren in *Stevenson* is implicit in paragraph 34 of the judgment of Lord Phillips of Worth Matravers MR in *Donoghue v Folkestone Properties Ltd* [2003] 2 WLR 1138. In that case the claimant dived from a slipway into Folkestone harbour after midnight in mid-winter. He struck his head on a grid pile under the water adjacent to the harbour wall and broke his neck. The Court of Appeal allowed an appeal by the defendant against the trial judge's finding of liability. The Master of the Rolls stated at pages 1147-1148:

> "33 The obvious situation where a duty under the 1984 Act is likely to arise is where the occupier knows that a trespasser may come upon a danger that is latent. In such a case the trespasser may be exposed to the risk of injury without realising that the danger exists. Where the state of the premises constitutes a danger that is perfectly obvious, and there is no reason for a trespasser observing it to go near it, a duty under the 1984 Act is unlikely to arise for at least two reasons. The first is that because the danger can readily be avoided, it is unlikely to pose a risk of injuring the trespasser whose presence on the premises is envisaged.
>
> 34 There are, however, circumstances in which it may be foreseeable that a trespasser will appreciate that a dangerous feature of premises poses a risk of injury, but will nevertheless deliberately court the danger and risk the injury. It seems to me that, at least where the individual is an adult, it will be rare that those circumstances will be such that the occupier can reasonably be expected to offer some protection to the trespasser against the risk."

Lord Phillips then went on to state that where a person was tempted by some natural feature of the occupier's land to engage in some activity such as mountaineering which carried a risk of injury, he could not ascribe to "the state of the premises" an injury sustained in carrying on that activity. However in the present case, as I have stated, I incline to the view that the dark and murky water can be viewed as "the state of the premises".

65. Therefore I consider that the risk of the respondent striking his head on the bottom of the lake was not one against which the appellants might reasonably have been expected to offer him some protection, and accordingly they are not liable to him because they owed him no duty. I would add that there might be

exceptional cases where the principle stated in *Stevenson* and *Taylor* should not apply and where a claimant might be able to establish that the risk arising from some natural feature on the land was such that the occupier might reasonably be expected to offer him some protection against it, for example, where there was a very narrow and slippery path with a camber beside the edge of a cliff from which a number of persons had fallen. But the present is not such a case and, for the reasons which I have given, I consider that the appeal should be allowed.

LORD HOBHOUSE OF WOODBOROUGH

My Lords,

66. In this case the trial judge after having heard all the evidence made findings of fact which are now accepted by the claimant:

> There was nothing about the mere which made it any more dangerous than any other stretch of open water in England. Swimming and diving held their own risks. So if the mere was to be described as a danger, it was only because it attracted swimming and diving, which activities carry a risk. Despite having seen signs stating "Dangerous Water: No Swimming", the claimant ignored them. The danger and risk of injury from diving in the lake where it was shallow was obvious. At the time of the accident, the claimant was 18 years of age and had regularly been going to the park since he was a small child. He knew it well. The accident occurred when he waded into the water until the water was a little above his knees and threw himself forward in a dive or plunge. He knew that he shouldn't. He could not see the bottom. In fact it was a smooth sandy surface without any obstruction or hazard. He dived deeper than he had intended and his head hit the sandy bottom causing his injury. Besides the notices already referred to, visitors were handed leaflets warning them of the dangers of swimming in the mere. Wardens patrolled the park and told people further that they should not swim in the mere. However it was the fact that visitors often took no notice and very many people did bathe in the mere in summer.

67. The claimant has made his claim for personal injuries under the Occupiers' Liability Act 1984 on the basis that at the time that he suffered his injury he was a trespasser in that he was swimming in the mere and swimming was, as he was aware, forbidden. This seems to me to be a somewhat artificial approach to the case; since paddling was apparently allowed but not swimming and the claimant was at the material time in water which only came a little above his knees. However, under the Occupiers' Liability Act 1957 (and at common law) when an invitee or licensee breaches the conditions upon which he has entered the premises, he ceases to be a visitor and becomes a trespasser: s.2(2). The claimant was permitted to enter the park on the condition that (*inter alia*) he did not swim in the mere. If he should swim in the mere, he broke this condition and as a result ceased to be a visitor. However, like all of your Lordships, I consider that whether he makes his claim under the 1984 Act or the 1957 Act, he does not succeed.

68. The two Acts apply the same general policy and the 1984 Act is a supplement to the 1957 Act. The earlier Act was the result of a re-examination of the common law relating to occupiers' liability. Its primary purpose was to simplify the law. It had previously been based upon placing those coming on another's land into various different categories and then stipulating different standards of care from the occupier in respect of each category. This was the historical approach of the common law to the question of negligence and found its inspiration in Roman law concepts (as was the case in the law of bailment: *Coggs v Bernard* 2 Lord Raym. 909). By 1957, the dominant approach had become the 'good neighbour' principle enunciated in *Donoghue v Stevenson* [1932] AC 562. But special rules still applied to relationships which were not merely neighbourly. One such was occupiers' liability. The relevant, indeed, principal simplification introduced in the 1957 Act was to introduce the 'common duty of care' as a single standard covering both invitees and licensees: see s.2(2). The 1957 Act applied only to visitors, *ie* persons coming onto the land with the occupier's express or implied consent. It did not apply to persons who were not visitors including trespassers. The 1984 Act made provision for when a duty of care should be owed to persons who were not visitors (I will for the sake of convenience call such persons "trespassers") and what the duty should then be, that is, a duty of care in the terms of s.1(3), more narrow than that imposed by the 1957 Act. Thus the duty owed to visitors and the lesser duty which may be owed to trespassers was

defined in appropriate terms. But, in each Act, there are further provisions which define the content of the duty and, depending upon the particular circumstances, its scope and extent.

69. The first and fundamental definition is to be found in both Acts. The duty is owed "in respect of dangers due to the state of the premises or to things done or omitted to be done on them". In the 1957 Act it is s.1(1). In the 1984 Act it is in s.1(1)(a) which forms the starting point for determining whether any duty is owed to the trespasser (see also s.1(3)) and provides the subject matter of any duty which may be owed. It is this phrase which provides the basic definition of 'danger' as used elsewhere in the Acts. There are two alternatives. The first is that it must be due to the state of the premises. The state of the premises is the physical features of the premises as they exist at the relevant time. It can include foot paths covered in ice and open mine shafts. It will not normally include parts of the landscape, say, steep slopes or difficult terrain in mountainous areas or cliffs close to cliff paths. There will certainly be dangers requiring care and experience from the visitor but it normally would be a misuse of language to describe such features as "the state of the premises". The same could be said about trees and, at any rate, natural lakes and rivers. The second alternative is dangers due to things done or omitted to be done on the premises. Thus if shooting is taking place on the premises, a danger to visitors may arise from that fact. If speed boats are allowed to go into an area where swimmers are, the safety of the swimmers may be endangered.

70. In the present case, the mere was used for a number of activities - angling, board-sailing, sub-aqua, canoeing and sailing model yachts - but none of these was suggested to have given rise to any danger to the claimant or others. Therefore the claimant has to found his case upon a danger due to the "state of the premises". His difficulty is that the judge has found that there was none and he has accepted that finding. Therefore his case fails *in limine*. If there was no such danger the remainder of the provisions of the Acts all of which depend upon the existence of such a danger cannot assist him. The claimant clearly appreciated this when he brought his claim since his Statement of Claim specifically pleaded that there had been "an obstruction under the surface of the water" on which he struck his head. The judge found that there was no such obstruction.

71. Section 2 of the 1957 Act deals with the content of the duty (if any). Thus s.2(2) defines the common duty of care as one "to take such care as in all the circumstances of the case is reasonable to see that the visitor will be reasonably safe in using the premises for the purposes for which he is invited or permitted by the occupier to be there". If swimming is not one of those purposes, the duty of care does not extend to him while he is swimming. Section 2(3) deals with what circumstances are relevant to assessing any duty owed. They include "the degree of care, and of want of care, which would ordinarily be looked for in such a visitor". Examples are given: "(a) An occupier must be prepared for children to be less careful than adults." A skilled visitor can be expected to appreciate and guard against risks ordinarily incident to his skilled activities: s.2(2)(b). An obvious instance of the second example is a steeple jack brought in to repair a spire or an electrician to deal with faulty wiring. Here, the claimant was an 18 year old youth who ought to be well able to appreciate and cope with the character of an ordinary lake. He can take care of himself; he does not need to be looked after in the same way as a child.

72. Turning to the 1984 Act, one can observe the same features. The basic requirement of a "danger due to the state of the premises" is there. Section 1(2) contains a cross-reference to s.2(2) of the earlier Act. Section 1(3) depends upon the existence, and knowledge, of a danger coming within s.1(1). The risk of personal injury arising from that danger must further be one against which, in all the circumstances, it is reasonable to expect the occupier "to offer the [trespasser] some protection". The equivalent phrase "reasonable in all the circumstances" is used in subsections (4) and (5). Subsection (5) specifically permits the use of warnings and discouragements against incurring the relevant risk.

73. It is an irony of the present case that the claimant has found it easier to put his case under the 1984 Act than under the 1957 Act and argue, in effect, that the occupier owed a higher duty to a trespasser than to a visitor. This is because the inclusion of the words in s.2(4), duty "to see that he does not suffer injury on the premises by reason of the danger concerned". The claimant did suffer injury whilst on the premises; the defendants failed to see that he did not. Whilst this argument in any event fails on account of the fundamental point that the state of the premises did not give rise to any danger, it would be perverse to

construe these two Acts of Parliament so as to give the 1984 Act the effect which the claimant contends for. (See also the quotation from the Law Commission Report by Brooke LJ in his judgment in *Donoghue v Folkestone Properties* [2003] 2 WLR at pp.1157-8.) The key is in the circumstances and what it is reasonable to expect of the occupier. The reference to warnings and discouragements in subsection (5) and the use of the words "some protection" in subsection (3)(c) both demonstrate that the duty is not as onerous as the claimant argues. Warnings can be disregarded (as was the case here); discouragements can be evaded; the trespasser may still be injured (or injure himself) while on the premises. There is no guarantee of safety any more than there is under the 1957 Act. The question remains what is it reasonable to expect the occupier to do for unauthorised trespassers on his land. The trespasser by avoiding getting the consent of the occupier, avoids having conditions or restrictions imposed upon his entry or behaviour once on the premises. By definition, the occupier cannot control the trespasser in the same way as he can control a visitor. The Acts both lay stress upon what is reasonable in all the circumstances. Such circumstances must be relevant to the relative duties owed under the two Acts.

74. Returning to the facts of this case, what more was it reasonable to expect of the defendants beyond putting up the notices and issuing warnings and prohibitions? It will not have escaped your Lordships that the putting up of the notices prohibiting swimming is the peg which the claimant uses to acquire the status of trespasser and the benefit of the suggested more favourable duty of care under the 1984 Act. But this is a case where, as held by the judge, all the relevant characteristics of this mere were already obvious to the claimant. In these circumstances, no purpose was in fact served by the warning. It told the claimant nothing he did not already know. (*Staples v W Dorset* [1995] PIQR 439, *Whyte v Redland* (1997) EWCA Civ 2842, *Ratcliffe v McConnell* [1999] 1 WLR 670, *Darby v National Trust* [2001] PIQR 372.) The location was not one from which one could dive into water from a height. There was a shallow gradually sloping sandy beach. The bather had to wade in and the claimant knew exactly how deep the water was where he was standing with the water coming up to a little above his knees. The claimant's case is so far from giving a cause of action under the statute that it is hard to discuss coherently the hypotheses upon which it depends. There was no danger; any danger did not arise from the state of the premises; any risk of striking the bottom from diving in such shallow water was obvious; the claimant did not need to be warned against running that risk; it was not reasonable to expect the occupier to offer the claimant (or any other trespasser) any protection against that obvious risk.

75. Faced with these insuperable difficulties and with the fact that they had failed to prove the pleaded case, counsel for the claimant put the argument in a different way. They pointed to the internal reports and minutes disclosed by the defendant councils. Passing over a minute of 22nd November 1984 which under the heading "Swimming" accurately stated

> " Probably as a result of the larger notice boards the problems of swimming were no worse than in previous years and perhaps marginally better. Every reasonable precaution had now been taken, but it was recognised that some foolhardy persons would continue to put their lives at risk.",

they referred to an undated report of some time in 1992 concerning swimming in the mere. It reported many instances of swimming during hot spells with up to 2,000 people present and as many as 100 in the water. It referred to the popularity of the extensive beach areas with families where children paddled and made sand castles and groups picnicked, adding "not unnaturally many [people] will venture into the water for a swim". The "hazards" pointing to the likelihood of future problems were stated to include "lakeside grassy picnic area". The recommendations were directed at the beach areas: "Suggest cutting down on beach area by increasing reed zones". "Signs should indicate the nature of the hazard e.g. 'Danger - Water 5m. deep'. It is clear that accidents such as that suffered by the claimant were not in the writer's mind. Other similar reports are referred to in the Opinion of my noble and learned friend Lord Hoffmann and it is otiose to quote from them again.

76. In July of the same year a departmental memorandum referred to the council's policy to stop all swimming. It therefore called upon the council to engage on a scheme of landscaping to make "the water's edge to be far less accessible, desirable and inviting than it currently is for children's beach/water's edge type of play activities". The solution called for was to remove or cover over the beaches and replace them

by muddy reed beds. Part of the reasoning was that with attractive beaches "accidents become inevitable" and "we must therefore do everything that is reasonably possible to deter, discourage and prevent people from swimming or paddling in the lake or diving into the lake." An estimate of cost was asked for.

77. Funds were short but in 1994 a request for finance was presented. It was based upon the public's disregard of the embargo on bathing in the lake despite having "taken all reasonable steps" to educate the public. The request states that "we have on average three or four near drownings every year and it is only a matter of time before someone dies". "If nothing is done about [the landscaping] and someone dies the Borough Council is to be held liable and would have to accept responsibility." This was the nub of the claimant's case. The situation was dangerous. The defendants realised that they should do something about it - remove the beaches and make the water's edge unattractive and not so easily accessible. They recognised that they would be liable if they did not do so. This reasoning needs to be examined.

78. The first point to be made is that the councils were always at liberty, subject to the Local Government Acts, to have and enforce a no swimming policy. Indeed this had all along been one of the factors which had driven their management of this park. Likewise, subject to the same important qualification, they were at liberty to take moral responsibility for and pay compensation for any accident that might occur in the park. It is to be doubted that this was ever, so stated, their view. But neither of these factors create any legal liability which is what is in question in the present case. If they mistakenly misunderstood what the law required of them or what their legal liabilities were, that does not make them legally liable.

