GOM Diving Safety Work Group

COMMITTEE WORK GROUP

Emergency Response and Procedures Committee Work Group

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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.

Emergency Response and Procedures Committee Work Group

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 stake holders. 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

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

The preparation of emergency response plans for diving operations. The guidance provided is meant to be a tool in preparing a project site specific plan. This is not an exhaustive plan nor do all of the mentioned features required for every plan.

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Part 1: Executive Summary of Committee

In the workplace, both onshore and offshore, barriers to prevent incidents are put in place to make the work being performed safer for personnel and assets. Even the most well thought out plans and procedures to prevent incidents are not always successful. Inevitably equipment can break and personnel can make mistakes. In those events, the actions that take place after an incident occurs can be critical and may determine the severity of the outcome. The Emergency Response Plan (ERP) is therefore an important reactive component to the overall mitigations of risk.

For the purposes of this discussion it is assumed that an effective preventative plan focused on the left side of the bowtie is in place. Our focus will be on the right side, the reactive side. It is here that a practical attempt will be made to effectively control the event and prevent escalation. The bowtie diagram (figure 1) is shown below to demonstrate the ERP focus on the reaction side of the incident.

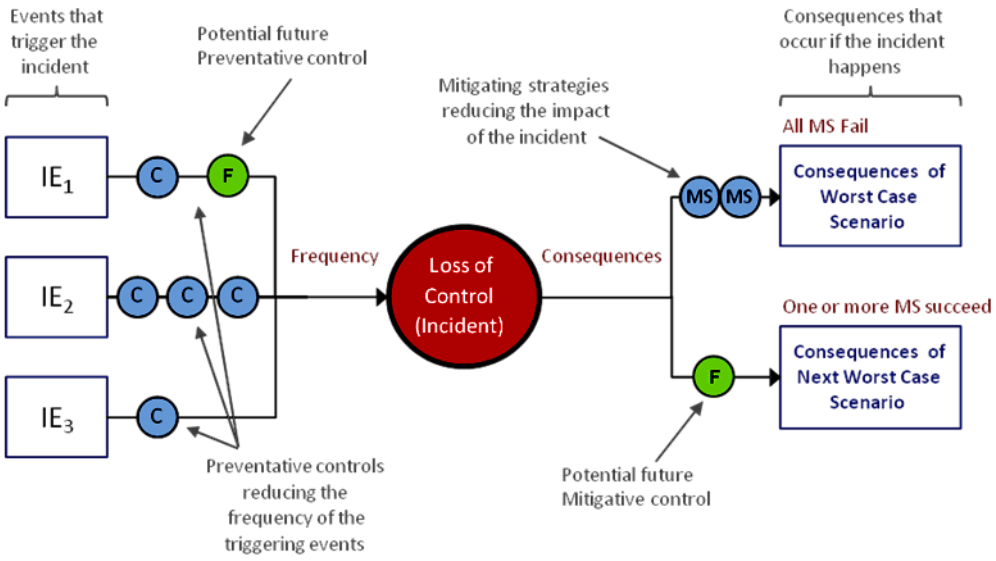

Figure 1: An example of a risk analysis bowtie; Emergency Response Plans would fall to the right of the incident, found in the middle of the diagram. http://www.r4risk.com.au/Bow-tie-Analysis.php

It is the opinion of the committee that emergency plans lacking in detail can fall short in fulfilling their mission. Therefore, it is recommended that the plan be specific to the vessel, systems, equipment, work performed and location of the worksite. It should account for environmental factors such as climate, weather and work environment. It is also important that the ERP is up to date with the most

current information available. The entity performing the work will ultimately be the best evaluator of what should be included in the Emergency Response Plan.

