GOM Diving Safety Work Group

COMMITTEE WORK GROUP

Hyperbaric Evacuation System Planning

21 September 2016

DISCLAIMER

This US GOM DSWG document is not meant to be all-inclusive and not every rule and regulation is contained herein. The US GOM DSWG does not issue policy or create regulations. The

reader should consult additional resources and subject matter experts for more detailed information as required.

The GOM Diving Safety Workgroup is a US GOM focused, non-competitive and non-commercial group of oil and gas operators, transmission companies, commercial diving companies, supporting sub-contractors, organizations and industry stakeholders. The group will provide a unified voice to promote and improve diving safety, through the following:

- Identification and sharing of best practices
- Identify and seek solutions to industry challenges and issues
- Review and comment of existing and proposed standards and guidelines
- Provide input to the regulators and industry associations

Purpose of Committee

Committee Goal:

To provide useful information to Diving Contractors and Oil and Gas Operators in the Gulf of Mexico on the Hyperbaric Evacuation System necessary to promote the survival of the divers in the worst case scenario, a hyperbaric evacuation system launch. The committee will review existing and proposed guidelines and regulations to develop a template that can be referenced for best practices to be considered when planning the use of saturation diving.

This document has been prepared and accepted by the US GOM DSWG as guidance for:

Hyperbaric Evacuation Systems Planning

The document is divided into seven sections:

- **Part 1: Executive Summary**

- **Part 2: Definition**
  - Defines the activity that is being evaluated and provides definitions from regulatory or industry groups that are associated with the activity.

- **Part 3: Regulatory and Industry Gap Analysis**
  - Identifies regulatory and industry association requirements to perform the activity or operation and provides a visual aid to determine the consistencies between these groups as it relates to the activity

- **Part 4: Past Incidents**
  - Identifies past near misses, incidents, and fatalities and provides causal factors and the root cause of the incident in order to provide supporting documentation for the hazard analysis in Part 5.
- **Part 5: Hazard Analysis**
  - Identifies the hazards of the activity or operation, Identifies the risks associated with the hazards, and provides specific mitigation considerations for each hazard to reduce or eliminate risk

- **Part 6: Drills and Preparation**
  - Provides a list of drills, along with referenced documents, that should be performed to prepare the crew members for possible emergency situations

- **Part 7: Appendix**
  - Please do not alter the template in order to maintain the consistency of the documents it relates to other committees, but please add additional documentation, reports, drawings, etc. in this section that may provide more depth or relevant information to the report.

Part 1: Executive Summary of Committee

The purpose of this document is to give guidance in regard to hyperbaric evacuation systems and assist applicable parties in having a viable means of evacuating divers from the primary system to a hyperbaric escape system and to the surface.

The document intends to ensure that each saturation system has a HES and that each systems have:

A SPHL or HRC with capacity for each diver in SAT

A means to launch independent of the ships power

Capability to support the lives of the divers

A means to recover the SPHL/HRC and move it to a safe haven

A facility to decompress the divers in a controlled manner

An emergency plan

A Diving Medical Officer and a means to contact

Planned audits and drills

This document is not intended to take the place of Governmental or Industry, local or international laws, requirements, regulations, standards or best practices. It is intended as a high level educational and assurance document.

Part 2: Definition

The Hyperbaric Evacuation System (HES) is a broad term that includes the equipment identified for evacuation of the divers, the plan for evacuation, and the planned method of transport to a predetermined safe haven. Planned drills and contingency plans are also included, as well as additional components needed, such as the Life Support Package (LSP). How the divers are to be decompressed with the ability to render medical attention must be included in the plan.

Acronyms

ABS	American Bureau of Shipping
ADCI	Association of Diving Contractors International
ALARP	As low as reasonably practical
CFR	Code of Federal Regulations
DDC	Deck decompression chamber
DNV	Det Norske Veritas
DSV	Dive support vessel
EES	Emergency Evacuation System
EPIRB	Emergency position indicating radio beacon
FRC	Fast rescue craft
HAZID	Hazard Identification
HRC	Hyperbaric rescue chamber
HRF	Hyperbaric rescue facility
HRU	Hyperbaric rescue unit
IACS	International Association of Class Societies
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
IOGP	International Association of Oil and Gas Producers
JSEA	Job Safety Environmental Analysis
LSP	Life support package
NOSAC	National Offshore Safety Advisory Committee

OSHA	Occupational Safety and Health Administration
OSV	Offshore supply vessel
PMP	Project Management Plan
PSV	Platform supply vessel
PVHO	Pressure vessel for human occupancy
SDC	Submersible Decompression Chamber
SOLAS	Safety of Life at Sea
SPHL	Self-propelled hyperbaric lifeboat
SWP	Safe Work Plan
TUP	Trunk Under Pressure
USCG	United States Coast Guard
VHF	Very high frequency

Definitions

Hyperbaric Evacuation Plan (HEP)
The comprehensive planning document that describes the methods, the processes and the procedures used to evacuate saturation divers away from a stricken diving system to a safe refuge where decompression can be carried out.