79. The second point is the mistreatment of the concept of risk. To suffer a broken neck and paralysis for life could hardly be a more serious injury; any loss of life is a consequence of the greatest seriousness. There was undoubtedly a risk of drowning for inexperienced, incompetent or drunken swimmers in the deeper parts of the mere or in patches of weed when they were out of their depth although no lives had actually been lost. But there was no evidence of any incident where anyone before the claimant had broken his neck by plunging from a standing position and striking his head on the smooth sandy bottom on which he was standing. Indeed, at the trial it was not his case that this was what had happened; he had alleged that there must have been some obstruction. There had been some evidence of two other incidents where someone suffered a minor injury (a cut or a graze) to their head whilst diving but there was no evidence that these two incidents were in any way comparable with that involving the claimant. It is then necessary to put these few incidents in context. The park had been open to the public since about 1982. Some 160,000 people used to visit the park in a year. Up to 200 would be bathing in the mere on a fine summer's day. Yet the number of incidents involving the mere were so few. It is a fallacy to say that because drowning is a serious matter that there is therefore a serious risk of drowning. In truth the risk of a drowning was very low indeed and there had never actually been one and the accident suffered by the claimant was unique. Whilst broken necks can result from incautious or reckless diving, the probability of one being suffered in the circumstances of the claimant were so remote that the risk was minimal. The internal reports before his accident make the common but elementary error of confusing the seriousness of the outcome with the degree of risk that it will occur.

80. The third point is that this confusion leads to the erroneous conclusion that there was a significant risk of injury presented to the claimant when he went into the shallow water on the day in question. One cannot say that there was no risk of injury because we know now what happened. But, in my view, it was objectively so small a risk as not to trigger s.1(1) of the 1984 Act, otherwise every injury would suffice because it must imply the existence of some risk. However, and probably more importantly, the degree of risk is central to the assessment of what reasonably should be expected of the occupier and what would be a reasonable response to the existence of that degree of risk. The response should be appropriate and proportionate to both the degree of risk and the seriousness of the outcome at risk. If the risk of serious injury is so slight and remote that it is highly unlikely ever to materialise, it may well be that it is not reasonable to expect the occupier to take any steps to protect anyone against it. The law does not require disproportionate or unreasonable responses.

81. The fourth point, one to which I know that your Lordships attach importance, is the fact that it is not, and should never be, the policy of the law to require the protection of the foolhardy or reckless few to deprive,

or interfere with, the enjoyment by the remainder of society of the liberties and amenities to which they are rightly entitled. Does the law require that all trees be cut down because some youths may climb them and fall? Does the law require the coast line and other beauty spots to be lined with warning notices? Does the law require that attractive water side picnic spots be destroyed because of a few foolhardy individuals who choose to ignore warning notices and indulge in activities dangerous only to themselves? The answer to all these questions is, of course, no. But this is the road down which your Lordships, like other courts before, have been invited to travel and which the councils in the present case found so inviting. In truth, the arguments for the claimant have involved an attack upon the liberties of the citizen which should not be countenanced. They attack the liberty of the individual to engage in dangerous, but otherwise harmless, pastimes at his own risk and the liberty of citizens as a whole fully to enjoy the variety and quality of the landscape of this country. The pursuit of an unrestrained culture of blame and compensation has many evil consequences and one is certainly the interference with the liberty of the citizen. The discussion of social utility in the Illinois Supreme Court is to the same effect: *Bucheleres v Chicago Park District* 171 Ill 2d 435, at 457-8.

82. I cannot leave this case without expressing my complete agreement with the reasoning of the judgment of Lord Phillips, the Master of the Rolls, in *Donoghue v Folkestone Properties* [2003] 2 WLR 1138.

83. For these reasons and those given by my noble and learned friend Lord Hoffmann, and in agreement with the judgment of Longmore LJ, I too would allow this appeal.

LORD SCOTT OF FOSCOTE

My Lords,

84. I have had the advantage of reading in draft the opinion of my noble and learned friend Lord Hoffmann. Subject to one reservation I am in complete agreement with the reasons he gives for allowing this appeal. But I find myself in such fundamental disagreement with the approach to this case by the majority in the Court of Appeal that I want to add, also, a few comments of my own.

85. My reservation is that the Act which must be applied to the facts of this case in order to decide whether the Council is under any liability to Mr Tomlinson is, in my opinion, the Occupiers' Liability Act 1957, not the 1984 Act.

86. The 1957 Act regulates the duty of care which an occupier of premises owes to visitors to the premises (section 1(1)). "Visitors" are persons who would, at common law, be invitees or licensees (section 1(2)). The 1984 Act, on the other hand, applies to persons on the premises who are not visitors but are trespassers. It lays down the criteria for deciding whether the occupier of the premises owes any duty of care at all to the trespasser in question in relation to the type of injury he has suffered (section 1(3)). If a duty of care is owed, the Act describes the duty (section 1(4)).

87. Mr Tomlinson's case against the Council is based on an alleged breach of the duty of care they owed him. There is no doubt at all that he was a visitor at the Park. The Park was open to the public and he was entitled to be there. Wearing the shoes of a visitor, he was owed the duty of care prescribed by the 1957 Act.

88. The notices prominently displayed at various places in the Park forbade swimming in the lake. But entry into the water was not forbidden. Visitors to the Park were entitled to paddle and splash in the shallows of the lake. Many did so, particularly children. They were entitled to run into the water and splash one another. They were entitled to lie in the shallows and let the cool water lap over them. In doing these things they were visitors and were owed the 1957 Act duty of care. All they were forbidden to do was to swim. If they had started swimming, using the lake for a purpose which was forbidden, they would have lost their status as visitors and become trespassers. The 1984 Act would then have applied.

89. Mr Tomlinson did not suffer his tragic accident while swimming in the lake. He ran into the water and, when the depth of the water was at mid thigh level, executed the disastrous "dive" and suffered the

accident. At no stage did he swim. It may be that his "dive" was preparatory to swimming. But swimming in water not much above knee level, say 2 feet 6 inches deep, is difficult. There might be some element of flotation but I do not think the activity would normally justify the use of the verb "swim". In any event, Mr Tomlinson's injury was not caused while he was swimming and cannot be attributed in any way to the dangers of swimming. His complaint against the Council is that the Council did not take reasonable care to discourage him while in the shallows of the lake from executing a "dive". If the "dive" was, which I regard as doubtful for the reasons given, a preliminary to an attempt to swim, the complaint may be regarded as a complaint that the Council failed to prevent him from becoming a trespasser. But this must necessarily, in my view, have been a duty owed to him while he was a visitor.

90. An analogous situation might arise in relation to the trees in the Park. Suppose there were notices forbidding the climbing of trees. Nonetheless a visitor to the Park climbs a tree, falls from it, injures himself and sues the Council. He would have been a trespasser vis-à-vis the tree. But a claim under the 1984 Act would be hopeless. The proposition that the Council owed him a duty to make the tree easier or safer to climb would be ridiculous. But the injured climber might contend that the presence of the tree posed an enticing, exciting and irresistible challenge to those visitors to the Park who, like himself, were addicted to the adrenalin surge caused by climbing high trees and that, consequently, the Council owed a duty to make it impossible for him, and others like him, to succumb to the temptation, to prevent him from becoming a trespasser vis-à-vis the tree. This duty, if it were owed at all, would be a duty owed to him, a visitor, under the 1957 Act. The contention would, of course, be rejected. The Council's 1957 Act duty of care to its visitors would not require the trees to be cut down or the trunks and lower branches to be festooned with barbed wire in order to prevent visitors to the Park from disobeying the notices and turning themselves into trespassers by climbing the trees. For present purposes, however, the point I want to make is that the climber's contention would engage the 1957 Act, not the 1984 Act.

91. In the present case it seems to me unreal to regard Mr Tomlinson's injury as having been caused while he was a trespasser. His complaint, rejected by the trial judge but accepted by the majority in the Court of Appeal, was that the Council ought to have taken effective steps to discourage entry by visitors into the waters of the lake. The notices were held to be inadequate discouragement. But, if there was this duty, it was a duty owed to visitors. The people who read the notices, or who could have read them but failed to do so, would have been visitors. These were the people to be discouraged. The alleged duty was a 1957 Act duty.

92. The Council's duty under the 1957 Act to its visitors was a duty "to take such care as in all the circumstances of the case is reasonable to see that the visitor will be reasonably safe in using the premises for the purposes for which he is invited or permitted …. to be there" (section 2(2)). The purpose for which visitors were invited or permitted to be in the Park was general recreation. This included paddling and playing about in the water. The proposition that in order to discharge their 1957 Act duty to visitors the Council had to discourage them from any entry into the water and, in effect, to prevent the paddling and playing about that so many had for so long enjoyed is, in my opinion, for the reasons so cogently expressed by Lord Hoffmann, wholly unacceptable. There was no breach by the Council of its 1957 Act duty. The question whether it owed any 1984 Act duty did not, in my opinion, arise. If, wrongly in my opinion, the 1984 Act were to be regarded as applicable, the case would be a fortiori.

93. There are two respects, in my opinion, in which the approach of the courts below to the facts of this case have been somewhat unreal. First, the action of Mr Tomlinson that brought about his tragic injury has been described as a "dive". I think it is misdescribed. A dive into water, as normally understood, involves a hands-arms-head-first movement from a standpoint above the water down into the water. A dive is dangerous if the depth of the water is unknown for the obvious reason that if the depth is inadequate the head may strike the bottom of the pool or the lake before the diver is able to check his downwards trajectory and curve out of the dive. There had, apparently, been two previous occasions over the past five years or so on which a person diving into the lake had suffered head injuries. The evidence did not disclose the details but it seems reasonable to assume that these occasions had involved dives properly so-called. Mr Tomlinson did not execute a dive in the ordinary sense. He ran into the lake and, when he thought he was far enough in to do so, he threw himself forward. His forward plunge may, for want of a

better word, be called a "dive" but it should not be confused with the normal and usual dive. Mr Tomlinson was not diving from a standpoint above the lake down into water of uncertain depth. His feet were on the bottom of the lake immediately before he executed his forward plunge. He knew how deep the water was when he began the plunge. He must have expected the downward shelving of the bottom of the lake to continue and there is no evidence that it did not. The accident happened because the trajectory of his forward plunge was not sufficiently shallow. This was not a diving accident in the ordinary sense and there was no evidence that an accident caused in the manner in which Mr Tomlinson's was caused had ever previously occurred at the lake.

94. Second, much was made of the trial judge's finding that the dangers of diving or swimming in the lake were obvious, at least to adults. No one has contested that finding of fact. But I think its importance has been overstated. Mr Tomlinson was not diving in the normal sense, nor was he swimming. He simply ran into the water and when he could not run any further, because the water was above his knees and the galloping action that we all adopt when running into water on a shelving beach had become too difficult, he plunged forward. This is something that happens on every beach in every country in the world, temperature and conditions permitting. Mr Tomlinson would not have stopped to think about the dangers of swimming or diving in the lake. He was not taking a pre-meditated risk. It would not have occurred to him, if he had thought about it, that he was taking a risk at all. He was a high spirited young man enjoying himself with his friends in a pleasant Park with a pleasant water facility. If he had set out to swim across the lake, it might have been relevant to speak of his taking an obvious risk. If he had climbed a tree with branches overhanging the lake and had dived from a branch into the water he would have been courting an obvious danger. But he was not doing any such thing. He was simply sporting about in the water with his friends, giving free rein to his exuberance. And why not? And why should the Council be discouraged by the law of tort from providing facilities for young men and young women to enjoy themselves in this way? Of course there is some risk of accidents arising out of the joie de vivre of the young. But that is no reason for imposing a grey and dull safety regime on everyone. This appeal must be allowed.

OFFICE OF THE ST. GEORGE WEST COUNTY
PORT OF SPAIN CORONER

FINDINGS OF INQUEST

CITATION: Inquest into the death of Ojo Moyo Oliver

TITLE OF COURT: Port of Spain's Coroner's Court

COR FILE NO(s): INQ 10 of 2008

DELIVERED ON: 22nd April 2009

FINDINGS OF: Nalini Singh
St. George West County
Port of Spain Coroner

REPRESENTATION:

Police Corporal Samuel appeared to assist the Coroner
Ms. Geeta Maraj appeared for Home Construction Limited (HCL)
Ms. Natasha Dean appeared for the Water and Sewerage Authority (WASA)
Mr. Ashook Balroop appeared for the Environmental Management Authority (EMA).

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PREFACE

On the 28th January 2009 an inquest was formerly opened into the death of Ojo Moyo Oliver. He died from asphyxia associated with drowning on the 15th April 2007 at a pond located on the HCL Quarry premises Morne Coco Road, Petit Valley.

These are the findings of that inquest. They are divided into five parts.

Part 1 contains an introduction and sets out the extent of a coroner's jurisdiction in relation to such matters. This part also describes the inquest proceedings.

Part 2 deals with the law as it relates to the findings of this inquest.

Part 3 contains a summary of my findings as Coroner in relation to Ojo Moyo Oliver's death.

Part 4 contains my observations about the need in our jurisdiction for safety regulations governing landowners with artificial bodies on water on their premises. Recommendations have been made in this regard in an attempt to avoid future deaths from occurring by drowning in unsecured artificial bodies of water.

Part 5 contains my concluding remarks in this inquest and a formal conclusion of same.

PART 1

INTRODUCTION

1. The Preliminary Investigation and the Inquest

I conducted a preliminary investigation into this matter as per section 10 (2) of the Coroners Act Chap 6:04 (hereinafter referred to as "the Act"). I did this by perusing all the material relating to this matter which was forwarded to the Coroner's office. I then decided to conduct an inquest in relation to this matter and same commenced on the 28th January 2009.

During the course of this inquest evidence was taken from a number of witnesses and exhibits have been tendered into evidence as well. Additionally, the court made a site visit in this matter and this was done after being invited onto the HCL Quarry premises by HCL employees.

It is against this background that the following facts have emerged.