The focus of this document is on the overall planning for emergency response rather than laying out of a standard for technical competency and equipment. There are various entities that have adequately reviewed those issues and so for the purposes of this discussion those issues will not be addressed. Our focus will be on the plan, the risks associated with the plan and the practice of the plan through drills. This document is intended to aid in the creation and updating of an effective site specific and scenario specific ERP; one that can be relied on in an emergency situation to guide those involved in that emergency through the response. These guidelines can help the planner identify the tools they need to bring an incident under control minimizing the overall impact of the event.

Part 2: Definition

Emergency Response Plan (ERP) is a plan that identifies plausible incidents that could reasonably occur during the execution of a work scope. The plan identifies the resources required to manage an incident as well as the actions that will need to be taken in order to prevent the incident from escalating. The plan should be practical and executable avoiding over complexity. Emergency response plans should be job and site specific. The plan should be up to date with the most current information available.

The ERP can further be defined as a plan of actions to be taken after an incident has occurred that prevents the incident from becoming a worst case scenario. The plan should lay out the framework tying together other operational plans in support of managing an emergency.

Emergency plans must have the following characteristics:

- Believable, they should address realistic risk.
- Doable, able to be performed by the personnel at the potential incident site.
- Executable in a timely manner, able to response effective with minimal delay.
- They must clearly define the roles and responsibilities of competent personnel and be scenario based.
- They must adequately spell out the actions taken to remedy the situation following through until the response to the incident has been concluded.
- They must be practiced as drills onboard the respective vessel(s) or worksites.

In summary, an ERP is a plan of action for the efficient deployment and coordination of resources to provide the earliest possible response to an emergency providing aid to the injured and returning the operation to under control.

Abbreviations:

ERP	Diving Emergency Response Plan
PRP	Primary Responding Personnel
SRP	Supporting Responding Personnel
IMCA	International Marine Contractors Association
ADCI	Association of Diving Contractors International
USCG	United States Coast Guard
OSHA	Occupational Safety and Health Administration
DSWG	Diving Safety Work Group
OGP	Oil and Gas Producers
SAT	Saturation Diving
Surface	Surface Supplied Diving
US	United States
GOM	Gulf of Mexico
FSW	Feet of Seawater
HSE	Health Safety and Environmental
DMT	Diving Medical Technician
LSP	Life Support Package
SPHL	Self Propelled Hyperbaric Lifeboat
HRC	Hyperbaric Rescue Craft
HRF	Hyperbaric Rescue Facility

Part 3: Regulatory and Industry GAP Analysis

In order to initiate a GAP analysis with pertinent governing agencies and industry organizations, the table below lists the best practices identified by this committee. It further identifies those that have been addressed by the listed agencies and industry organizations. An asterisk is used for those items that have not been specifically addressed or the information needed to perform a GAP analysis is not readily available and as such will require further review outside of the charter of this committee.

Item	Description of Item	IMCA	ADCI	USCG	OSHA	Comments
1	ERP written in font style and size able to be read in low light conditions. Consider having a battery powered light source attached to or in close proximity to the ERP.	*	*	*	*	
2	Location of the ERP on the job site readily available with the location known by PRP and SRP. Consider multiple copies to accommodate restrictions to the access of the ERP (i.e. large areas or compartmentalized locations such as vessels)	*	*	*	**Yes**	
3	ERP is easily identifiable by PRP and SRP.	*	*	*	**Yes**	
4	ERP written in the native language(s) of PRP and SRP.	*	*	*	*	
5	ERP constructed of durable material able to perform in the environmental conditions of the job site (i.e. water, hydrocarbons, high/low temperatures, etc.).	*	*	*	*	
6	ERP contains primary and alternate contact information for supplemental support (i.e. relevant company/operator personnel, response teams, emergency services, hospitals, regulatory agencies, etc.).	**Yes**	**Yes**	**Yes**	**Yes**	