Hyperbaric Evacuation Unit (HEU)
A unit whereby Divers under pressure can be safely evacuated from a ship or floating structure to a place where decompression can be carried out. An IMO term, this can be used to describe a HRC or SPHL. **Note: This will be referred to as a HRU throughout this document, even though the terms HRU and HEU mean the same and are interchangeable (See HRU below)**

Hyperbaric Rescue Chamber (HRC)
The HRC is a towable hyperbaric rescue unit. It is a PVHO that is not housed in a conventional life boat and has no capability to accommodate a support crew. The HRC must have the ability to sustain the maximum capacity of divers for 72 hours.

Hyperbaric Rescue Facility (HRF)
The HRF is a facility, or safe haven, capable of accepting an HRU where the divers can be transferred under pressure to receive medical attention and safely complete decompression.

Hyperbaric Rescue Unit (HRU)
A unit whereby Divers under pressure can be safely evacuated from a ship or floating structure to a place where decompression can be carried out. An IMO term, this can be used to describe a HRC or SPHL.

Life Support Package (LSP)

The LSP is a self-contained package of supplies and equipment kept in a predetermined location dedicated to support the HRU in the event of a hyperbaric evacuation. The LSP must be mobilized quickly to provide the necessary support while the HRU is in transit to the HRF.

Self-Propelled Hyperbaric Lifeboat (SPHL)
The SPHL is a PVHO fitted in a conventional lifeboat hull, making it a hyperbaric rescue unit capable of maneuvering under its own power with the ability to accommodate a support crew. The SPHL must have the ability to sustain the maximum capacity of divers for 72 hours.

Part 3: Regulatory and industry GAP Analysis

The following documents were referenced in development of this Guidance or provide additional information and guidance on HES operations.

- *IMCA D004, IMCA D014, IMCA D024, IMCA D052, IMCA D053*
- *ADCI – Consensus Standard current edition*
- *IOGP Report No. 411, IOGP Report No.478*
- *IMO Resolution A.692(17)*
- *USCG 46 CFR, Subchapter V, Part 197, Subpart B*

Item	Description of Item	ADCI	IMCA	IMO	IOGP	USCG	Comments
1	Allows HRU to be either HRC or SPHL	Yes	Yes	Yes	No	N/A	IOGP Report 478 refers only to SPHL
2	Allows diving bell to be HRU	No	No	Yes	No	N/A	IMO includes method of evacuation as a transfer of the diving bell from one facility to another
3	HRU documented deployment drills required	Yes	Yes	No	Yes	N/A	IOGP report 478 requires deployment every 6 months. ADCI and IMCA require annually. IMO does not specify.
4	HES and HRU required to be under Class	No	No	No	Yes	N/A	IOGP report 411 requires HES be under class and free of all outstanding notations.

5	Annual audit of the HES required	No	Yes	No	Yes	N/A	ADCI requires one time Saturation Diving Inspection and Checklist Protocol audit. IMCA requires D 024 audit to be completed annually. IOGP requires IMCA D 024 audit annually under IMCA guidelines. IMO states initial inspection with survey to be completed every two years.

Item	Description of Item	ADCI	IMCA	IMO	IOGP	USCG	Comments
6	Specifies required oxygen for specific metabolic oxygen consumption rate	Yes	No	No	No	N/A	ADCI states requirement of .017cfm/0.48 liters per minute per occupant for 72 hours. IMCA and IOGP reference sufficient metabolic consumption rate for 72 hours which is to be specified by the diving contractor.
7	Location and Tracking Devices Required on all HRU's	Yes	Yes	No	Yes	N/A	ADCI requires distress beacon locating device. IMCA requires EPIRB or similar. IMO references the need for acoustic transponder for HRU designed to be placed on the sea bed. IOGP references the need for Critical System Monitoring and Tracking (CSMT) with detailed list in 7.4 of OGP Report 478.
8	Specifies additional locating devices required for HRU with surface crew	No	Yes	No	Yes	N/A	IMCA references VHF radio and GPS receiver or similar when HRU has a surface crew. IOGP references SPHL with surface crew only.
9	Record and transmit all internal data of deployed HRU	No	No	No	Yes	N/A	IOGP has a requirement that all data is transmitted and accessible during the time HRU is in the water through the CSMT. This includes two way satellite voice communication and medical data that must be transmitted in real time to remote physician.
10	Scrubbing capabilities for other gases (CO, Ammonia, etc.)	No	Yes	No	No	N/A	IMCA provides guidance on how to scrub Carbon Monoxide, Ammonia, and other possible organic compounds