Sometime around 6:30PM on Sunday the 15th April 2007 the deceased 20 year old Ojo Moyo Oliver along with his friends Kern Thompson and Leo Hamilton trespassed onto the HCL Quarry premises in Morne Coco Road Petit Valley. They made their way to the pond area and were bathing in same when Ojo Moyo Oliver got into some difficulty and drowned. After the HCL staff was alerted to this fact, a search was made to recover the body of Ojo Moyo Oliver but this proved unsuccessful due to the lighting conditions at the time. Ojo Moyo Oliver's body was recovered on Monday 16th April 2007 when it was observed to be bareback, and clad only in red boxers. The body itself bore no marks of violence. The body was lifeless and its face was covered entirely in mud. Ojo Moyo Oliver was pronounced dead by the District Medical Officer and his body was taken to the Port of Spain Mortuary where, on Tuesday 17th April 2007 he was identified by his mother Ida Oliver. An autopsy was then performed under Dr. Jankey's supervision. The cause of death was found to be asphyxia associated with drowning. The body was later disposed of by burial under Spiritual Baptist Rites on Friday 20th April 2007 at the Mucurapo Cemetary Port of Spain.

This incident clearly demonstrates that the manner in which artificial bodies of water are secured is something which must be strictly controlled and scrutinized. Citizens are conferred with the right to the enjoyment of their property. This right is tempered by the fact that trespassers must be treated with ordinary humanity and if a trespasser is killed because an artificial body of water is not properly secured, the landowner of such premises will be held accountable for this grave omission.

Tragic incidents such as this are traumatic for the deceased person's family as well as the landowners involved but at the end of the day, the deceased person's family members are entitled to a thorough and impartial examination of the circumstances of the death to determine whether there is evidence of the commission of a criminal offence. In fact the community needs to be satisfied as to whether or not the landowner took such steps as common sense or common humanity would dictate to exclude or warn or otherwise within reasonable practicable limits, so as to reduce or avert danger -if it is to maintain its trust and confidence in our legal system. And so, if the death was avoidable, the public is entitled to expect that those responsible will be held accountable and that changes will be made to reduce the likelihood of similar deaths occurring in future.

It is also in the interests of the landowners involved that these maters be scrupulously and independently investigated and publicly reported on so that there can be no suggestion of a "cover up."

The Act recognizes and responds to this need for public scrutiny and accountability by requiring deaths in custody for instance, to be brought to the attention of the Coroner[1] and by mandating that an inquest be held into all such deaths[2].

JURISDICTION

1. The scope of the Coroner's inquest and findings

A Coroner has jurisdiction to inquire into the cause and the circumstances of a reportable death[3]. I understand this to mean that if it is possible, a Coroner is required to find:-

[1] Section 4 (3) states that "The Keeper of any prison within which a prisoner dies shall forthwith give notice of the death to the Coroner and the District Medical Officer within whose respective districts the prison is situated".

[2] Section 11 states that "A Coroner, where there is in his district the body of any person who died in any prison or as to whose death an inquest is prescribed, shall hold an inquest as to the cause and circumstances of the death, whether the District Medical Officer does or does not make a report thereon".

[3] Section 10(1) states that "A Coroner having received the report of the District Medical Officer as to the cause of death of any person, shall carry out a preliminary investigation as to the cause and circumstances of the death".

- whether a death in fact happened;
- the identity of the deceased;
- when, where and how the death occurred; and
- what caused the person to die.

Ojo Moyo Oliver's death was reportable because it was unnatural in that it occurred in an unnatural manner[4].

As required by the relevant legislation, I have made findings in relation to the particulars of this death. This is out in Part Three of these findings.

I have also thought it best to make some comments on existing legislation because they relate to public safety, the administration of justice and ways to prevent deaths from happening in similar circumstances in the future. These recommendations can be found in Part Four of these findings.

An inquest is not a trial between opposing parties but an inquiry into the death. In **R v. South London Coroner; ex parte Thompson (1982) 126 S.J. 625** it was described in this way:

[4] Section 2 defines an unnatural death as including "every case of death of any person (a) which occurs in a sudden, violent, or unnatural manner". Additionally, section 4(1) states that "Every person who becomes aware of an unnatural death shall forthwith give notice thereof to the District Medical Officer of the district in which the body is or to a constable, and the constable shall forthwith cause information to be given to the Medical Officer".

"It is an inquisitorial process, a process of investigation quite unlike a criminal trial where the prosecutor accuses and the accused defends… The function of an inquest is to seek out and record as many of the facts concerning the death as the public interest requires".

The focus of an inquest is on discovering what happened, but in the process of doing this, the Act authorizes a Coroner to issue a warrant for the apprehension of any person once the Coroner is of the opinion that sufficient grounds are disclosed for making a charge on indictment against that person[5].

2. *The standard of proof*

Before arriving at such a finding, the Coroner must be satisfied on the necessary facts to the required standard of proof. For a finding of unlawful killing the standard is the same level set in a criminal court, that is to say "beyond reasonable doubt" as was made clear in **R v. Wolverhampton Coroner ex parte McCurbin (1990) 1 WLR 719**.

Accordingly, the findings I have made in this case have been made after being satisfied of the necessary facts beyond reasonable doubt.

It is also clear that a Coroner is obliged to comply with the rules of natural justice and to act judicially. This is set out at page 994 in **Harmsworth v. State Coroner [1989] VR**

[5] Section 28 states that "If, during the course or at the close of any inquest, the Coroner is of opinion that sufficient grounds are disclosed for making a charge on indictment against any person, he may issue his warrant for the apprehension of the person and taking him before a Magistrate, and may bind over any witness who has been examined by or before him in a recognisance with or without surety to appear and give evidence before the Magistrate".

989. This means that no findings adverse to the interest of any party may be made without that party first being given an opportunity to be heard in opposition to that finding. In fact **Annetts v. McCann (1990) 65 ALJR 167 at 168** is authority for the point that this opportunity to be heard actually includes being given an opportunity to make submissions against findings that might be damaging to the reputation of any individual. In arriving at my findings in this case, I have endeavored to ensure the rules of natural justice and procedural fairness were applied as the particular circumstances warranted.

To this end I have invited submissions on all legal issues as they arose. I have provided HCL with the opportunity to give evidence in these proceedings and to call witnesses on its behalf. Finally a copy of all documents forming the bundle submitted to this court for consideration have been forwarded to HCL and in so doing I have relied upon the authority of **R v. Southwark Coroner, ex p. Hicks [1987] 1 W.L.R. 1624.**

PART II

THE LAW

It is stated in **Archbold 2008 at para 19-110** that where an allegation of manslaughter is based on an omission to act (not itself being unlawful), the issues to be left to the jury are whether a duty of care was owed to the deceased, whether there has been a breach of that duty; whether the breach caused death; and whether it should be characterised as gross negligence and, therefore a criminal act.

Charlesworth & Percy on Negligence (London: Sweet & Maxwell, 2006) is also useful in this regard since it is stated at para 1-16 under the rubric "Criminal Negligence" that "it must be proved, to the criminal standard, that the conduct of the accused was, in the first instance, such as to amount to a beach of duty of care towards the victim. The Crown must then show that the negligence in question caused the victim's death and should be characterised as gross negligence and therefore a crime. It is for the judge to direct the jury whether the facts are capable of giving rise to a duty of care and for the jury to decide, in light of the judge's directions, whether there was indeed such a duty on the particular facts. The jury must then consider whether, having regard to the risk of death, the accused conduct was so bad in all the circumstances as to amount to a criminal act or omission".

The following matters have therefore arisen for determination at this inquest:

1. Did HCL owe Ojo Moyo Oliver a duty of care?

2. Did HCL breach that duty of care towards Ojo Moyo Oliver?

3. Has Ojo Moyo Oliver's death resulted from that breach?

4. Was the breach grossly negligent and therefore a criminal act?

I turn now to the resolution of each of these matters.

1. Did HCL owe Ojo Moyo Oliver a duty of care?

Duty of care of one person towards others flows from millennia of social customs, philosophy and religion. Serving as the glue of society, duty of care is the thread that binds humans to one another in the community. Duty of care constrains and channels behavior in a socially responsible way before the fact, and it provides a basis for judging the propriety of behavior thereafter.

Essentially, negligence law assesses human choices to engage in harmful conduct as proper or improper. Because choices are deemed improper only if they breach a preexisting obligation to avoid and repair carelessly inflicted harms to others, duty of care gives definitional coherence to the negligence inquiry. Serving in this manner as the foundational element of a negligence claim, duty of care provides the front door to recovery for the principal cause of action in the law of tort: in that every negligence claim must pass through the "duty portal" that bounds the scope of tort recovery for accidental harm[6].

[6] David G. Owen, *The Five Elements of Negligence,* Volume 35 No.4 Hofstra Law Review 1671, 1676-77 Volume 35 No.4 (2007).

A duty of care could therefore be said to connote a relationship by which an obligation is imposed upon one person for the benefit of another to take reasonable care in all the circumstances.

It follows from this that before one can say whether HCL owed Ojo Moyo Oliver a duty of care in this case, one must necessarily determine whether there was first of all, a relationship between HCL and Ojo Moyo Oliver at the material time which was capable of giving rise to such a duty.

A. Relationship between HCL and Ojo Moyo Oliver

(a) Status of HCL

From the evidence which emerged during this inquest, HCL was at all material times the owner of the land upon which the pond is located. It is also evident that HCL did not only have an interest in the land at the time but, they also had exclusive occupation of those premises as well. HCL can therefore be said to be the occupier of those premises.

(b) Status of Ojo Moyo Oliver

According to **Charlesworth & Percy on Negligence (London: Sweet & Maxwell, 2006) at para. 7-141** a trespasser is one who wrongfully enters on land in the possession of another and has neither right nor permission to be there. According to Lord Dunedin in **Robert Addie & Sons (Collieries), Ltd. v. Dumbreck [1929] A.C. 358 at 371** he is one "who gets on the land without invitation of any sort and whose presence is either unknown to the proprietor or, if known, is practically objected to". The term trespasser covers "the wicked and the innocent: the burglar, the arrogant invader of another's land, the walker, blithely unaware that he is stepping where he has no right to walk or the wandering child…"[7].

A trespasser can be distinguished from a lawful visitor in two main respects. First "…he has no right to enter on the land, or, having entered, to remain there". Second "…so long as he is an unknown and merely possible trespasser, his presence and his movements are unpredictable. The lawful visitor, coming and remaining as of right, is expected to come and be there, also he is likely to come at a normal hour, and to enter by the proper entrance, and to go to, and normally to remain at, the part of the premises where he has business or with which he is concerned. By contrast, the unknown and merely possible trespasser may come at any time or may never come at all; if he does come, he may walk, break, creep or climb into the premises at any place and go by any route to any part of the premises and remain for any length of time"[8].

The evidence at this inquest makes it clear that Ojo Moyo Oliver was, at all material times, a trespasser on the HCL Quarry premises.

As far as the law is therefore concerned, Ojo Moyo Oliver was a trespasser and HCL was the owner and occupier of the HCL Quarry premises upon which the pond was located.

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[7] Herrington v. British Railways Board [1972] A.C. 877 at 904, *per* Lord Morris
[8] Videan v. British Transport Commission [1963] 2 Q.B. 650 at 679, *per* Pearson L.J.

Having identified the status of the parties concerned in this matter, the issue which must be determined before it can be said that HCL owed Ojo Moyo Oliver a duty of care is whether the relationship of trespasser and occupier gives rise to the creation of an obligation upon an occupier to take reasonable care in all the circumstances for the benefit of the trespasser. This is critical because unless the existence of a duty of care can be established, an action in negligence will fail: **Black v. Fife Coal Co. Ltd [1912] A.C. 149 at 159 *per* Lord Kinnear.**

B. Does the relationship between HCL and Ojo Moyo Oliver create a duty of care?

Trespassers, as a class, were not recognized as capable of suing occupiers of dangerous premises for injuries caused by negligence, although they could sue if their injuries were inflicted willfully or recklessly, for example by the laying of a spring gun. This is borne out in the case of *Robert Addie & Sons (Collieries) Ltd. v. Dumbreck (supra) at 365* where Lord Hailsham L.C. laid down the proposition that "the trespasser comes on to the premises at his own risk. An occupier is in such a case liable only where the injury is due to some act done with the deliberate intention of doing harm to the trespasser, or at least some act done with reckless disregard of the presence of the trespasser". This stern rule was followed for decades and the Occupiers' Liability Act 1957 did not alter the law.

This initial position was greatly modified however as a result of case of **Herrington v. British Railways Board [1972] A.C. 877** where the House of Lords declared that an occupier did owe a duty of care towards a trespasser, albeit not the same duty owed to a lawful visitor, but *a duty to take such steps as common sense or common humanity would* *dictate to exclude or warn or otherwise, within reasonable practicable limits, reduce or avert danger.* (emphasis mine). Thereafter statute intervened and the Occupiers' Liability Act 1984 and subsequent cases have elaborated on the duty owed.

Since Trinidad and Tobago has no legislation governing possible causes of action trespassers may have against land occupiers for damage incurred from negligence, I must turn to the common law position. I therefore address my mind to the law as it is stated in the case of *Herrington v. British Railways Board (supra).* The facts of this case are that in June 1965, the plaintiff, a child aged six, and his two older brothers had been playing lawfully in a meadow, on National Trust property and open to the public, at Mitcham, Surrey, when suddenly he was discovered to be missing. He was found seriously burnt lying against the electrified rail of the defendants' single line railway. The track was separated from the public footpath by chain link fencing, some four feet high and supported by concrete posts. At a point opposite to where the injured boy was found, the fence had become detached from the posts and had been trodden down to within about 10 inches of the ground by people leaving the footpath and taking a short cut across the railway line to the meadow. The defendant's station master, who was responsible for that stretch of railway, had been notified two months previously that children had been seen on the lines and had requested the police to investigate but the fence had not been repaired. The first instance judge held the defendants liable the Court of Appeal affirmed that decision and the House of Lords dismissed a further appeal. Indeed their Lordships refused to follow *Robert Addie & Sons (Collieries) Ltd. v. Dumbreck (supra)* which was considered to be decided wrongly. In its place they substituted a test of liability which they described in various terms. Lord Reid described it as requiring the occupier to do that which was humane or decent (at 899). Lord Pearson described it as requiring that a trespasser be treated with ordinary humanity (at 927) and Lord Morris of Borth-y-Gest described it as requiring such steps as ordinary thought and intelligence, exercising common sense would dictate (at 909).