Item	Description of Item	IMCA	ADCI	USCG	OSHA	Comments
7	ERP identifies primary and alternate location identifiers (i.e. address, GPS coordinates, latitude and longitude, etc.).	*	*	*	*	
8	ERP details the location and contact information of primary and secondary medical facilities capable of providing the level of care required (i.e. hyperbaric treatment, burn centers, surgical centers, etc.). Consider listing the maximum levels of care for each facility listed.	**Yes**	**Yes**	**Yes**	**Yes**	
9	Incorporate third party logistical support at the work location in the ERP (i.e. other in- field vessels, platforms, helicopters, onshore facilities, docks, crane services, etc.)	*	*	*	**Yes**	
10	Demonstrate the critical elements in the ERP in the form of a process map or flow chart.	*	*	**No**	**No**	
11	ERP incorporates a site specific hyperbaric treatment abort plan (abandon ship/facility).	*	*	**No**	**No**	
12	Schedule and perform drills for each of the elements of the ERP on a regular basis and at the beginning of the work scope. Incorporate SRP and third parties in the drills.	**Yes**	**Yes**	**Yes**	**Yes**	
13	Perform a risk assessment of the ERP and drills. Using the findings update and/or modify the ERP.	**Yes**	**Yes**	**Yes**	**Yes**	
14	ERP defines the site specific injured diver recovery method.	**Yes**	**Yes**	**Yes**	**Yes**	
15	ERP lists the site specific references the detailed procedure for common emergencies as well as project and site specific scenario should be in place (i.e. decompression sickness,	**Yes**	**Yes**	**Yes**	**Yes**	

	omitted decompression, hand injuries, etc).					
16	List and detail the roles and responsibilities of all PRP and SRP in the ERP.	**Yes**	**Yes**	**Yes**	**Yes**	
Item	**Description of Item**	**IMCA**	**ADCI**	**USCG**	**OSHA**	**Comments**
17	Incorporate the job specific equipment that could impact the execution of the ERP in the plan. Provide instructions as to how to safely disengage or de-energize the equipment to secure the worksite.	**Yes**	**Yes**	**Yes**	**Yes**	
18	PRP and SRP trained to the level of competency required to perform their assigned role and/or task (i.e. the use of emergency equipment, execution of relevant procedures, etc.).	**Yes**	**Yes**	**Yes**	**Yes**	
19	Ensure that PRP and SRP are not assigned other emergency duties that could conflict with the execution of the ERP (i.e. vessel firefighting, medical response, etc.).	**Yes**	**Yes**	**Yes**	**Yes**	
20	Maintain adequately trained onsite medical support such as an EMT or DMT. Evaluate the number personnel and work hours when determining the manning requirements. Consider training SRP as first responders to supplement the onsite medical support.	**Yes**	**Yes**	**Yes**	**Yes**	
21	Cross train personnel for critical PRP and SRP roles.	**No**	**No**	**No**	**No**	
22	Identify alternate personnel to cover PRP and SRP roles in the event PRP are rendered in effective.	**No**	**No**	**No**	**No**	
23	Identify long lead critical spares for life support and emergency equipment. Maintain spares onsite.	*	*	*	*	

24	Include up to date life support/emergency equipment operation manuals, schematics, process maps/flowcharts and d checklists in the ERP (i.e. SPHL, decompression chambers, firefighting equipment, etc.).	**Yes**	**Yes**	**Yes**	**Yes**	
Item	**Description of Item**	**IMCA**	**ADCI**	**USCG**	**OSHA**	**Comments**
25	Verify that all life support/emergency response equipment is fit for purpose and at a minimum meets all regulatory requirements (i.e. equipment running proper fuel and lubricants for climate, etc.).	**Yes**	**Yes**	**Yes**	**Yes**	
26	Include mitigation of common weather events that may impact emergency operations. Take into account (i.e. lightning storms, tropical weather, tornadoes, freezing rain, etc.).	*	*	*	*	

*Not specifically addressed in reviewed material.