11	Identified areas where an HES should not be used	No	No	Yes	No	N/A	IMO states that an HES should not be located in zone 0, an area in which an explosive gas atmosphere or a flammable gas with a flashpoint below 60°C is present continuously or is present for long periods, or zone 1, an area in which an explosive gas atmosphere or a flammable gas with a flashpoint below 60°C is likely to occur in normal operation.
Item	**Description of Item**	**ADCI**	**IMCA**	**IMO**	**IOGP**	**USCG**	**Comments**
12	Specifies total elapsed time from when evacuation instructions are given to HRU launch	No	Yes	No	Yes	N/A	IMCA and IOGP states it should not exceed 15 minutes
13	Specifies total elapsed time from when HRU is launched to when it must be 100 meters from evacuated site	No	Yes	No	Yes	N/A	IMCA and IOGP states it should not exceed 30 minutes
14	Specifies time limit when LSP must be available at HRU	Yes	No	No	Yes	N/A	ADCI states a maximum of 24 hours, IOGP states 12 hours.
15	Specifies time limit when divers must be transferred to HRF	No	No	No	Yes	N/A	IOGP states that divers should be transferred to HRF within 54 hours.
16	Defines a safe haven	No	Yes	No	No	N/A	IMCA: a place where the HRU can be taken initially as part of the evacuation plan. It may also be a reception site or it may be an intermediate stop on the way to a reception site.
17	Defines an HRF	No	Yes	No	Yes	N/A	OGP Report 478 and IMCA D 053.

18	Requires drinking water quantity above SOLAS minimum	Yes	No	No	No	N/A	ADCI requires 1 gallon drinking water per occupant. IMCA refers to SOLAS minimum of 3 liters per occupant.
19	Ladle	No	Yes	Yes	Yes	N/A	Must be rust proof and have a suitable lanyard. IMCA 12.3, section 15.3 (page 14 of 15) Hyperbaric Rescue Unit, IMCA 024 Rev 2. IOGP is yes by default, as OGP Report 411 Appendix 8 requires an IMCA D024 audit. SOLAS requirement for lifeboats.
20	Drinking vessel	No	Yes	Yes	Yes	N/A	A rust proof graduated drinking vessel. IMCA 12.4, section 15.3 (page 14 of 15) Hyperbaric Rescue Unit, IMCA 024 Rev 2. IOGP is yes by default, as OGP Report 411 Appendix 8 requires an IMCA D024 audit. SOLAS requirement for lifeboats.
Item	**Description of Item**	**ADCI**	**IMCA**	**IMO**	**IOGP**	**USCG**	**Comments**
21	Specifies issues with a vessel with single HRU being positioned in port or alongside a fixed or floating structure that prevents a launch or poses potential damage to the HRU upon launch	No	Yes	No	Yes	N/A	IMCA D014 Rev 2 section 8.3. IOGP Report 478 section 8.1 and section 8.2.
22	Requires establishing a list of Safety Critical Elements (SCE)	No	No	No	Yes	N/A	SCE is an item of equipment or process whose purpose is to prevent or limit the consequences of a High Risk Hazard that if realized could result in the fatality of one or more diver's or support crew.
23	Requires producing a Matrix of Permitted Operations (MOPO)	No	No	No	Yes	N/A	IOGP clarifies the MOPO should specify all "line of fire" scenarios and their controls.

24	Requires permanent locating pins on the HRU for alignment of the mating flange to the receiving facility	No	Yes	No	Yes	N/A	IMCA D024 references Appendix B of IMCA D051. IOGP is yes by default, as IOGP Report 411 Appendix 8 requires an IMCA D024 audit.
25	Specifies the position of the mating flange on the HRU	No	Yes	No	Yes	N/A	IMCA D024 references Appendix G of IMCA D051. IOGP is yes by default, as IOGP Report 411 Appendix 8 requires an IMCA D024 audit.
26	Is the HRU flange profile specified providing protection within the hull of the craft	No	Yes	No	Yes	N/A	IMCA D024 references Appendix D of IMCA D051. IOGP is yes by default, as IOGP Report 411 Appendix 8 requires an IMCA D024 audit.
Item	**Description of Item**	**ADCI**	**IMCA**	**IMO**	**IOGP**	**USCG**	**Comments**
27	Is a sacrificial ring required when mating to the HRF	No	Yes	No	Yes	N/A	IMCA D024 references Appendix E of IMCA D051. IOGP is yes by default, as IOGP Report 411 Appendix 8 requires an IMCA D024 audit.
28	Are service connections specified to allow worldwide compatibility	No	Yes	No	Yes	N/A	IMCA D024 references Appendix H of IMCA D051. IOGP is yes by default, as IOGP Report 411 Appendix 8 requires an IMCA D024 audit.
29	Are mating trials with the intended HRF required	No	Yes	No	Yes	N/A	IMCA D024 and IOGP Report No 478 specify requirement.