In particular their Lordships held that although as a general rule a person who trespassed on the land of another did so at his own risk, and the occupier of the land did not owe him the common law duty of care owed to persons lawfully on the land, it did not follow that an occupier was never, in any circumstances, under a duty to take steps to protect a trespasser from potential danger; nor was the occupier's duty limited to refraining from acting with the deliberate intention of doing harm to a trespasser actually on the land or with reckless disregard to his presence there. Where an occupier knew that there were trespassers on his land, or knew of circumstances that made it likely that trespassers would come onto his land, and also knew of physical facts in relation to the state of his land or some activity carried out on the land which would constitute a serious danger to persons on the land who were unaware of those facts, the occupier was under a duty to take reasonable steps to enable the trespasser to avoid the danger. That duty would only arise in circumstances where the likelihood of the trespasser being exposed to the danger was such that, by the standards of common sense and common humanity, the occupier could be said to be culpable in failing to take reasonable steps to avoid the danger. It was accordingly held that the Board was in breach of their duty to the plaintiff for they had brought onto their land in the electrified rail something that was lethal to a small child and was a concealed danger as well. It would have been easy for them to have maintained and enforced a reasonable system of inspection and repair of the boundary fence and it was known to them that children were entitled and accustomed to playing on the other side of the fence and they must therefore have known that a young child might easily cross a defective fence and run into grave danger. Although in failing to take any steps to maintain the fence in good repair the board could not be said to have acted with reckless disregard of the plaintiff's presence on the track, they had failed to act with due regard to humane considerations and were, in the circumstances culpable.

I have found the case of **Kirton v. Rogers (1972) 19 W.I.R. 191** which came out of the High Court of Barbados to be instructive in this regard. The facts of this case are that the plaintiff was an eight year old boy. He brought an action against a quarry claiming damages for an injury received by him when he was struck on his forehead by a stone. He claimed that the stone was expelled from the defendant's quarry where explosives were being used at the time for the purposes of quarrying. His action was founded on the absolute liability rule in Rylands v. Fletcher and in the alternative, on negligence. The defence was a denial of the allegation and, in the alternative, implied consent and negligence of the plaintiff.

It was held that there was no evidence that the explosives or its results ever escaped from the place over which the defendant had control to a place where he had no control and therefore the case did not lie within the rule in Rylands v. Fletcher. It was further held that on the evidence it could not be decided whether the plaintiff at the time when he sustained the injury was outside the boundaries of the defendant's land or was a trespasser on the defendant's lands. However, in either case the defendant was liable in negligence. The law imposed on the defendant, as an employer, not only the duty to take care, but also the duty to see that the proper care was taken by anyone employed by him to use the explosive. In a case such as the present it ought to have been anticipated that potential trespassers were likely to arrive and the duty to take reasonable steps to avoid the danger could only be fully discharged by posting someone in a position to continue the warning and thereby keep those approaching out of range until the danger was past. In the circumstances the court gave judgment for the plaintiff.

In arriving at this decision the High Court of Barbados not only discussed the development of the law as it relates to the duty of care owed to trespassers but, it also referred to and applied the case of *Herrington v. British Railways Board (supra)* in arriving at its decision. Of particular interest is what the court had to say at pages 196-197:

> "In British Railways Board v. Herrington (7), decided by the House of Lords in February this year, the draconian rule of Addie's case was not followed, and the House recognized and explained a duty in the occupier towards trespassers on his land as well as trespassers likely to come there in certain circumstances.
>
> To quote the headnote in part: "Circumstances where the likelihood of the trespasser being exposed to the danger was such that, by the standards of

common sense and common humanity, the occupier could be said to be culpable in failing to take reasonable steps to avoid the danger." .

Then later at para H of page 197

"In applying the decision in Herrington, in a case such as the present one the defendant ought to have anticipated that potential trespassers were likely to arrive and in my opinion that duty to take reasonable steps to avoid the danger could only be fully discharged by posting someone in a position to continue the warning and thereby keep those approaching out of range until the danger is past. Such steps would not involve any considerable work, staff or expense and in the circumstances of the instant case would in my opinion have been reasonable.

In the words of Lord Reid in Herrington's case "By trespassing they [the trespassers] force a 'neighbour' relationship on him [the occupier]. When they do so he must act in a humane manner –that is not asking too much of him- but I do not see why he should be required to do more". Lord Reid also said at pg. 759 "I think that current conceptions of social duty do require occupiers to give reasonable attention to their responsibilities as occupiers, and I see nothing in legal principles to prevent the law from requiring them to do that".

This last passage is in my opinion most apt in relation to the instant case which has arisen in our densely populated Island with its maze of footpaths and thousands of adults and children daily walking along them and in many instances in the vicinity of quarries which are in operation."

Counsel for HCL has urged this court to apply the law as it is laid out in the case of *Robert Addie & Sons (Collieries) Ltd. v. Dumbreck (supra)* but in light of the developments in the law in *Herrington v. British Railways Board (supra)* where it was specifically stated that *Robert Addie & Sons (Collieries) Ltd. v. Dumbreck (supra)* was incorrectly decided, and *Kirton v. Rogers (supra)* which applied *Herrington v. British Railways Board (supra),* I find that I am unable to accede to the request of counsel. In the circumstances the law as stated in *Herrington v. British Railways Board (supra)* will be followed. It follows from this that HCL as occupier, owed Ojo Moyo Oliver as trespasser, a duty to take such steps as common sense or common humanity would dictate to:

-exclude or warn or otherwise

-within reasonable practicable limits

-reduce or avert danger.

Put simply, I find that there are sufficient grounds for concluding that HCL owed Ojo Moyo Oliver a duty of care.

2. *Did HCL breach the duty of care owed to Ojo Moyo Oliver*

The second matter which arises for determination as per the guidelines in *Archbold 2008 at para 19-110* is whether HCL breached its duty of care owed to Ojo Moyo Oliver.

A breach of the duty of care occurs with an improper act or an omission. Breach implies the pre-existence of a standard of proper behavior to avoid imposing undue risks of harm to other persons and their property, which circles back to duty. In early law, the standard of care imposed on one person for the protection of another depended heavily on the formal relationship between the parties such as doctor patient and the like. As society grew more complex, a general standard of care became necessary to govern the conduct of persons and enterprises who unavoidably imposed risks of injury on a daily basis on other persons. And so negligence law developed a standard for defining and assessing proper behavior in a crowded world. While the standard of care must be adjusted for certain special relationships, as classically was the norm, modern negligence law imposes a duty on most persons in most situations to act with reasonable care, often referred to as due care, for the safety of others and themselves. A person who acts carelessly – unreasonably, without due care –breaches the duty of care[9].

Using the test as set out in *Herrington v. British Railways Board (supra)*, a determination of whether HCL breached its duty of care owed to Ojo Moyo Oliver entails an examination of whether HCL took such steps as common sense or common humanity would dictate to:

1. Exclude or
2. Warn or otherwise
3. Within reasonable practicable limits

[9] David G. Owen, *The Five Elements of Negligence,* Volume 35 No.4 Hofstra Law Review 1671, 1676-77 Volume 35 No.4 (2007).

4. Reduce or avert danger.

The answer to this is hinged upon an examination of the HCL Quarry premises: if at the material time, there was any danger in respect of which HCL ought to have taken such steps as common sense or common humanity would dictate, to exclude or warn or otherwise within reasonable practicable limits, reduce or avert same, and they failed to do this, then HCL would have breached its duty of care to Ojo Moyo Oliver.

A. <u>The danger to be reduced or averted based on the state of the HCL Quarry premises</u>

Evidence of the state of the HCL Quarry premises emerged during this inquest from witness testimony, photographs which were tendered into evidence, as well as a site visit which was made by the court upon invitation of employees of the HCL Quarry. From this, the following has become apparent.

The HCL Quarry site is located on acres of land in the Petit Valley area. It is close in proximity to the Petit Valley Boys and Girls Roman Catholic Schools. The premises are directly bounded by residential property.

There is a dispute of fact as the whether at the material time the entire HCL Quarry premises was fenced or not. Leo Hamilton testified that the property was unfenced at the material time. P.C. Perry contends that the property was actually fenced to the south western side alone and not entirely so either as there was a gate belonging to an adjoining residential home that lead onto the HCL Quarry site. On both accounts it is clear that the

The facts of this matter can accordingly be distinguished from the facts as set out in **Tomlinson v. Congleton Borough Council [2004] 1 A.C. 46.** This case concerned diving into a pond formed from a disused gravel pit. The property was purchased by the local authorities who landscaped it and opened it to the public for their use as a recreational park. The pond was 40 foot deep at its deepest point towards which the shore shelves at varying degrees. Swimming was prohibited in this pond and the prohibition was made clear by notices posted to the entrance of that park as well as other locations about the park. Mr. Tomlinson waded into the water until it was a little above his knees, probably no deeper than mid-thigh level. He then threw himself forward in a dive. He intended it to be a shallow dive but it went wrong. He went deeper than he intended. His head struck the sandy bottom and he broke his neck. He claimed damages alleging that the accident had been caused by a breach of a duty of care owed to him.

The House of Lords found that the claimant had failed to establish that there was any risk to himself due to the state of the premises or to things done or omitted to be done on them. The court felt that he had voluntarily engaged in an activity which involved a degree of risk and it was the activity of diving into too shallow water rather than the premises itself, which gave rise to that risk. There being no danger attributable to the state of the premises, no duty arose to protect him from it.

The same cannot be said for the state of the pond located on the HCL Quarry premises. This is because the danger to be averted in the matter at hand does not arise from swimming per se but from the state or condition of the pond itself.

Another case which makes the distinction between the danger arising out of an activity which carries with it an inherent risk, as opposed to risk arising from special characteristics of land itself is **Bartrum v. Hepworth Minerals and Chemicals Ltd (unreported) 29 October 1999.** It was held in this case that the activity in question - rather than the state of the premises, was a dangerous one and the landowners were not in breach of their duty towards the claimant who ought to have appreciated that not diving far enough out from the cliff to enter the water was hazardous.

The facts of the instant matter are also in the view of this court, distinguishable from the case of **Darby v. National Trust [2001] EWCA Civ 189.** In this case the defendant owned land which was open to the public. A pond on the land was shallow around the edges but 10 foot deep in the middle and was used by visitors for swimming. The claimant's husband, who had swum in the pond previously, fell into difficulties while swimming there. A passer-by dragged him from the water, but he failed to regain consciousness and subsequently died. The claimant alleged that the defendant had breached its common law duty of care.

It was held on appeal that an occupier was only under a duty to warn visitors where they would be unaware of the risk without such a warning. If the danger was obvious, no warning was required. It was felt that the risk of swimming in the pond was perfectly obvious, so that the absence of warning signs regarding the danger of drowning was not a causative breach of duty. A notice warning against swimming would have told the deceased no more than he already knew and the appeal was allowed. (emphasis mine).

This court is of the view that in light of the peculiar condition of the pond on the HCL Quarry premises, a warning sign would have told trespassers more than they could have been taken to know about the actual dangers inherent in swimming in this particular pond. This is because the extraordinary dept of this man made pond presents a danger which is not an obvious one. This means that one cannot equate the risks attendant on swimming in the HCL Quarry pond as being the same as that incurred by a person swimming in a body of water which is open to the public for that precise purpose. In these circumstances this court is of the opinion that the *Darby v. National Trust (supra)* case is distinguishable because of its own peculiar factual matrix which is diametrically opposed to the facts before this court.

Another point which is apparent in *Darby v. National Trust (supra)* and a line of cases such as **Cotton v. Derbyshire Dales District Council The Times 20 June 1994**[10] is that they all concern natural features on land and the law in respect of this is clear: it is contrary to common sense, and therefore sound law, to expect an occupier to provide protection against an obvious danger on his land arising from a natural feature such as a

[10] In Cotton v. Derbyshire Dales District Council (supra) the Court of Appeal upheld the decision of the trial judge dismissing the plaintiff's claim for damages for serious injuries sustained from falling off a cliff. The Court of Appeal found that occupiers were under no duty to provide protection against dangers which are themselves obvious.

lake or a cliff and to impose a duty on him to do so[11]. In fact May LJ stated at p 378 of *Tomlinson v. Congleton Borough Council (supra)* that: "it cannot be the duty of the owner of every stretch of coastline to have notices warning of the dangers of swimming in the sea. If it were so, the coast would have to be littered with notices in places other than those where there are known to be special dangers which are not obvious. The same would apply to all inland lakes and reservoirs. In my judgment there was no duty on the National Trust on the facts of this case to warn against swimming in this pond where the dangers of drowning were no other or greater than those which were quite obvious to any adult such as the unfortunate deceased. That, in my view, applies as much to the risk that a swimmer might get into difficulties from the temperature of the water as to the risk that he might get into difficulties from the mud or sludge on the bottom of the pond".

The incident before this court relates to an artificially created pond and so the law relating to natural formations on land is wholly inapplicable.

B. Steps taken by HCL

Having identified that the danger or risk to be reduced or averted on the HCL Quarry premises is one of drowning in the pond, and, having distinguished the matter at hand from the aforementioned cases on the basis that:

1. The HCL Quarry pond itself was dangerous
2. The danger was a concealed danger and
3. The pond was an artificial feature in respect of which the rule concerning natural formations does not apply

[11] **Tomlinson v. Congleton Borough Council [2004] 1 A.C. 46 at 89 paras a-b**

I turn now to an examination of the steps taken by HCL to reduce or avert this danger. In evaluating the steps taken by HCL to exclude and/or warn trespassers of same, I bear in mind the principle stated in **Charlesworth & Percy on Negligence at para 6-10** which is to the effect that the degree of care to be taken depends on the magnitude of the risk; the greater the risk the more care should be taken. This principle has been voiced by Lord Macmillan in **Glasgow Corp v. Muir [1943] A.C. 448 at 456** where he said that "The degree of care for the safety of others which the law requires human beings to observe in the conduct of their affairs varies according to the circumstances. There is no absolute standard, but it may be said generally that the degree of care required varies directly with the risk involved. Those who engage in operations inherently dangerous must take precautions which are not required of persons engaged in the ordinary routine of daily life". Then this same judge said in the later case of **Read v. J. Lyons & Co. Ltd [1947] A.C. 156 at 173** that "the law in all cases exacts a degree of care commensurate with the risk created". It follows that at one end of the spectrum, where dangerous things, such as explosives, are handled "the law exacts a degree of diligence so stringent as to amount practically to a guarantee of safety": **Donoghue v. Stevenson [1932] A.C 562** *per* Lord Macmillan. At the other extreme, the degree of risk may be so small that no care may be taken.

The risk in this case is death by drowning and this court is of the view that, in terms of magnitude of risk, the loss of life is the greatest risk to incur. It follows that the steps taken to reduce or avert this danger must be on par with this magnitude of risk involved.

I come now to the steps actually taken by HCL to exclude or warn in an effort to reduce or avert the danger of drowning.

(i) Steps taken to exclude

With respect to the matter of the steps which were taken to exclude trespassers from coming onto the HCL quarry and therefore engaging in an unlawful user of the pond, evidence has emerged at the inquest of the fact that at the material time the pond area was unfenced, or not entirely fenced –depending on which version of the facts is accepted on this issue.