Part 4: Past Incidents

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Part 5: Hazard Analysis

The list below identifies some known and possible hazards to the performance of emergency response activities itself (not addressing the primary work) as well as training or drills for the ERP. The hazards are listed with their associated risks as well as some specific mitigation considerations that could be implemented to reduce or eliminate each risk. This is not an exhaustive list and should only be used as a tool to assist the planner.

Item	Hazard Identified	Risk Associated with Hazard	Mitigation Considerations (Be Specific)
1	Personnel becoming involved in the emergency response that do not have the proper training and or experience.	• Slowdown of response time due to miscommunication. • Personnel becoming at risk due to lack of knowledge of various risks present at the site.	• Identify potential third party responders and incorporate them into the emergency response plan. • Include the identified third party personnel in the drills and training. • Train primary personnel to manage third party responders.
2	Personnel operating at an elevated emotional state or become panicked.	• Personnel have tunnel vision decreasing their field of vision when it comes to hazards. • Personnel forget critical steps to response plan. • Personnel encounter fight or flight causing them to either have a decreased sense of risk or an irrational over assessment of risk.	• Train personnel in realistic scenarios. • Cross train personnel. • Train personnel to be able to recognize the symptoms and consciously address them. • Provide easy to understand instructions to supplement the loss of memory and decreased understanding during event.
3	Disruption of the chain of command.	• Confusion. • Panic. • Necessary information lost. • Loss of communication. • Demoralized.	• Cross train personnel to be able to perform the role of their supervisors and visa versa. • Perform realistic drills and training scenarios that eliminate key members of the chain of command. • Have multiple copies of the emergency response plan available to the personnel for study and familiarization.

Item	Hazard Identified	Risk Associated with Hazard	Mitigation Considerations (Be Specific)
4	Loss of communications with remote support.	• Loss of access to critical technical support to handle the situation. • Loss of access to critical medical support to handle the situation.	• Review the work to be performed and the possible medical developments and consider having critical rolls onsite instead of remote. • Provide backup communications able to operate under independent power.
5	Partial or total systems failure of critical equipment.	• Disruption of emergency response plan. • Increased risk of injury to responding personnel. • Risk of further escalating the emergency.	• Review the work site and associated emergency response plans for critical single points of failure and consider adding redundancy.
6	Debris impeding access to critical work sites.	• Disruption of emergency response plan. • Increased risk of injury to responding personnel. • Risk of further escalating the emergency.	• Review the work site and associated emergency response plans for critical single points of failure and consider adding redundancy. • Establish alternate access points and pathways. • Have tools/equipment available that can remove or gain access through the debris to the critical components.
7	Chemicals, materials that normally are isolated comingle due to damage of their respective containment.	• Disruption of emergency response plan. • Increased risk of injury to responding personnel. • Risk of further escalating the emergency. • Fire. • Poisonous gas. • Corrosive mixture.	• Review all of the chemicals and materials that will be at the worksite and determine what the worst case scenarios would be for the mixture of the components at the expected quantities and update the emergency response plan. • Have the containment and protective equipment available

			on site to handle the worst case cross contamination event.
Item	**Hazard Identified**	**Risk Associated with Hazard**	**Mitigation Considerations (Be Specific)**
8	First responders and third party personnel do not speak, read or comprehend the language the emergency plan is written in.	• Mistakes made in the execution of the plan due to misunderstanding or inability to read the instructions or understand verbal instructions from the primary personnel.	• Review the fluency of the personnel that could become involved in supporting the emergency response and identify all of the languages of the possible responders. • Consider having the emergency response plan available in alternate native languages. • When possible have personnel available onsite that are bilingual and capable of translating.
9	First responders and third party personnel do not speak, read or comprehend the technical jargon of the emergency plan.	• Mistakes made in the execution of the plan due to misunderstanding or inability to read the instructions or understand verbal instructions from the primary personnel.	• When possible include illustrations in the plan to describe critical steps. • When possible write the instructions in non technical terms.
10	Poor visibility due to loss of light source or smoke impeding the execution of the emergency response plan.	• Personnel at greater risk of slips, trips and falls. • In correct operation of critical equipment and systems due to inability to see controls. • Personnel unable to reach critical equipment, systems or areas due to in ability to see.	• Train personnel to memorize the location of critical controls without the aid of sight. • Use systems or modify existing systems that have or to have easily identifiable controls in low to no visibility conditions. • Drill the execution of the emergency response plan with simulated smoke or visibility restraint.
11	Personnel have limited visibility, range of motion, increase	• Personnel at greater risk of slips, trips and falls.	• Train and drill personnel to perform their duties with the