Part 4: Past Incidents

Item	Incident Type (Near Miss / Incident / Fatality)	Description of Event	Root Cause	Comments
1	Multiple Fatality 4 divers in sat	Feb 1982 Semi drilling rig sank in winter storm with the loss of all 84 personnel onboard.	Storm	
2	Multiple Fatality	Explosive decompression of sat system when TUP clamp failed, 5 fatalities, one serious injury.	Equipment failure, Human Factor	No HES
3	Multiple Fatality	Feb 1986 vessel sank with 4 divers in sat, 32 or 33 fatalities out of 71 on board. All 4 saturations divers perished.	Storm	No HES
4	Near Miss	Vessel ran aground and the divers were transferred into the SPHL. The SPHL launch was initiated but aborted before the SPHL entered the water, as the vessel had been stabilized. The divers were transferred back into the system.	Human Factor	First recorded use of an SPHL.

5	Multiple Fatality	Drillship capsized during Typhoon in November 1989. 91 crew members perished, including possible dive team in saturation.	Storm	No HES
6	Near Miss	Sat Divers rescued from platform after gas blow out. Performed bell to bell transfer with another vessel.	Blow out	No HES
7	Multiple Fatalities	Barge sank during Typhoon. 22 fatalities, including 4 divers in Saturation, out of 195 personnel onboard.	Storm	No HES
8	Near Miss	November 2008, Vessel ran into jetties entering port and became stuck on rocks. Sat Divers were evacuated from vessel in the diving bell. Bell was mated to another system and divers we decompressed. Vessel did not have an HES onboard.	Human Factor	No HES
9	High Potential Near Miss	GOM sat vessel fire, no HES, fire contained prior to injury to divers in sat.	Human Factor	No HES
Item	**Incident Type** (Near Miss / Incident / Fatality)	**Description of Event**	**Root Cause**	**Comments**
10	High Potential Near Miss	Another GOM sat vessel fire, no HES, fire contained prior to injury to divers in sat.	Human Factor	No HES
11	Near Miss	1981 Drilling semi mooring lines parted, 10 divers pressed into HES, tug managed to establish a tow line prior to collision with fixed platform	Storm	
12	High Potential Near Miss	1980 North Sea vessel fire, fire contained prior to injury to divers, no HES	Human Factor	No HES
13	High Potential Near Miss	2005 North Sea facility fire, fire contained prior to launch of HES	Human Factor	
14	High Potential Near Miss	Vessel collision with Gas Platform in the North Sea, badly damaged	Human Factor	

		vessel but managed to stay afloat, divers placed in HES		
15	High Potential Near Miss	Vessel collision with SBM in Canada, divers in sat, damaged vessel remained afloat. Had HES, but not needed.	Human Factor	
16	High Potential Near Miss	Vessel collision with fixed platform in the North Sea damaged vessel remained afloat, divers in sat. Had HES, but not needed.	Human Factor	
17	High Potential Near Miss	1986 Gas blow out in Brazil, no fire. 2 divers in sat system placed in bell and transferred to nearby drilling rig, decompressed in the bell.	Human Factor	No HES
18	Multiple fatalities	Sat vessel improperly loaded with vertical grout silos, vessel rolled in bad weather, divers in sat, vessel had HES, but never had a chance to use it.	Human Factor	
19	High Potential Near Miss	IMCA Safety Flash 10/14 - Main engine caught fire on DSV while divers were in saturation	Equipment failure	No injuries. The divers were evacuated to the HRC and the launch protocol was initiated but not activated.