HCL contends that the lack of complete fencing is immaterial since access to the pond area was in any event hindered by the presence of thick bushes and private residences bounding the HCL Quarry property making access to the quarry extremely difficult. HCL therefore submits that for trespassers to gain access to the HCL Quarry premises, they would not only have to trespass onto neighboring properties, but, they would then have to trek through a substantial amount of tall thick elephant grass and this deterrence was as good as if a fence had in fact been erected around the HCL Quarry premises.

HCL further argues that there was adequate patrol of the pond area. Evidence emerged during this inquest of the fact that at the material time, there was a loader who lived on the HCL Quarry premises and he would often chase trespassers from the property once he saw them. His testimony was to the effect that he would use dogs which he kept on the premises to achieve this end. Also submitted for consideration was the fact that at the material time, HCL had in their employ, two security guards who were stationed at the security booth to the entrance of the quarry. They testified that at any time there would always be two security officers on duty on those premises. Additionally, when the quarry operations ceased for the day, the security officers managed to patrol the pond area about 2-3 times per day. They further stated that if during their patrol of the grounds they came across trespassers swimming in the pond, they would chase them away.

It is against this background that HCL contends that they took all the steps within reasonable practicable limits to exclude trespassers from their property so as to reduce or avert the danger of drowning in the HCL Quarry pond.

(ii) Steps taken to warn

I now turn to the steps which were taken by HCL to warn trespassers of the dangers associated with coming onto the HCL Quarry premises and engaging in an unlawful user of the pond.

Evidence has emerged at the inquest that at the material time, HCL had three warning signs posted about their property. The specifics of these signs were alluded to previously.

C. <u>The court's view of steps taken to exclude or warn</u>

(i) Fencing

Regarding the fencing of the pond itself, this court concludes that HCL must be taken to be aware of the possibility of drowning in this case. The evidence of the efforts made by the security guards employed at the HCL Quarry to chase trespassers from the pond whenever they were spotted makes this knowledge of danger beyond question. This is all the more reason why proper fencing should have been installed on the property and at the very least, certainly in the vicinity of the pond area.

The importance of adequate fencing is something made apparent in the case of **<u>Jones</u> v. <u>Mobil Oil Canada Ltd.</u> [2000] 1WWR 479.** The plaintiff rancher raised cattle herd on land where oil and gas operations were conducted by the defendant company. Some cattle died, became ill or failed to breed. The plaintiff brought an action for damages against the defendant for negligence causing injury to the cattle herd. The action was allowed. It court felt that the defendant's knowledge of the harmful effects of the oil and gas contaminants on livestock raised the standard of care owed to the plaintiff to effectively prevent access by cattle to the contaminants. It was held that the defendant was in breach of the duty of care by failing to erect adequate fencing.

The same point was made in the case of **<u>Vogel</u> v. <u>Canadian Roxy Petroleum Ltd</u> [1995] 3 WWR 49.** In this case the plaintiff held a grazing lease which required that he fence the leased lands prior to livestock entry. The lease was also subject to a mineral surface lease granted to the defendant. Under the lease the defendant was obliged to comply with the Mineral Surface Lease Regulations. Those regulations did not require well sites to be fenced but they did provide that a lessee would be liable for all damage caused to persons or stock. A calf belonging to the plaintiff was killed after becoming caught in the pump jack on the defendant's well site. The well site was fenced in a rudimentary fashion which did not enclose the entire base of the pump jack. The plaintiff successfully sued the defendant for damages in negligence, the trial judge finding that the defendant had breached the common law duty of care owed by an occupier in failing to properly fence the area. The defendant appealed and the appeal was dismissed. It was the view of the court that there was ample evidence to support the trial judge's findings of a duty, breach and damage.

(ii) Signs

With respect to the existing signs, it is the view of this court that the duty to take care can not be discharged by the mere display of warning notices. It must be placed where it can be perceived as being likely to have the required effect. This court is of the opinion that the warning signs in this case could not have had any effect because of their locations and positioning away from the pond area itself. Both factors combined to ensure that none of these signs would have been seen or read by trespassers making an unlawful user of the pond located on those premises if they had used the route taken by Ojo Moyo Oliver and his friends that fateful day. Furthermore, they would not have even seen any of the warning signs from the pond area itself either.

In these circumstances there is an obvious need to resort to alternative preventative measures. The duty to take care remains one to do that which is practicable in the circumstances to prevent the occurrence of accidents and the signs located where and how they are, do nothing more than merely warn people -who come in the vicinity of the guard booth, that accidents might occur. Since the trespasser must be presumed by definition to be unpredictable in that "he may walk, break, creep or climb into the premises at any place and go by any route to any part of the premises"[12], this court is of the view that warning signs ought to be posted at the site of the danger itself.

In this regard the case of **Roles v. Nathan, Roles v. Corney [1963] 2 All ER 908** is useful. It applies the principle that so long as warnings are enough to enable one to be reasonably safe the duty of care will be discharged. The facts of this case are that a building was centrally-heated by a boiler in which coke was used as a fuel, there being an old system to carry away the smoke and fumes, which included a horizontal flue running from the boiler under the floor to a vertical flue which went up a chimney. The smoke and fumes had to descend about two feet four inches into the horizontal flue and then pass along it for 70 feet. In the vertical flue there was a sweep-hole, about twelve inches in diameter and nine feet above the ground. It was sometimes difficult to get the bolier lighted up, the difficulty being to get a draught going along the flues. In December 1958, a fire was lit and there was a lot of smoke. A boiler engineer was consulted, who said that the flues needed cleaning. Two chimney sweeps were called in, and ignoring the engineer's warning of the danger from fumes, one of them crawled into the horizontal flue. The fire was let out and the chimney sweeps cleaned out the flues, but when the fire was relit there was further trouble with the fumes and smoke. Another expert was called in who advised that the fire should be withdrawn and told everyone present to get out into the fresh air. The chimney sweeps said that they did not need any advice, but eventually were more or less dragged out by the expert. Later the expert made his inspection and

[12] Videan v. British Transport Commission [1963] 2 Q.B. 650 at 679, *per* Pearson L.J.

gave his advice, and, in the presence of the chimney sweeps, advised that the sweep-hole was to be sealed up before the boiler was lit again, and that the chimney sweeps, while doing the sealing, ought not to stay too long in the alcove. The following day, the fire was re-lit by the caretaker. By the evening, the chimney sweeps had not finished sealing up the sweep-hole, and it was arranged that they would finish the work the next morning. The next morning, both the chimney sweeps were found dead by the sweep-hole. Apparently they had retuned the previous night to complete their work and had been overcome by the carbon monoxide fumes.

It was held on appeal that the warnings given to the chimney sweeps by the expert on behalf of the occupier of the danger which in fact killed them were enough to enable them to be reasonably safe, and therefore the occupier was discharged from his common law duty of care he owed to the chimney sweeps.

In the matter at hand, this court is of the view that HCL did not do enough to enable would be trespassers to be reasonably safe. This conclusion is borne out by the poor location of the warning signs as well as the poor positioning of those very signs.

Compounding this is the fact that HCL never had at any material time any sign warning would be trespassers of the extraordinary dept of the pond. Since the pond is murky, one cannot fully appreciate the true dept of this pond. This serves to make this pond a concealed danger which highlights the need for not only effectively located and properly positioned signs but informative ones as well. In this regard the case of **Breslin and**

<u>Breslin</u> v. <u>Droscoll</u> [1956] SCR 64 is instructive. In this case, the respondent with another truck driver was instructed by a fuel company to deliver two truck loads of coal to the appellants' premises. On arrival they were told by one of the appellants' employees to put the coal through a window in the east wall of the appellants' building. The east wall was separated from the street curb by a 16-foot concrete strip and a station wagon was parked near the window. After it was moved by the appellants' employees, the respondent's companion moved his truck close to the window. The appellants knew, but the respondent did not, that the truck was then over a part of the cellar which extended under the strip and that the latter formed part of the city sidewalk. The respondent was between the truck and the wall when the concrete collapsed causing the loaded truck to tilt and pin him against the wall. In an action in damages for injuries sustained the appellants were liable for failing in their duty to give notice of this concealed danger.

This court accordingly finds that the steps taken by HCL to exclude or warn trespassers, within reasonable practicable limits, so as to reduce or avert the danger of drowning, were inadequate. And in all of these circumstances, the inescapable conclusion must be that HCL failed to ensure that would be trespassers would be reasonably safe on its property.

I have had regard to the dicta of Asquith L.J. in **<u>Daborn</u> v. <u>Bath Tramways Ltd.</u> [1946] 2 All E.R. 333** where he states that "In determining whether a party is negligent, the standard of reasonable care is that which is reasonably to be demanded in the circumstances. A relevant circumstance to take into account may be the importance of the end to be served by behaving in this way or in that. As has often been pointed out, if all the trains in this country were restricted to a speed of five miles an hour, there would be fewer accidents, but our national life would be intolerably slowed down. The purpose to be served, if sufficiently important, justifies the assumption of abnormal risk". This court is of the view that the end to be served is the saving of a life and this justifies the taking of abnormal measures and at the very least, measures which would have passed the common humanity test.

In this light it is felt that the following steps could have been adopted by HCL to exclude or warn or otherwise within reasonable practicable limits reduce or avert the danger of drowning from an unlawful user of the pond:

1. At least one sign located at the pond area itself, warning trespassers that swimming in the pond is prohibited;
2. At least one sign located at the pond area itself warning trespassers of the dept of the pond; and
3. A fence around the entire pond.

This it is felt, would have sufficed as what was humane or decent in the circumstances (per Lord Reid) or, put another way, if these steps were taken by HCL, then it could have been said that Ojo Moyo Oliver was treated with ordinary humanity (per Lord Pearson) or, then it could have been said that HCL had taken such steps as ordinary thought and intelligence, exercising common sense would have dictated in the circumstances (per Lord Morris of Borth-y-Gest).

D. <u>Was what was done by HCL within reasonable practicable limits?</u>

The third matter which arises for consideration in determining whether HCL breached its duty of care to Ojo Moyo Oliver is whether the steps taken by HCL could be considered to be all that could have been done within reasonable practicable limits.

In the view of this court the poor placement of warning signs, the sporadic patrols made by HCL's compound security guards and its resident laborer and the lack of adequate fencing are wholly unsatisfactory measures to adopt in the circumstances. This is compounded by the fact that the recommended steps would not have imposed an unduly harsh financial burden on HCL were they to implement same. Indeed the correlation between risk and the financial burden of remedying it is often illustrated by reference to the dicta of Lord Reid in **<u>Overseas Tankship (UK) Ltd.</u> v. <u>The Miller Steamship Co. Pty.</u> [1967] 1 A.C. 617** where he said at 642 that: "… it does not follow that, no matter what the circumstances may be, it is justifiable to neglect a risk of such a small magnitude. A reasonable man would only neglect such a risk if he had some valid reason for doing so, e.g. that it would involve considerable expense to eliminate the risk. He would weigh the risk against the difficulty of eliminating it".

If one balances the risks involved in this case against the steps which could have been taken to prevent it from occurring, it is clear that no realistic financial burden would have been imposed on HCL to adopt same. This point is reinforced by the fact that at the material time, HCL was a company with resources. Indeed the evidence which has emerged at this inquest is that for all intents and purposes, HCL is still a viable company.

This brings up an interesting question as to the extent to which in other cases limited resources should be taken into account. In *British Railways Board v. Herrington (supra)* the court was considering the standard of care to be required of an occupier with considerable financial resources, who, it was suggested, by relatively small expense, could have reduced or prevented the possibility of a child trespasser coming into contact with a potentially lethal electrical installation. The House of Lords agreed that it was carelessness on the part of the defendants not to take the steps suggested: Lord Reid opined that "… an impecunious occupier with little assistance at hand would often be excused from doing something which a large organization with ample staff would be expected to do".

The test in *British Railways Board v. Herrington (supra)* is a subjective test. Accordingly matters such as an occupier's wealth, "ability and resources" are relevant in determining liability (at pg. 899). With this in mind the inescapable conclusion must be that the erection of well placed and more informative signs as well as a fence enclosing the entire pond, would have been within reasonable and practicable limits in the circumstances.

So taking all these matters into account, I find that there are sufficient grounds for concluding that HCL breached its duty of care towards Ojo Moyo Oliver.

3. ***Has Ojo Moyo Oliver's death resulted from this breach?***

The third matter which arises for determination as per the guidelines in *Archbold 2008 at para. 19-110* is whether HCL's breach of its duty of care caused Ojo Moyo Oliver's death.

Before a court can assign responsibility to an individual for another's harm, it demands that that some cause and effect relationship between the breach and the harm be established. Causation thus provides the central negligence element that links one party's wrong to another's harm. Thousands of people everyday are injured or killed in car collisions, slip and fall accidents and myriad other kinds of accidents. While many such incidents are attributable to the negligence of one or more persons, many others result from simple bad luck or the careless behavior of the victims themselves. Negligence law will hold individuals responsible for breaches if it can be shown that such an individual was at least partially responsible for the incident. In other words there must be some connection between the negligence and the harm.

A. <u>The "but for" test</u>

One mechanism which is used by the courts in this regard is the "but for" test, which requires that a defendant's negligence be a sine qua non of the plaintiff's harm, a necessary antecedent without which the harm would not have occurred. Put otherwise, the defendant's negligence is a cause of the plaintiff's harm if the harm would not have occurred but for the defendant's negligence. In other words, reference is made to a fact but for which the accident would not have occurred; or to facts which caused the accident as opposed to merely set the scene. Lord Hoffmann in **South Australia Asset Management Corp.** **v.** **York Montague Ltd (SAAMCO)** **(1997) A.C. 191 at p. 214** gave a classic example: "A mountaineer about to undertake a difficult climb is concerned about the fitness of his knee. He goes to a doctor who negligently makes a superficial examination and pronounces the knee fit. The climber goes on the expedition, which he would not have undertaken if the doctor had told him the true state of his knee. He suffers an injury which is an entirely foreseeable consequence of mountaineering but has nothing to do with his knee". The doctor's negligence does result in the mountaineer running a risk which he otherwise would not have done, but this is insufficient to incur liability. The purpose of the doctor's duty to take care is to protect the mountaineer against injuries caused by the failure of the knee, not rock falls. Even though the injury might be reasonably foreseeable, the doctor is not liable.