	heat risk due to PPE when executing the ERP	• In correct operation of critical equipment and systems due to inability to see, feel or hold controls. • Personnel unable to reach critical equipment, systems or areas due to in ability to see. • Difficulty breathing.	PPE that would be worn in a worst case scenario.

Part 6: Drills and Preparation

Below is a list of drills that can be performed to familiarize the crew with the various emergency response procedures. While performing the drill the personnel practice the emergency response procedure to help mitigate the inherent risks and hazards of the emergency response plan itself. The emergency response plan drills should be appropriate for the onsite conditions. Site specific environmental and technical factors should be incorporated into the drills and simulated.

The drills can be combined with each other for other plausible scenarios to increase the realism. Upon completion of the drill(s), the level of success should be evaluated; adjustments are then made to the emergency response procedure if required. It may be necessary to repeat the drill with the incorporated changes.

Item	Drill Name	Describe Drill
1	Loss of breathing gas drill	Loss of primary breathing gas to the working diver.
2	Loss of diver to surface communications drill	Loss of communications between the working diver and dive control.
3	In water hose change out for fouled or entrapped diver drill	Entrapped or fouled working diver.
4	Injured diver in water drill	Recovery of an injured diver. The scenario should be relevant to the work to be performed.
5	Severance of diver's umbilical – breathing gas hose only drill	The primary breathing gas hose of the working diver becomes partially severed. This drill should be incorporated with other scenarios such as loss of gas, loss of communications, etc.
6	Diver's umbilical completely severed	The complete severing of the working diver's hose. This drill should be incorporated with other scenarios such as loss of gas, loss of communications, etc.
7	Topside fire drill	A fire at the worksite, on the vessel (non hyperbaric).
8	Fire inside PVHO drill	A hyperbaric fire inside the PVHO. Consider performing this in conjunction with another drill such as abandon ship, topside fire, etc.
9	Adverse environmental conditions drill	Simulation of a response to an environmental condition such as a hurricane or lightning storm.
10	Oxygen toxicity in water drill	Simulation of a diver experiencing Oxygen toxicity while in the water.

11	Oxygen toxicity during treatment drill	Simulation of a diver experiencing Oxygen toxicity during decompression in a PVHO.
Item	**Drill Name**	**Describe Drill**
12	Emergency evacuation drill	Simulation of the evacuation of the worksite, vessel.
13	Diver becomes dizzy on ascent	Simulation of a diver experiencing while ascending from depth.
14	In water bell to bell transfer of diver(s)	Simulation of the transfer of a diver(s) from one systems bell to another systems bell at depth.
15	CO2 build up in chamber	An alarm is received indicating an unsafe level of CO2 buildup in the PVHO. The personnel perform the emergency procedures to restore the CO2 to a safe level.
16	CO2 build up in bell	An alarm is received indicating an unsafe level of CO2 buildup in the bell. The personnel perform the emergency procedures to restore the CO2 to a safe level.
17	Contaminated breathing gas	The diver(s) main breathing gas having become or been found to be contaminated with an unsafe contaminant. Diver is switched over to secondary gas supply or emergency gas and instructed to free flow to clear dive hose until uncontaminated gas is restored. Note: The diver's bailout gas is a source of uncontaminated gas, but should only be used as a last resort.
18	Type I/Type II decompression sickness	A diver experiencing Type I or Type II decompression sickness either in water, on surface prior to SURD, under pressure while performing SURD or on surface after completion of SURD.
19	Diver electrically shocked while underwater welding, burning, or from coming in contact with energized electrical source.	Diver experiences an electrical shock resulting in injury and possibly becoming unconscious. This drill can be combined with lifesaving drills such as utilization of an AED for restoring normal heart rhythm
20	Diver with pneumothorax	Diver while working or decompressing encounters the symptoms of a pneumothorax. Support personnel simulate the medical response to the diagnosis.
21	Heat related injury	Topside personnel or diver while working on deck or at depth encounters the symptoms of a heat related illness. Support personnel simulate the medical response to the diagnosis.
22	Recovery of unconscious diver in water or in the bell.	Diver becomes unconscious at depth while working or decompressing. The standby diver and support personnel respond to the event to bring the diver into a stable