Part 5: Hazard Analysis

Item	Hazard Identified	Risk Associated with Hazard	Mitigation Considerations (Be Specific)
1	Integrity of the vessel or structure is compromised by fire or collision	Vessel is sinking and evacuation of all personnel is required	Follow all abandon ship training which includes the launch of the HRU
2	Fire or other disaster within the diving system	Dive system has become compromised or inoperable	Follow prepared plan and risk assessment for Hyperbaric Evacuation
3	Inexperienced Crew	Unable to launch HRU Mechanical or material damage to the HRU as a result of no training	Training for all personnel responsible for the evacuation of the HRU • Regular drills • Preventative Maintenance Plan

4	Structural damage to launching system	Unable to launch HRU	HRU will be dependent for a Float Off or Crane assisted release. Alternatives should be identified
5	The vessel is unable to maintain a favorable heading to facilitate the launch due to extreme weather conditions.	Unable to launch HRU	The use of a static crane may provide a better opportunity to allow release of the HRU from the stricken vessel
6	HRU becomes fouled in the vessel during evacuation	HRU remains in the high risk zone	Fast Rescue Craft or other support vessel is required to assist in clearing the HRC from the support vessel in distress
7	Vessel is listing beyond acceptable limits of the Launch System	HRU will be dependent for a "Float Off Release"	HRU may require an early launch to avoid being forced into a float off release
8	Injured divers in the HRU	Increased risk of death due to absence of medical care	An HES plan that includes the transfer to an HRF will allow for medical care
9	Travel to recovery site	Broken tow line Delayed arrival to recovery site Death or injury due to failure of life support during transit Sickness and injury due to sea state	Rigging should be addressed in PMP Should be addressed in Hazid and contingency plans must be created to minimize travel time
Item	**Hazard Identified**	**Risk Associated with Hazard**	**Mitigation Considerations (Be Specific)**
10	HRU lost during travel to recovery site	Flotation fails Tow line breaks HRU sinks to the bottom Unqualified Operator	HRU shall be equipped with a strobe light, radar reflector and acoustic transponder to meet IMO Code for Safe Diving Systems (resolution A.583). The operator of the SPHL must possess the same qualifications and license as one has to operate a lifeboat.
11	Life Support Package not available	Death due to lack of life support controls associated with the LSP	LSP should be staged at an offshore location or on a dedicated recovery vessel LSP umbilical shall be longer that the tow cable in the event the HRU

			cannot be lifted from the water. The LSP and cradle should be suitable for transportation by helicopter.
12	Fire in the HRU	Death or injury due to smoke inhalation, Mechanical and material damage, explosion	Each compartment should be equipped with a hyperbaric fire extinguisher approved for the maximum operational depth of the chamber
13	Complete decompression by means of the LSP only	Increased risk of death due to absence of medical care for previously injured divers Illness as a result of poor hygiene in the HRU	Hazid should address a planned Hyperbaric Rescue Host Site. (This could be another compatible system on shore or on another vessel.)
14	Illness as a result of large concentrations of human waste gases in the HRU	HRU not provided with a proper method for the collection and discharge of human waste.	One toilet should be provided. It may be a flush type or disposable bag type. There should be a scavenging or cleaning facility to get rid of the bacteria and odor
15	Injured Diver in the system	Must transfer from system to HRU	Should be addressed in the Evacuation Plan. HRU and TUP should be designed for movement of injured personnel
16	Damage to HRC/SPHL while lifting from water to transport vessel/trailer	Unable to attach to host facility	Should be addressed in Contingency Plan for HRU Recovery. There should be a method of protecting the mating flanges included in the recovery plan. Contingency plan should include mating HRU to the HRF
Item	**Hazard Identified**	**Risk Associated with Hazard**	**Mitigation Considerations (Be Specific)**
17	SDC recovery system is inoperable due to mechanical failure or damage	Unable to recover SDC	Contingency Plan should address secondary means of recovery of the SDC and method to mate to the system

Part 6: Drills and Preparation

Pre-planning and rehearsal are effective and necessary to ensure that systems occupants and topside support recognize the evacuation alarm or other alarm and know how to respond correctly. Drills are proven to increase correct action and efficiency during a true emergency. Practicing an evacuation with a non-emergency drill provides training and feedback that will be invaluable in an emergency.

Each member company should hold regular drills for anticipated emergencies. These drills should be documented/logged with (as a minimum); drill participants, type of drill, drill duration and that the drill results were discussed. Below are examples of drills and frequencies that are required by industry groups.

HRC/SPHL Launch and recovery	IMCA Every 6 months ADCI Annually	IMCA D024 Rev 2,022 Rev 1,052
Diver recovery/evacuation	Prior to commencement and every 14 days after	IMCA D052 ADCI CS rev 6.2
Incapacitated diver recovery to deck or bell	Prior to commencement and every 14 days after	IMCA D052 ADCI CS rev 6.2
Bell Rescue Open and or Closed	Prior to commencement and every 14 days after	IMCA D022 Rev 1
Hyperbaric rescue/evacuation	With the vessel fire drill	IMCA D022 Rev 1 section14.34.2, ADCI CS Rev 6.2
Split Sat (table top)	Regular	IMCA D052
LSP (tabletop/with vessel)	Regular	IMCA D052
HRF (tabletop)	Regular	IMCA D052 IMCA D053

Each member company should ensure that the necessary drills be conducted in accordance with federal governmental, local governmental, industry standards, best practices and recommendations subscribed to.