Similarly, in **The Empire Jamaica** (1955) 1 All E.R. 452, the owners sent their ship to sea without properly licensed officers. The pilot fell asleep, and a collision occurred. Though the pilot was negligent at the time, he was generally competent. Thus the question for the courts was: were the owners liable for the collision because they sent their ship to sea without properly licensed officers, or, was the factual precondition superseded by the question as to the competence of the pilot? There was no question that sending the ship to sea was "a cause" of the collision. The legal question was whether it is "the cause". This is a question that the courts treat as objective, addressed by evidence and argument. Hart and Honore (1985)[13] describe the process for establishing legal

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[13] Hart, H. L. A. & Honore, A. M. (1985). "Causation in the Law". Oxford: Clarendon Press.

causation as constructing a parallel series of events (counterfactual situation), and comment: "the parallel series is constructed by asking what the course of events would have been had the defendant acted lawfully". Thus, the owners were not liable. Although they sent the ship to sea without licensed officers (what actually transpired) rather than with licensed officers (the lawful course), the cause of collision was failing to navigate a safe passage. As to the pilot, his lack of licence did not bear on his general competence. The significant factor was the pilot's negligence at the time, and the pilot's lack of license made no difference there. Had the pilot been licensed, he would have been no less likely to sleep. The license would not have awoken him. The owners were, therefore, exonerated on grounds that whether or not the pilot held a license made no difference to the real cause, which was not the pilot's general level of competence, but rather his negligence at the time.

B. <u>The "substantive cause" test</u>

In cases where there are a number of actual or potential causes operating either consecutively or concurrently, the substantive cause test will have to be adopted. In **<u>Robinson</u> v. <u>Post Office</u> (1974) 1 W.L.R. 1176** following an accident at work, the claimant had an anti-tetanus injection. Nine days later, there was an adverse reaction to the serum and brain damage resulted. No matter what tests the doctor might have performed, there would have been no sign of an adverse reaction within a reasonable time. The doctor's reasonable decision to provide the standard treatment was therefore not the relevant cause of the brain damage because the claimant would not have been injected "but for" the defendant's negligence. Thus, in deciding between sequential contributions to the final result, the court had to decide which the more substantial cause of harm was.

Similarly in **Bonnington castings Ltd v. Wardlaw [1956] A.C. 613** it has been held sufficient that the claimant prove that the defendant's breach of duty was a material, rather than exclusive, cause of any injury sustained. The facts were that a pursuer complained that, in the course of his work over many years, he had inhaled minute particles of silica, which accumulated in his lungs and caused pneumoconiosis. It was found that he had been exposed to two different sources of dust, against one of which no complaint could be made, and one arising from a breach of statutory duty. Such circumstances were sufficient to establish liability. Liability would be established if the breach materially contributed to the damage. Lord Reid said at p. 621 that "the disease is caused by the whole of the noxious material inhaled and, if that material comes from two sources, it cannot be wholly attributed to material from one source or the other… and the real question is whether the dust from the swing grinders materially contributed to the disease…A contribution which comes within the exception de minimis non curat lex is not material, but I think that any contribution which does not fall within that exception must be material".

HCL has put forward two contentions which they say go towards breaking the chain of causation in this case.

C. The acts of the deceased and causation

The first point they make is that Ojo Moyo Oliver caused his own death. He knew he was trespassing and was prohibiting from going into the pond so, it is his own negligence which has caused his death.

The law on this is clear. It is no defence, where the death of the deceased is shown to have been caused in part by the negligence of the defendant, that the deceased was also guilty of negligence and so contributed to his own death:

R v. Swindall and Osbourne (1846) 2 C. & K. 230; 1 Russ. Cr., 12th ed., 418

R v. Dant (1865) L. & C. 567

R v. Hutchinson (1864) 9 Cox 555

R v. Jones (1870) 11 Cox 544

R v. Kew and Jackson (1872) 12 Cox 355

So, without deciding whether the actions of the deceased were negligent actions, I am guided by the aforementioned principle of law and I accordingly find that there is no merit in this point.

D. The acts of the deceased man's friends and causation

The second submission advanced by HCL is that the delay in Ojo Moyo Oliver's friends acting to save him, operated as a *novus actus interveniens.* The law on this point is also clear.

The law is that where, after the defendant has been negligent and created a foreseeable and unreasonable risk of harm to another and a third person has the opportunity to avert the threatened harm by taking positive action and, had such action been taken, it would have prevented the defendant's negligence from causing the harm which has in fact occurred, it will not be a superseding cause of that harm.

I start with a consideration of the case of **<u>Knightley</u> v. <u>Johns</u> [1982] 1 All E.R. 851 (C.A.)** where Stephenson L.J. ventured the view that "negligent conduct is more likely to break the chain of causation than conduct which is not; positive acts will more easily constitute new causes than inaction"[14]

I also consider the fact that if I proceed on the basis that the conduct of Ojo Moyo Oliver's friends in hesitating before they sought assistance, amounts to negligence, it cannot be said that such a negligent omission by a third party will break any chain of causation. The general rule is that the original defendant will be held responsible for harm caused by a third party as a direct result of his or her negligence, provided it was a highly likely consequence. So, where the third party is faced with a dilemma created by the defendant, the chain of causation is unlikely to be broken and the defendant will normally be liable to the claimant for the damage caused: **<u>Home Office</u> v. <u>Dorset Yacht Co Ltd</u>. [1970] A.C. 1004.**

Support for this proposition can also be gathered from the dicta of L.J. Goff in **<u>Muirhead</u> v. <u>Industrial Tank Specialities Ltd</u>. [1986] Q.B 507 (C.A.) at p. 533** where he opines that if the intervening conduct consists of a negligent failure to prevent damage caused by

[14] Ibid at p.865.

the defendant's negligence, it may not constitute a *novus actus interveniens*[15]. This may be due to the fact acknowledged by the Privy Council in **Attorney General v. Hartwell (British Virgin Islands) [2004] UKPC 12 para 25 (23 February 2004)** that liability for omissions is less extensive than for positive negligent acts.

At any rate the law is that there is no general duty to render aid to someone who is in trouble. Thus in **Haynes v. Harwood [1935] 1 KB 146** a plaintiff police constable sued for negligence after he was injured while attempting to stop the defendant's runaway horses on a street on which a large number of people, including children, were present. In that case it was held that the defendant's negligence was the cause of the accident because: "If what is relied upon as novus actus interveniens is the very kind of thing which is likely to happen if the want of care which is alleged takes place, the principle embodied in the maxim is no defence"[16].

What then is the result when these principles are applied to the question of whether the death of the deceased was a consequence of his own negligence? The evidence at the inquest clearly shows that the requirements of the first principle were satisfied in that it can be said that but for HCL's breach of its duty of care towards Ojo Moyo Oliver, he would not have died by drowning. Furthermore, there is no real question of the access to the pond being the substantial cause of death. Additionally the acts of the deceased man himself and that of his friends do not serve to break this chain of causation.

[15] His Lordship did qualify this, however, by adding that a negligent omission has no causative effect unless it is "a wholly independent cause of the damage, i.e. a novus actus interveniens.
[16] Per Greer L.J. at 156.

Accordingly I find that there are sufficient grounds for concluding that HCL's breach of its duty of care towards Ojo Moyo Oliver caused his death.

4. WAS THE BREACH GROSS NEGLIGENCE AND THEREFORE A CRIMINAL OMISSION?

I turn now to the final matter which arises for consideration as per the guidelines in *Archbold 2008 at para. 19-110.* This relates to whether the breach should be characterized as gross negligence and therefore a crime. This is eminently a jury question to decide whether, having regard to the risk of death involved, HCL's conduct was so bad in all the circumstances as to amount to a criminal omission: **R v. Adomako [1995] 1 A.C. 171** following **R v. Bateman 19 Cr. App. R. 8** and **Andrews v. DPP [1937] A.C. 576.**

On the evidence before this court I find that there are sufficient grounds for concluding that HCL's omissions were grossly negligent and consequentially criminal.

Before moving off the issue of the law in this inquest, I must say that I have analyzed the facts of this matter bearing in mind the words of Lord Steyn in **Jolley v. Sutton London Borough Council [2000] 1 WLR 1082 at 1089.** It is to the effect that "...in this corner of the law the results of decided cases are inevitably very fact sensitive. Both counsel nevertheless at times (invite comparison of) the facts of the present case with the facts of other decided cases. That is a sterile exercise. Precedent is a valuable stabilizing influence in our legal system. But comparing the facts of and outcomes of cases in this branch of the law is a misuse of the only proper use of precedent, viz, to identify the relevant rule to apply to the facts as found". As much as possible, principles enunciated in precedents were applied but in the final analysis it was found that the facts of this case lent itself to the application of no one decided case.

I move now to my findings of fact in this matter.

PART 3

FINDINGS

Findings pursuant to the Coroners Act Chap. 6:04

Section 10(1)

I am required to find, so far as has been proved, the cause and circumstances of the death of Ojo Moyo Oliver. As stated previously I understand this to encompass who the deceased person was and when, where and how he came by his death.

As a result of considering all of the evidence which came out during the course of this inquest, I am able to make the following findings:

IDENTITY OF THE DECEASED

The deceased person was Ojo Moyo Oliver

PLACE OF DEATH

He died in a pond at the HCL Quarry site, Morne Coco Road, Petit Valley in the county of St. George West

DATE OF DEATH

He died on 15th April 2007

CAUSE OF DEATH

The cause of death was asphyxia associated with drowning.

Section 28

In so far as it is relevant to this inquest, the Act provides in section 28 that "if during the course or at the close of any inquest the Coroner is of the opinion that sufficient grounds are disclosed for making a charge on indictment against any person, he may issue his warrant for the apprehension of the person…".

It is not my role as coroner to decide whether any person is guilty of an offence in connection with the death or indeed, even whether the prosecutorial discretion should be exercised in favor of presenting an indictment and bringing the matter before a jury. Rather, I only have the jurisdiction to determine whether there are sufficient grounds disclosed for making a charge on indictment against any person.

I understand this to require me to consider whether a properly instructed jury could, on all of the material I have considered reasonably convict any person of a charge on indictment.

Section 6 of the Offences Against the Persons Act Chap. 11:08 provides that any person who is convicted of manslaughter is liable to imprisonment for life or for any term of years, or to pay such fine as the Court shall award.

On the evidence as it unfolded in this inquest, it is evident that

- HCL has a duty of care towards persons trespassing onto their HCL Quarry property.
- Ojo Moyo Oliver was a trespasser on that property at the material time.
- There are sufficient grounds for concluding that HCL breached that duty of care.
- The result was that Ojo Moyo Oliver died by drowning in an unsecured pond situated on the HCL Quarry site.
- There are sufficient grounds for concluding that the gross negligence in this case amounts to a criminal omission on the part of HCL.

This brings me to a consideration of whether HCL as a corporation could be charged for the offence of manslaughter.

I find authority for the point that a corporation may be convicted of manslaughter in a number of cases. They include cases such as **R v. P&O European Ferries (Dover) Ltd. 93 Cr. App. R. 72, R v. H.M. Coroner for East Kent, ex p. Spooner 88 Cr. App. R. 10** and **Att.-Gen.'s Reference (No. 2 of 1999) [2000] a Cr. App. R. 207.** The important caveat running through these cases is that a corporation can indeed be convicted of manslaughter –but only if the acts or omissions relied upon are those of someone who can be said to embody the company in that his mind and will can be said to be the mind and will of the company. This principle is referred to as the identification theory.

The identification theory, attributing to a company the mind and will of senior directors and managers, was developed in order to avoid injustice: it would bring the law into disrepute if every act and state of mind of every individual employee was attributed to a company which was entirely blameless:

Tesco Supermarkets Ltd. v. Nattrass [1972] A.C. 153, 169, per Lord Reid, Canadian Dredge & Dock Co. Ltd. v. The Queen (1985) 19 D.L.R. (4th) 314, 342 per Estey J. of the Supreme Court of Canada.

Its origins lay in the speech of Viscount Haldane L.C. in **Lennard's Carrying Co. Ltd. v. Asiatic Petroleum Co. Ltd. [1915] A.C. 705, 713**; and it was developed by the judgment of Denning L.J. in **H. L. Bolton (Engineering) Co. Ltd. v. T. J. Graham & Sons Ltd. [1957] 1 Q.B. 159, 172** and **Tesco Supermarkets Ltd. v. Nattrass [1972] A.C. 153, 170** in which Lord Reid said: "A living person has a mind which can have knowledge or intention or be negligent and he has hands to carry out his intentions. A corporation has none of these: it must act through living persons, though not always one or the same person. Then the person who acts is not speaking or acting for the company. He is acting as the company and his mind which directs his acts is the mind of the company. There is no question of the company being vicariously liable. He is not acting as a servant, representative, agent or delegate. He is an embodiment of the company or, one could say, he hears and speaks through the persona of the company, within his appropriate sphere, and his mind is the mind of the company. If it is a guilty mind then that guilt is the guilt of the company".