		environment for further treatment of the root cause. Consider combining this with another drill for realism.
Item	**Drill Name**	**Describe Drill**
23	Hydrocarbons in the bell	Hydrocarbons in the bell are simulated to be detected. Divers in the bell and support personnel respond to stabilize the divers breathing gas and regain control of the atmosphere in the bell.
24	Arterial gas embolism	Diver while working or decompressing encounters the symptoms of an arterial gas embolism. Support personnel simulate the medical response to the diagnosis.
25	Evacuate injured person/personnel via platform crane to platform	Injured personnel are evacuated to a platform with support of the platform crew.
26	Evacuate injured person/personnel via platform crane to another vessel	Injured personnel are evacuated to another vessel with support of the platform crew and supporting vessel.
27	Evacuate injured person/personnel via helicopter from vessel helideck	Simulation of injured personnel being evacuated to via helicopter. Personnel are prepared for transportation short of actual flight.
28	Evacuate injured person/personnel via vessel crane to another vessel	Injured personnel are evacuated to another vessel with the vessels crane with support from supporting vessel.
29	Emergency loss of pressure in one of the PVHO chambers	One or more of the chambers begins losing pressure. In chamber personnel as well as topside support isolate the leak.
30	Loss of anchorage or DP while diver(s) is in the bell or working at depth.	The loss of anchorage or DP is simulated. Divers and support personnel respond to recover the diver(s), stage, bell, etc. to surface.
31	Lost bell recovery	ROV or surface diver simulates the connecting of the recovery rigging in support of recovering a lost bell.

Part 7: Appendix

The listed documentation, reports, drawings, etc. in this section are provided for more depth or relevant information to this report.

Item	Appendix Item	Description of Item
Example	***Drawing of Dive Spread #1***	***A Handwritten written drawing of a possible dive spread schematic that is appropriate for Live Boating***
1	OGP – Diving recommended Practice, Report No. 411 June 2008	Diving standard for the International Association of Oil and Gas Producers
2	International Consensus Standards for Commercial Diving and Underwater Operations, 6th Edition	Diving standard for the Association of Diving Contractors International
3	DMAC 15 REV 3	Medical equipment to be held at the site of an offshore diving operation
4	DMAC 28 REV 1	Provision of emergency medical care for divers in saturation
5	AODC 019 REV 1	Emergency procedures - provisions to be included for diving bell recovery
6	AODC 026	Diver emergency heating
7	AODC 048	Offshore diving team manning levels
8	IMCA C 013	First Aid and Other Emergency Drills
9	IMCA C 002 REV 2	Guidance on Competence Assurance and Assessment – Marine Division
10	IMCA C 003 REV 2	Guidance on Competence Assurance and Assessment – Diving Division
11	COMDTINST 6260.31B	Commandant Instruction 6260.31B Safety and Health Training for Emergency Response Operations
12	OSHA 3122-06R 2004	Principle Emergency Response Preparedness
13	CPL 02-00-151	29 CFR Part 1910, Subpart T - Commercial Diving Operations
14	SLG 101	Guide for All-Hazard Emergency Operations Planning