The diving contractor and the operator should agree to the applicable drills through the HAZID process prior to commencement of diving activities.

Part 7: Appendix

Insert additional documentation, reports, drawings, etc. in this section that may provide more depth or relevant information to the report. List additional material in table and attach original to the back of this report.

Item	Appendix Item	Description of Item
1.	US Gulf of Mexico Diving Safety Work Group Hyperbaric Evacuation System Checklist Rev 0	A checklist developed by the HES Committee to provide valuable guidance and education on Hyperbaric Evacuation Systems (Added to end of this appendix)

2.	ADCI International Consensus Standards For Commercial Diving and Underwater Operations 6.2	The Association of Diving Contractors International (ADCI) published standards.
3.	IMCA D014 Rev 2 Code of Practice for Offshore Diving	The International Marine Contractors Association (IMCA) offers examples and provides good advice on ways diving operations can be carried out safely and efficiently.
4.	IMCA D004	The Initial and Periodic Examination, Testing and Certification of Hyperbaric Evacuation Launch Systems
5.	IMCA D025 Rev 1	Evacuation of Divers from Installations
6.	IMCA D024 Rev 2 Design for Saturation Diving Systems	A guidance document for auditing a saturation diving system, including the HES
7.	IMCA D018 Rev 1	Code of Practice for the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment
8.	IMCA D051 Rev 1	Hyperbaric Evacuation Systems Interface Recommendations
9.	IMCA D052 Hyperbaric Evacuation Systems	IMCA Guidance on Hyperbaric Evacuation Systems. Includes guidance on development of Hyperbaric Evacuation Systems and planning for the use of the HES
10.	IMCA D053	Design for the Hyperbaric Reception Facility (HRF) forming part of a Hyperbaric Evacuation System (HES)
11.	IMO Resolution A.692(17)	International Maritime Organization Guidelines and Specifications for Hyperbaric Evacuation Systems
12.	IMO Resolution A.831(19) Code of Safety for Diving Systems	The purpose of this Code is to recommend design criteria and construction and survey standards for diving systems
13.	Information Note IMCA D 02/06	The Evaluation and Testing of the Environment Control of Hyperbaric Evacuation Systems
14.	IOGP Report 411	The International Association of Oil and Gas Producers Diving Recommended Practice
15.	IOGP Report 478	IOGP Performance of Saturation Diving Emergency Hyperbaric Evacuation and Recovery
Item	**Appendix Item**	**Description of Item**
16.	USCG 46 CFR Part 197 Subpart B – Commercial Diving Operations	The Code of Federal Regulations that prescribes the rules for design and operation of commercial diving systems
17.	ABS Class Rules	Rules for Building and Classing Underwater Vehicles Systems and Hyperbaric Facilities
18.	DNV Offshore Standard	DNV-OS-E402 Offshore Standard for Diving Systems

19.	DNV Recommended Practice	DNV-RP-E403 Hyperbaric Evacuation Systems
20.	Lloyd's Register of Shipping	Rules and Regulations for the Construction and Classification of Submersibles and Underwater Systems

	US GOM DIVING SAFETY WORK GROUP HYPERBARIC EVACUATION SYSTEM (HES) CHECKLIST	Y/N	Notes
A. GENERAL			

1. ARE THERE MAINTENANCE AND TEST RECORDS IN COMPLIANCE WITH APPLICABLE REGULATIONS AND STANDARDS/GUIDELINES FOR THE HES?		
2. IS THERE A WRITTEN STEP BY STEP HYPERBARIC EVACUATION PROCEDURE FOR THIS SPECIFIC SYSTEM?		
3. DOES THE HYPERBARIC RESCUE UNIT (HRU) HAVE A DEDICATED LIFE SUPPORT PACKAGE (LSP)?		
4. IS THERE CERTIFICATION AND TESTING DOCUMENTATION FOR ALL RIGGING AND TOWING/LIFTING POINTS?		
5. ARE ALL LIFTING/TOWING ATTACHMENTS AND RIGGING CERTIFIED AND IN PLACE FOR EASE OF ACCESS?		
6. DOES HYPERBARIC EVACUATION PLAN CLEARLY STATE CHAIN OF COMMAND AND WHO IS ULTIMATELY IN CHARGE OF EVACUATED DIVERS?		
7. IS THE HES OPERATION MANUAL UP TO DATE AND LOCATED IN THE HRU,LSP AND OTHER APPLICABLE LOCATIONS?		
8. DOES HYPERBARIC EVACUATION PLAN INCLUDE PLANS FOR MULTI-LEVEL SATURATION EVACUATION?		
9. Is there a designated Diving Medical Officer with a proven means of communication and is this means identified on the emergency contact list?		
10. DOES THE HES HAVE A MEANS TO TRANSFER AN INJURED DIVER ON A STRETCHER FROM THE LIVING CHAMBERS TO THE HRU AND SECURE THE INJURED DIVER FOR LAUNCH?		
11. DOES HRU HAVE EQUIPMENT IN PLACE TO LOCATE UNIT IF UNATTENDED OR LOST AND ARE THEY CHARGED AND IN GOOD WORKING ORDER?		
	Y/N	Notes
12. IS THE NECESSARY PROTECTION EQUIPMENT FOR DIVERS INSIDE THE CHAMBER PRESENT?		