The speech of Lord Hoffmann in **Meridian Global Funds Management Asia Ltd. v. Securities Commission [1995] 2 A.C. 500** is also informative on this point. It was a case in which the chief investment officer and senior portfolio manager of an investment management company, with the company's authority but unknown to the board of directors and managing director, used funds managed by the company to acquire shares, but failed to comply with a statutory obligation to give notice of the acquisition to the Securities Commission. The trial judge held that the knowledge of the officer and manager should be attributed to the company, and the Court of Appeal of New Zealand upheld the decision on the basis that the officer was the directing mind and will of the company. The Privy Council dismissed an appeal. Lord Hoffmann, giving the judgment of the Privy Council, said, at p. 506, that the company's primary rules of attribution were generally found in its constitution or implied by company law. But, in an exceptional case, where the application of those principles would defeat the intended application of a particular provision to companies, it was necessary to devise a special rule of attribution. Lord Hoffmann said, at p. 507: "For example, a rule may be stated in language primarily applicable to a natural person and require some act or state of mind on the part of that person "himself," as opposed to his servants or agents. This is generally true of the rules of the criminal law, which ordinarily impose liability only for the actus reus and mens rea of the defendant himself. How is such a rule to be applied to a company? One possibility is that the court may come to the conclusion that the rule was not intended to apply to companies at all; for example, a law which created an offence for which the only penalty was community service. Another possibility is that the court might interpret the law as meaning that it could apply to a company only on the basis of its primary rules of attribution, i.e. if the act giving rise to liability was specifically authorised by a resolution of the board or a unanimous agreement of the shareholders. But there will be many cases in which neither of these solutions is satisfactory; in which the court considers that the law was intended to apply to companies and that, although it excludes ordinary vicarious liability, insistence on the primary rules of attribution would in practice defeat that intention. In such a case, the court must fashion a special rule of attribution for the particular substantive rule. This is always a matter of interpretation: given that it was intended to apply to a company, how was it intended to apply? Whose act (or knowledge, or state of mind) was for this purpose intended to count as the act etc. of the company? One finds the answer to this question by applying the usual canons of interpretation, taking into account the language of the rule (if it is a statute) and its content and policy". Lord Hoffmann then referred to **Tesco Supermarkets Ltd. v. Nattrass [1972] A.C. 153** and in **re Supply of Ready Mixed Concrete (No. 2) [1995] 1 A.C. 456,** Viscount Haldane's speech in **Lennard's Carrying Co. Ltd. v. Asiatic Petroleum Co. Ltd. [1915] A.C. 705** and Denning L.J.'s judgment in **H. L. Bolton (Engineering) Co. Ltd. v. T. J. Graham & Sons Ltd. [1957] 1 Q.B. 159.** Having referred to the concept of directing mind and will, he went on to say [1995] 2 A.C. 500, 511: "It will often be the most appropriate description of the person designated by the relevant attribution rule, but it might be better to acknowledge that not every such rule has to be forced into the same formula. Once it is appreciated that the question is one of construction rather than metaphysics, the answer in this case seems to their Lordships to be as straightforward as it did to Heron J. The policy of section 20 of the Securities Amendment Act 1988 is to compel, in fast-moving markets, the immediate disclosure of the identity of persons who become substantial security holders in public issuers . . . what rule should be implied as to the person whose knowledge for this purpose is to count as the knowledge of the company? Surely the person who, with the authority of the company, acquired the relevant interest. Otherwise the policy of the Act would be defeated . . . the company knows that it has become a substantial security holder when that is known to the person who had authority to do the deal. It is then obliged to give notice". Lord Hoffmann went on to comment that it was not necessary in that case to inquire whether the chief investment officer could be described as the "directing mind and will" of the company. He said, at p. 511: "It is a question of construction in each case as to whether the particular rule requires that the knowledge that an act has been done, or the state of mind with which it was done, should be attributed to the company".

In **Tesco Supermarkets Ltd.** **v.** **Nattrass** **[1972] A.C. 153, 173** Lord Reid said: "the judge must direct the jury that if they find certain facts proved then as a matter of law they must find that the criminal act of the officer, servant or agent including his state of mind, intention, knowledge or belief is the act of the company". In **R** **v.** **Coroner for East Kent, Ex parte Spooner, 88 Cr.App.R. 10, 16** Bingham L.J. said: "for a company to be criminally liable for manslaughter . . . it is required that the mens rea and the actus reus of manslaughter should be established . . . against those who were to be identified as the embodiment of the company itself". In **R** **v.** **P. & O. European Ferries (Dover) Ltd. (1990) 93 Cr. App. R. 72, 84** Turner J., in his classic analysis of the relevant principles, said that: "where a corporation, through the controlling mind of one of its agents, does an act which fulfils the prerequisites of the crime of manslaughter, it is properly indictable for the crime of manslaughter".

The issue recently arose as to whether it is still necessary to attribute the offending omission to a high level company employee before a charge of manslaughter by gross negligence can be sustained. The case was the **Attorney-General's Reference (No. 2 of 1999) 2000 3 W.L.R. 196.** The facts of this case are that in September 1997 a high speed train operated by the defendant company collided with a freight train, killing seven passengers and injuring many others. At the outset of the defendant's trial, on an indictment containing seven counts of manslaughter by gross negligence, the judge ruled that it was a condition precedent to a conviction for manslaughter by gross negligence for a guilty mind to be proved and that where a non-human defendant was prosecuted it might only be convicted via the guilty mind of a human being with whom it might be identified. Following that ruling verdicts of not guilty were entered in relation to those seven counts. The defendant subsequently pleaded guilty to count 8 on the indictment, an offence of failing to conduct an undertaking in such a way as to ensure that members of the public were not exposed to risks to their health and safety, contrary to the Health and Safety at Work Act 1974. The Attorney-General referred two questions for the opinion of the court, namely: (1) Can a defendant be properly convicted of manslaughter by gross negligence in the absence of evidence as to that defendant's state of mind? And (2) Can a non-human defendant be convicted of the crime of manslaughter by gross negligence in the absence of evidence establishing the guilt of an identified human individual for the same crime?

On the reference the first question was answered in the affirmative in that evidence of a defendant's state of mind was not a prerequisite to a conviction for manslaughter by gross negligence, although there might be cases where his state of mind was relevant to the jury's assessment of the grossness and criminality of his conduct, so that a defendant who was reckless might well be the more readily found to be grossly negligent to a criminal degree; and that, accordingly, the judge's ruling on the first issue was wrong. Regarding the second question it was held that a corporation's liability for manslaughter was based solely on the principle of identification, which was just as relevant to actus reus as to mens rea so that unless an identified individual's conduct, characterisable as gross criminal negligence, could be attributed to the corporation, the corporation was not in the present state of the common law liable for manslaughter.

From the evidence which emerged at this inquest, it is a fact that the responsibility for the security of the HCL Quarry rested with the quarry manager Mr. Roger Blanch. It is the finding of this court that the omissions of Mr. Roger Blanch can be considered to be the omissions of HCL. It follows that the gross failure in the management of safety on the quarry will result in HCL as a company being liable to prosecution for gross negligence manslaughter.

Before I turn my attention to matters of procedure I will deal with a submission made by HCL concerning the lack of mens rea on the part of HCL as this too could impact on my findings as per section 28 of the Act. It is submitted that HCL lacks mens rea, this is an essential ingredient to sustain a charge of manslaughter and since it is lacking HCL ought not to be charged.

This point was dealt with conclusively in *Attorney-General's Reference (No. 2 of 1999) (supra).* It was submitted in this case that since **R v. Adomako [1995] 1 A.C. 171**, a defendant can be found guilty of gross negligence manslaughter in the absence of evidence as to his state of mind. The dictum of Lord Mackay of Clashfern L.C., at p. 187 was relied upon to support this point: in particular where he said that "the ordinary principles of the law of negligence apply to ascertain whether or not the defendant has been in breach of a duty of care towards the victim who has died. If such breach of duty is established the next question is whether that breach of duty caused the death of the victim. If so, the jury must go on to consider whether that breach of duty should be characterised as gross negligence and therefore as a crime. This will depend on the seriousness of the breach of duty committed by the defendant in all the circumstances in which the defendant was placed when it occurred. The jury will have to consider whether the extent to which the defendant's conduct departed from the proper standard of care incumbent upon him, involving as it must have done a risk of death to the patient, was such that it should be judged criminal". As a result of *R v. Adomako (supra)* it was submitted that gross negligence manslaughter can be proved without the need to enquire into the state of the defendant's mind. Further support for this proposition was found in **Smith & Hogan on Criminal Law, 7th ed. (1992), at pp. 90 and 91**, where the learned author not only dealt with the issue but culminated the discussion by contrasting crimes requiring mens rea with crimes of negligence.

The court in *Attorney-General's Reference (No. 2 of 1999) (supra)* accepted this argument and held that although there may be cases where the defendant's state of mind is relevant to the jury's consideration when assessing the grossness and criminality of his conduct, evidence of his state of mind is not a prerequisite to a conviction for manslaughter by gross negligence.

This court is guided by this finding and in the circumstances I find that there is no merit in HCL's argument to the effect that there must be evidence of mens rea for a charge of gross negligence manslaughter to stand.

Accordingly, I make the finding pursuant to section 28 of the Act that sufficient grounds are disclosed for making a charge on indictment against HCL for the common law offence of manslaughter.

Ordinarily I would now proceed to issue a warrant for the apprehension of individuals against whom I have concluded that sufficient grounds have been disclosed for making a charge on indictment against them but I cannot arrest HCL or any other company.

However, when I have regard to the contents of the coroners warrant, I note that the coroners warrant is directed to the police and it authorizes and in fact requires the police to bring persons (against whom it is concluded that sufficient grounds have been disclosed for making a charge on indictment against them after an inquest) before a magistrate for examination on the charge in question. It follows that as Coroner I do have the power to authorize and require the police to bring HCL before a magistrate for examination on the charge of manslaughter.

Accordingly, I direct the Commissioner of Police to institute proceedings against HCL for the common law offence of manslaughter in light of my findings that sufficient grounds have been disclosed for making a charge on indictment against HCL for the common law offence of manslaughter. I further direct that HCL be brought before a magistrate for examination on this charge by way of a defendant summons which is form 3 issued under section 42 of the third schedule of part II of the Summary Courts Act Chap. 4:20.

I have drafted the defendant summons and an affidavit of service and same are annexed to this ruling for the guidance of the Commissioner of Police.

I have made these findings bearing in mind the fact that it is extremely important that companies and other organisations take safety seriously. Failure to do so can have devastating consequences and this is all the more reason why there must be proper accountability when very serious management failings lead to people being killed. This is not about over-regulation. Businesses should see this decision as a warning from the courts of our country that they must ensure that proper arrangements are put in place for managing safety. Indeed it is crucial for our country that companies are responsible and successful corporate citizens.

In making these findings I am also mindful of the provisions of **section 14** of the **Criminal Procedure (Corporations) Act Chap. 12:03.** It states that "where a corporation is charged with an indictable offence or a summary offence, any summons or other document requiring to be served on the corporation in connection with the proceedings shall be served by leaving it at or sending it by post to the registered office of the corporation, or if there be no such office in Trinidad and Tobago, by leaving it at or sending it by post to the corporation at any place in Trinidad and Tobago at which it trades or conducts its business". This suggests that any defendant summons issued for HCL will have to be served on HCL by posting it to them at their registered address or, by leaving same at their registered address.

What then will be the ramifications of the issuing charges against HCL? For this I turn to the following provisions of the **Criminal Procedure (Corporations) Act Chap. 12:03:**

"**4.** Where a corporation is charged before a Magistrate with an indictable offence, a representative of the corporation may, on behalf of the corporation—

(a) make a statement before the Magistrate in answer to the charge;

5. Where a representative appears before a Magistrate as provided in section 4, any requirement of any law that anything be done in the presence of the accused, or be read or said to the accused, shall be construed as a requirement that that thing be done in the presence of the representative or read or said to the representative.

9. A representative is not, by virtue only of being appointed as such, qualified to act on behalf of the corporation before any Court for any purpose other than those authorized by this Act.

10. For the purposes of this Act a representative need not be appointed under the seal of a corporation, and a statement in writing purporting to be signed by a managing director of the corporation, or by any person (by whatever name called) having, or being one of the persons having, the management of the affairs of the corporation, to the effect that the person named in the statement has been appointed as the representative of the corporation for the purposes of this Act is admissible in evidence as *prima facie* proof that the person has been so appointed.

11. Nothing in this Act renders a representative liable to fine or imprisonment for any offence for which the corporation is convicted.

12. A corporation that is convicted of an offence is liable, in lieu of any imprisonment that is prescribed as punishment for that offence, or where no fine is prescribed—

(a) to be fined in an amount that is in the discretion of the Court, where the offence is an indictable offence; or

13. Where a fine that is imposed under section 12 is not paid forthwith the prosecutor may, by filing the conviction, enter as a judgment the amount of the fine and costs, if any, in the High Court, and that judgment is enforceable against the accused in the same manner as if it were a judgment entered against the accused in the High Court in civil proceedings.

15. (1) Sections 28 to 37 of the Indictable Offences (Preliminary Enquiry) Act do not apply to a corporation.

(2) Subject to this Act, the provisions of any law relating to the inquiry into and trial of indictable offences or to the trial of summary offences apply to a corporation as they apply to any person who is sixteen years of age or over."

A reading of these sections suggests that HCL will in the ordinary scheme of things appoint a representative to attend court. At any rate once charges have been laid, proceedings will commence by way of a preliminary enquiry in very much the same way as one does where the accused is a natural person. If there is a committal and the matter goes to the High Court and HCL is convicted by a jury, HCL will be punished by being mandated to pay a fine and this is enforceable as a civil debt. The representative will not be subject to imprisonment. Finally the issue of bail will not arise as a company as opposed to a natural person is arrested and so I find that the usual provisions relating to the setting of bail on a coroners warrant are inapplicable in the circumstances.

PART 4

RECOMMENDATIONS

It is traditional for Coroners where they deem it appropriate, to add to the findings a "rider" in which recommendations or suggestions are made, and these are directed toward reducing the likelihood that similar circumstances will occur and lead to avoidable deaths. Nyland J. reflected in **Perre v. Chivell [2000] SASC 279 at para 4** that the "coroner's office now is much different to its early form. Today, particularly in Australia, New Zealand and Canada, the overt emphasis of many coroners is upon making recommendations to help prevent injury and death, as well as providing accurate statistical information as to causes of death". As Evans noted in 2004 "If Coroners are to serve a useful purpose in an increasingly complex and tightly regulated society there is a need for probing at depth and the taking of a "wide brush" approach towards the question of how and why a death occurred and how the repetition of such a death in the same or similar circumstances might be prevented"[17].

Historically, coroners have had the right to append to the inquisition "riders" that made recommendations or suggestions of measures which should be taken to reduce the incidence of needless deaths similar to that which was the subject of the inquest.

The power to make a "rider" of censure or blame was formerly abolished in England in 1980. All that now remains is a power under Rule 44 of the Coroners Rules 1984 (UK).

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[17] G Evans, "The Chain of Causation leading to Death, Attribution and Blame and the Coroner's Jurisdiction" (2004) 11 *The New Zealand Coroner (The Newsletter of new Zealand Coroners)* 1.

It states that a coroner who believes that action should be taken to prevent the recurrence of fatalities similar to that in respect of which the inquest is being held may announce at the inquest that he is reporting the matter in writing to the person or authority who may have the power to take such action and he may report the matter accordingly.

No such legislation has been implemented in this jurisdiction and I accordingly make the following recommendations.

Crucial information regarding the need for the securing of settling ponds (i.e. artificial bodies of water on sites such as quarries) has been placed before this court. I am therefore in a position to make some definitive recommendations regarding same.

I make the following recommendations and request that such recommendations be provided to all government departments responsible for quarrying operations and settling pond security in the hope that each and every recommendation will be taken positively and acted upon with a view to preventing any further waste of life and further distress to families and friends. These recommendations are as follows:

1. Different regulations apply to settling ponds depending on whether applications are made for certificates of environmental clearance before 2001 or after 2001. Applications made for certificates of environmental clearance after 2001 are subject to the Environmental Management Authority rules and regulations. These regulations provide that no certificate will be granted

unless measures are put in place for the public safety (as opposed to occupational safety) in relation to settling ponds and it is to be noted that these measures include the installation of proper fencing and the adoption of proper security measures such as the erection of warning signs especially when such sites are in close proximity to communities. Applications made before 2001 were applications for town and country approval simplicter. Such approvals were granted without any requirement for certificates of environmental clearance.