13. DOES THE HRU HAVE MULTIPLE OPTIONS FOR SAFE DEPLOYMENT?		
14. DOES THE HRU HAVE SAFE LAUNCH CAPABILITY INDEPENDENT OF THE VESSEL POWER?		
15. IS THE HRU CAPABLE OF REGULATING THERMAL BALANCE TO REDUCE RISK OF HYPO/HYPERTHERMIA?		
B. SITE SPECIFIC		
1. IS THERE AN UPDATED EMERGENCY CONTACT LIST?		
2. IS AN EMERGENCY DIVER EVACUATION PLAN UNDERSTOOD BY ALL CREW MEMBERS INCLUDING CAPTAIN AND MARINE CREW?		
3. HAS A PROPER RISK ASSESSMENT BEEN CONDUCTED FOR SPECIFIC WORK SITE IN REGARD TO DIVER EVACUATION?		
4. IS THERE DOCUMENTATION STATING THE LOCATION OF ALL EMERGENCY EVACUATION RESOURCES?		
5. HAVE THE DIVERS REVIEWED THE HYPERBARIC EVACUATION PLAN?		
6. IS THERE CERTIFICATION FOR ALL LIFTING EQUIPMENT TO BE USED ON THE HES?		
7. ARE ALL INSTRUCTIONS DISPLAYED EXTERNALLY AND VISIBLE ON THE HRU?		
8. DOES THE HES HAVE SUFFICIENT CAPACITY TO EVACUATE ALL DIVERS UNDER PRESSURE?		
9. IS A FULL REQUIRED LOAD OUT OF CO2 ABSORBENT SUPPLIES MAINTAINED INSIDE OF THE HRU?		
	Y/N	Notes

10. DOES THE HRU HAVE ENOUGH SUPPLIES, INCLUDING GASES, FOOD, WATER, MEDICAL SUPPLIES AND A MEANS TO PRESERVE AIR QUALITY, FOR AT LEAST 72 HOURS?		
11. HAS A CHECKLIST BEEN CREATED OR REFERENCED PER SYSTEM CLASS SOCIETY, ASSOCIATION OR GOVERNING AGENCY TO ACCOUNT FOR THE NECESSARY SUPPLIES?		
12. ARE HUMAN WASTE DISPOSAL DEVICES IN PLACE IN THE HRU?		
13. HAS AN HRF OR SAFE HAVEN BEEN IDENTIFIED AND HAS THE HRF BEEN NOTIFIED OF HYPERBARIC ACTIVITY?		
14. IS THE SAFE HAVEN OR HRF ESTABLISHED WITHIN REASONABLE DISTANCE?		
15. HAS A DETAILED LOGISTICS PLAN BEEN WRITTEN ON HOW THE HRU WILL BE TRANSPORTED TO THE HRF OR SAFE HAVEN?		
16. IS THE LSP STAGED FOR MOVEMENT?		
17. HAS THE LSP BEEN PROPERLY MAINTAINED AND DOES IT HAVE RECORDS AS PROOF?		
18. HAS A DETAILED PLAN BEEN WRITTEN FOR HOW THE LSP WILL BE MOBILIZED IF THERE IS A LAUNCH AND DOES THE PLAN ENSURE THAT THE LSP WILL BE CONNECTED TO THE HRU WITHIN 54 HOURS AFTER LAUNCH?		
19. HAS A DETAILED PLAN BEEN WRITTEN FOR DECOMPRESSING THE DIVERS IN A SAFE HAVEN WHERE THERMAL BALANCE, CLEAN LIVING CONDITIONS AND APPROPRIATE BREATHING ATMOSPHERE WILL BE PROVIDED FOR THE DURATION OF THE DECOMPRESSION?		
20. HAS A PLAN FOR PROVIDING OUTSIDE MEDICAL ASSISTANCE TO DIVERS AT THE HRF OR SAFE HAVEN BEEN IDENTIFIED?		
21. HAVE ADDITIONAL EMERGENCY MEDICAL AND LIFE SUPPORT PERSONNEL BEEN IDENTIFIED FOR DECOMPRESSION IF REQUIRED AND ARE THEY AVAILABLE TO BE MOBILIZED TO ASSIST IN THE EVENT OF A LAUNCH?		

C. HRC SPECIFIC	Y/N	Notes
1. HAS THE WEIGHT OF THE HRC WITH MAXIMUM OCCUPANTS AND GEAR BEEN CALCULATED AND DOCUMENTED?		
2. HAS A RECOVERY VESSEL BEEN IDENTIFIED AND NOTIFIED OF THE REQUIREMENT TO RECOVER/TOW THE HRC, AND HAS A CONTINGENCY VESSEL BEEN CONSIDERED?		
3. IS THE TOW EQUIPMENT EASIILY ACCESSIBLE ON THE HRC?		
4. HAS A CRANE BEEN IDENTIFIED THAT CAN LIFT THE HRC?		
5. DOES THE HRC HAVE CERTIFIED LIFTING GEAR EASILY ACCESSIBLE?		
6. HOW WILL THE LSP RENDEZVOUS WITH THE HRC AND WILL IT BE WITHIN 54 HOURS?		
7. HAS A DETAILED PLAN BEEN PROVIDED FOR MOBILIZING THE HRC TO THE HRF OR SAFE HAVEN?		
D. SPHL SPECIFIC		
1. HAS THE WEIGHT OF THE SPHL WITH MAXIMUM OCCUPANTS AND GEAR BEEN CALCULATED AND DOCUMENTED?		
2. HAS A RECOVERY VESSEL BEEN IDENTIFIED AND NOTIFIED OF THE REQUIREMENT TO RECOVER/TOW THE SPHL, AND HAS A CONTINGENCY VESSEL BEEN CONSIDERED?		
3. IS TOW EQUIPMENT AVAILABLE?		
4. HOW WILL THE LSP RENDEZVOUS WITH THE SPHL AND WILL IT BE WITHIN 54 HOURS?		
5. DOES THE SPHL HAVE CERTIFIED LIFTING GEAR EASILY ACCESSIBLE?		
6. HAS A CRANE BEEN IDENTIFIED THAT CAN LIFT THE SPHL?		

	Y/N	Notes
7. DOES THE RECOVERY VESSEL HAVE THE SPHL CRADLE ON BOARD TO ALLOW THE SPHL TO BE LOADED AND QUICKLY TRANSPORTED?		
8. HAS A DETAILED PLAN BEEN PROVIDED FOR MOBILIZING THE SPHL TO THE HRF OR SAFE HAVEN?		
E. DRILLS		
1. HAVE HES LAUNCH AND RECOVERY DRILLS BEEN PERFORMED AND DOCUMENTED?		
2. HAVE EVACUATION DRILLS BEEN PERFORMED WITH THE DIVERS?		
3. HAVE EVACUATION DRILLS WITH AN INJURED DIVER TRANSFERRED TO THE HRU BEEN PERFORMED?		
4. HAVE HRU LAUNCH AND RECOVERY SYSTEMS BEEN TESTED AND DOCUMENTED?		
5. HAS THE HRU BEEN PHYSICALLY MATED TO THE DESIGNATED HRF?		
6. HAS THE LSP BEEN CONNECTED TO THE HRU TO SIMULATE AN EMERGENCY?		
7. HAS A FULL HRU TO HRF OR SAFE HAVEN DESKTOP DRILL BEEN COMPLETED?		
8. HAS A FULL LSP TO HRU DESKTOP DRILL BEEN COMPLETED?		
9. HAVE SPLIT SAT EVACUATION DESKTOP DRILLS TO THE HRU BEEN COMPLETED?		

	Y/N	Notes
10. HAS THE VESSEL CAPTAIN BEEN INVOLVED IN A SIMULATED HRU LAUNCH TO CONSIDER POSITIONING OF VESSEL FOR LAUNCH WHETHER ON ANCHORS OR DP, SUCH AS BEING DOWN WIND, DOWN CURRENT AND ON THE LEEWARD SIDE, AND IS THE CAPTAIN AWARE OF THE PROPER DISTRESS CALL?		
11. HAVE THE DIVERS BEEN BRIEFED IN THE VARIOUS MEDICAL COMPLICATIONS THAT COULD ARISE FROM AN EMERGENCY EVACUATION AND PROLONGED STAY IN THE HRU?		
F. HES RECOVERY AND SAFE HAVEN		
1. HAS THE DESIGNATED HRF OR SAFE HAVEN LOCATION BEEN IDENTIFIED?		
2. WILL THE HRU MATE TO THE HRF?		