It has also become clear at this inquest that quarries less than 150 acres do not have to comply with the security and fencing measures relating to settling ponds as EMA's authority does not extend to quarries less than 150 acres. This means that HCL which is give or take 90 acres would not have been under EMA's purview because of their size as well as the fact that their application was a pre 2001 one.

I recommend that the Trinidad and Tobago Parliament consider providing a single piece of legislation containing a uniform set of rules and requirements relating to the fencing and security of settling ponds, irrespective of the dates of filing of applications for certificates of environmental clearance/applications for town and county approval, or the acreage of land upon which settling ponds are located.

2. Legislation to require routine compulsory inspection of all properties with settling ponds on them to ensure continued compliance with rules and requirements established under recommendation 1 (above).

3. That legislation clearly set out the right of enforcement officers to enter private property to monitor compliance.

4. That local authorities be conferred with legislative powers to issue on the spot fines in order to create an awareness by property owners of their obligations to comply with settling pond security legislation.

5. Legislation giving local authorities appropriate powers to have serious defects attended to immediately as any legislation allowing time to rectify defects will have the effect of allowing a dangerous situation to remain an unacceptable risk. This is in relation to the powers of inspection suggested in recommendation 2 (above).

6. That the government through WASA, institute a system to identify all properties with settling ponds on them. For example, a highlighted tick box on water rate notices requiring each rate payer to identify whether a settling pond is on that particular property to which the water rate notice relates, which may ensure an accurate or a better database than currently exists.

7. I recommend that the Trinidad and Tobago Law Society review the standard form of contracts for the sale of land with a view to including a mandatory provision that a certificate of environmental clearance be obtained from the EMA before any premises with a settling pond can be conveyed and that such conveyance not be able to be effected until there has been full compliance with this rule.

In this regard, I also recommend that this be reinforced by legislation, requiring the certificate to be produced before a registration of a transfer is perfected.

8. Evidence came out during the course of this inquest that the existing rules and requirements regarding the security and fencing of settling ponds leave it at the land owner's discretion when it comes to deciding on the location and content of warning signs. It is felt that this be updated and upgraded to include precise specifications relating to the locations of warning signs as well as the actual text of those warning signs.

9. An awareness campaign to be undertaken by local authorities to promote awareness by landowners of the liability they could incur for failing to ensure that settling ponds are properly secured.

10. That local authority websites provide information or links to the relevant information relating to settling pond security legislation and requirements.

11. That legislation similar to England's Corporate Manslaughter and Corporate Homicide Act 2007 be enacted in our jurisdiction. Presently corporate liability for manslaughter depends on the identification principle so if an individual can not be said to embody the mind and will of a company then his grossly negligent actions or omissions will go unpunished as a charge against that company will not be sustainable. If legislation similar to that in England is implemented in our jurisdiction it would mean that our courts can look at a wider range of management conduct than at present as the focus will be on responsibility for the working practices of the organization rather than limiting investigations to questions of individual gross negligence by management.

I have approached the making of these recommendations with a view to introducing measures which I believe will assist to minimize the possibility of a re-occurrence of a death such as Ojo Moyo Oliver's. The recommendations are not intended to attribute blame: as that is not the function of the coronial system.

PART 5

CONCLUDING REMARKS

Finally, I would like to express my personal sympathy and condolences, as well as those of the Court to the deceased person's family. This is something which is done by this Court at the conclusion of each and every inquest and preliminary investigation carried out by this Court as constituted.

In this case it would be Ojo Moyo Oliver's mother Ida Oliver, other members of Ojo Moyo Oliver's family as well as his friends, at their sad loss. Mrs. Oliver, I cannot begin to imagine what a painful experience it must have been. I can only thank you for the dignity and courtesy you displayed to this court during the proceedings. I am certain that the pain of loosing Ojo Moyo Oliver will never pass but I hope that the completion of this inquest will, in some manner, allow you some form of closure.

I wish to place on record my thanks to my court staff and Corporal Samuel for their valuable assistance in this inquest. I also take this opportunity to thank all parties and their legal advisors for their contribution to this inquest.

All manner of persons who have had anything to do at this court before the Coroner for this County touching the death of Ojo Moyo Oliver, having discharged your duty may depart hence.

I now declare this inquest closed.

....

Her Worship Ms. Nalini Singh

St. George West County Coroner.

REPUBLIC OF TRINIDAD AND TOBAGO

SUMMONS TO A DEFENDANT UPON COMPLAINT IN THE COURT OF SUMMARY JURISDICTION

IN THE MATTER OF THE SUMMARY COURTS ACT, CHAP. 4:20
(FORM 3, S. 42, THIRD SCHEDULE, PART II)

2009 No. -------------- COUNTY OF ST GEORGE WEST
at **PORT OF SPAIN MAGISTRATES' COURT**

-- **COMPLAINANT**

V.

HOME CONSTRUCTION LIMITED (HCL) **DEFENDANT**

TO HOME CONSTRUCTION LIMITED (HCL)
OF LEVEL FOUR LONG CIRCULAR MALL, ST. JAMES

WHEREAS Complaint has this day been made before me, the undersigned Magistrate/Justice for the said District, for that you on the 16th April 2007 in the island of Trinidad and Tobago, unlawfully killed Ojo Moyo Oliver
CONTRARY TO COMMON LAW.

This is to require you to be and appear at the **Port of Spain Magistrates' Court on ------------------------- the --------------------- of ------------------ 2009 at ------** o'clock a.m. before the Magistrate/Justice of the said Court, to answer the said Complaint and to be further dealt with according to Law.

Dated this ---------------- day of -------------------2009.

--

Magistrate/Justice

AFFIDAVIT OF SERVICE OF SUMMONS

IN THE MATTER OF THE STATUTORY DECLARATIONS ACT, CHAP. 7:04

I, ...

Constable/Transport Officer of ....

Do solemnly and sincerely declare as follows:

That on the .... day of .... 20 .... at ....

.... a.m./p.m., I duly served the Defendant ....

with a summons, of which the within on the reverse side is a true copy, by delivering the summons to the said Defendant/by leaving the summons with

....

state name of person and relationship

....

state address

I make this declaration conscientiously believing the same to be true and according to the Statutory Declarations Act, and I am aware that if there is any statement in this declaration which is false in fact, which I know or believe to be false or do not believe to be true, I am liable to fine and imprisonment.

Signed ....

Declarant

Declared before me this .... day of .... 20 ....

Signed ....

Magistrate/Justice

INSTITUTE OF SURVEYORS OF TRINIDAD AND TOBAGO (ISTT)

Incorporated 1996

Professional Center, 11-13 Fitzblackman Drive, Woodbrook
Port-of-Spain, 170516, Trinidad and Tobago
1 868 468-3356 | info@instituteofsurveyors.com | www.instituteofsurveyors.com

March 9, 2023

STATEMENT ON SURVEYING ASPECTS OF THE PARIA DIVING TRAGEDY OF FEBRUARY 2022

The ISTT is the professional body of surveyors practising in various disciplines including Building Surveyors, Land Surveyors, Quantity Surveyors and Valuation Surveyors.

ISTT discussed amongst its members the evidence presented by Expert Witness, Engineer Zaid Khan in January 2023 at the Commission of Enquiry into the Paria Diving tragedy which occurred on February 25, 2022 when divers perished after being sucked into an underwater pipeline because of a Delta-P Event. Of particular interest to surveyors was the lack of definitive information with respect to the seabed topography on which the horizontal portion of the particular pipeline lay and the methods used to measure the level of fluid in the vertical risers of the pipeline.

Surveyors with experience in the particular environment of the pipeline noted the following –

1. The particular pipeline is part of a network of original pipelines constructed 50-70 years ago. The topography of the seabed was, at best, uncertain given the propensity for soft mud to have accumulated over the decades, from the discharge of Venezuelan rivers into the Gulf of Paria, rendering the pipelines and the seabed of the Gulf of Paria almost opaque to contemporary surveying equipment and measurements.
2. Historical or legacy data, information and knowledge, such as maps of the original pipelines, may have been misplaced or lost over time as the various transitions occurred from predecessor companies to Paria Fuel Trading Limited (PFTL). PFTL has a significant knowledge gap to close.
3. It is difficult to manage and maintain seabed infrastructure without knowing exact locations, depths, sizes, alignments, connections and associated marine hazards. As such the mapping and preparation of an accurate marine cadastre for the Gulf of Paria is strongly recommended to prevent future disasters. The Hydrographic Unit of the Surveys and Mapping Division can assist with basic mapping.
4. The levels of fluid in the vertical (risers) of the particular pipeline should have been measured relative to a common benchmark, given the approximate 400-metre distance between the risers. This would have indicated a better relative difference related to ullage to be achieved.

END

GRETEL E. BAIRD, B.Sc., LL.B.
ATTORNEY-AT-LAW

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26th April 2023

Ms. Sarah Sinanan
Secretary to the Commission
Southern Academy of Performing Arts (SAPA)
Todds Street
San Fernando

Dear Ms. Sinanan

Re: Statement on Surveying Aspects of the Paria Diving Tragedy of February 2022 from Institute of Surveyors of Trinidad and Tobago (ISTT) dated March 9, 2023.
Commission of Enquiry into the Circumstances which led to the tragic incidents which occurred on February 25th 2022 at facilities owned by Paria Fuel Trading Company Limited ("Paria") located at No.36 Sealine Riser on Berth No. 6, Pointe-a-Pierre ("the Commission").

I write in reference to the matter at caption wherein I, along with Messrs. Thane Pierre and Sebastian Peterson, continue to instruct Mr. Jason Mootoo who is led by Mr. Gilbert Peterson S.C.

By correspondence dated 9th March 2023 (disclosed to Paria on 18th April, 2023) the Institute of Surveyors of Trinidad and Tobago ("ISTT") provided its views and/or comments to the Commission in relation to "*the evidence presented by Expert Witness, Engineer Zaid Khan*" at the Commission. The Commission, by email communication of 18th April, 2023, has invited parties interested in commenting on the remarks of ISTT to do so by 26th April, 2023.

Pursuant to the Commission's invitation, Paria contends that the Commission should not admit into evidence the comments and/or views of ISTT contained in its said letter dated 9th March, 2023 by reason of the following facts and matters:

a) ISTT is not a party to the Commission and has not applied for or obtained standing.

b) ISTT's comments are in the nature of expert evidence submitted several months after the evidential hearing phase of the Commission has been closed and well after closing submissions of the parties have already been made.

c) The late delivery of ISTT's expert evidence completely disregards prior directions issued by the Commission for the submission of evidence and/or material in relation to the matters under enquiry.

d) ISTT has not, in any event, applied for or been granted an extension of time to provide expert evidence to the Commission.

e) In any event, an extension of time could not properly be granted to ISTT in relation to the provision of expert evidence given the fact that Mr. Khan's evidence on which it now seeks to opine has been available to the public on the Commission's website since the year 2022. ISTT has provided no reason whatsoever for its inordinate delay in addressing such evidence before April, 2023. Indeed, such delay in clearly inexcusable.

f) The evidential hearings of the Commission are now closed. Accordingly, no opportunity exists for Paria or any other any party to test ISTT's expert evidence by way of cross examination. Allowing ISTT's to provide expert evidence by way of letter would be manifestly unfair and highly prejudicial in those circumstances.

g) Separate and apart from the above, although ISTT's letter attributes the expert views and/or comments contained therein to "*Surveyors with experience*", it has curiously and for reasons best known to it, failed to provide the Commission with the identity of those surveyors or the nature and extent of their experience. The comments are therefore those of nameless and faceless persons with no information as to their credentials. No weight could or should properly be attributed to material of that nature and such material could have no probative value.

h) Further, there is no scientific underpinning (whether by reference to tests, academic articles, empirical data, maps or surveys, etc.) to any of the expert opinions advanced in ISTT's letter. By way of example, item 1 at the third paragraph of the letter refers to the topography of the seabed on which the "*network of original pipelines constructed 50-70 years ago*" lay as being "*at best, uncertain given the propensity for soft mud...*". Nothing is provided to substantiate this expert opinion. Similarly, item 4 at the third paragraph of the letter purports to critique and/or opine upon the method utilised for ascertaining levels of fluid in the vertical risers without any supporting analysis or scientific or other expert literature being referenced.

i) ISTT's letter is also highly speculative in part rendering those parts of no value to the Commission. In this regard, it is to be noted that item 2 at the third paragraph of the letter asserts that "*Historical or legacy data,.....may have been misplaced or lost over time...*". This remark is also reckless in nature given that any person or entity taking a proper interest in the evidential phase of the Enquiry would be aware that Paria voluntarily provided the Commission with a Bathymetric survey dated Nov-Dec 2013 as well as other substantial "*historical or legacy data*" dating back to previous surveys.

In light of the above Paria respectfully submits that ISTT's letter to the Commission dated 9th March 2023 should not be admitted into evidence or relied upon by the Commission and looks forward to the Commission's ruling on this issue in due course.

Yours faithfully

....
GRETEL BAIRD
Attorney-at-Law

From: **Kamini Persaud** <kaminiper8@gmail.com>
Date: Thu, Apr 27, 2023 at 10:32 AM
Subject: Re: 23.03.09 Statement from Institute of Surveyors of Trinidad and Tobago (ISTT)
To: Sarah Sinanan <commissionsecretariat@coe2022.com>

Dear Ms. Sinanan,

We thank you for your email of 18th April, 2023 attaching for our attention the statement by ISTT sent to the Commission.

LMCS Limited during the Commission had indeed raised the issue of the pipeline profile between Berths 5 and 6. The record will show that it was accepted by several of Paria's witnesses that there were no drawings or pipeline profile between Berths 5 and 6 at SL 36. As such LMCS concurs with points 1-3 of the statement. The evidence of Christopher Boodram speaks to the number of "air pockets" on the horizontal section of the pipeline which accounts for its profile being other than "flat" as indicated by Paria and surmised by LMCS.

Point 4 however seems to fall into error and gives an incorrect impression of how "ullage" is measured. Ullage, I am instructed, is taken from the top of the pipeline at mean sea level. Again, the evidence from LMCS was that the ullage was taken at the riser at Berth No. 6.

These are the comments from LMCS Limited on the matter, unless the Honourable Commission requires further input from LMCS.

Thank you.
Kind regards,

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