National Offshore Safety Advisory Committee (NOSAC)

Final Report

COMMERCIAL DIVING SAFETY ON THE OUTER CONTINENTAL SHELF (OCS)

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EXECUTIVE SUMMARY

TASK STATEMENT

Evaluate current state of Offshore Commercial Diving operations, advances in technology and recent Commercial Diving casualties and develop recommendations to the U.S. Coast Guard to improve Commercial Diving Operational Safety on the OCS. NOSAC is to review current Coast Guard Diving Regulations and Policy and compare with technological and operational advances in Diving associated with the offshore industry to assess relevance and future direction and improvements in Coast Guard oversight.

BACKGROUND

Technological advances have made oil exploration and production in previously inaccessible locations a reality. As the search for oil has moved further offshore and into deeper water new and unique challenges have been encountered. As an example mobile offshore drilling units that used to anchor when drilling in shallow water now use Dynamic Positioning Systems to maintain station in deeper water. Diver services have been an integral part of this expansion and the diving industry has adapted as well.

ISSUE

Current Commercial Diving, CFR 46 Part 197 is not consistent and current with Industry Best Practices.

SUBCOMMITTEE BACKGROUND

A Subcommittee was formed with the appointment of four (4) Co-Chairs, two (2) from NOSAC, and two (2) from the Public. There were over forty (40) members from the diving community or who work in a related industry position reviewing the current CFRs and practices.

After reviewing the Task Statement and CFR 46 Part 197, it was determined that the CFR's were two numerous and needed to be prioritize and broken out into multiple phases. Ten (10) sections were chosen to be addressed in Phase I, of which these groups were given the task to review in their respective areas for additions, changes, deletions, or adoption to update the CFRs to reflect the industry's current practices. The focus groups met in regularly scheduled meeting beginning in August 2013. The recommendations reflect changes due to regulation to increase overall safety of the diving industry. The following Focus Groups were established:

- Availability of Standards

- DP Vessel Diving
- Diver Competency / Certifications
- Equipment: Hot Water Systems
- Hyperbaric Evacuation Systems
- Live Boating Including Manning Requirements
- Manning Levels
- Maximum Depths
- Reserve Gas Supply
- Specific Diving Mode Procedures

Four (4) sections were chosen to be addressed in Phase II, again these groups were given the task to review in their respective areas for additions, changes, deletions, or adoption to update the CFRs to reflect the industry's current practices. The focus groups met in regularly scheduled meeting beginning in August 2014. The recommendations reflect changes due to regulation to increase overall safety of the diving industry. The following Focus Groups were established:

- Hyperbaric Evacuation System
- Surface Chamber Operations and Decompression Competency Criteria
- Equipment
- Accountability

Focus Group Findings & Recommendations

Phase I

AVAILABILITY OF STANDARDS

Finding - There are no standards for Commercial Diving
Recommendation – Adoption of current

- IMCA International Code of Practice for Offshore Diving
- Association of Diving Contractors International Consensus Standards

DP VESSEL DIVING

Finding – Current CFR does not define nor address DP Diving
Recommendation – Adopt the following:

- Definition –

  Diving operations, surface supplied or saturation, conducted from a vessel operating in DP Mode; whenever there is any form of motive power in operation, e.g., thrusters or propellers, which automatically maintains its position (fixed or a predetermined track) by means of thruster force. The DP system consists of a power system, a thruster system, a DP-control system with the redundancy built in to maintain or restore its function, e.g. DP2 and DP3. Diving Operations conducted from a DP2 or DP3 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.

- Adopt the following standards
  - IMCA
  - ADCI Consensus Standards.

DIVER COMPETENCY / CERTIFICATION

Finding - Current CFR does not define.
Recommendation – Current CFR does not define or address.

- **Diver Qualifications** - Commercial Divers and supervisors shall possess a recognized commercial diving qualification suitable for the scope of work they intend to perform unless they are engaged in a recognized training or advancement program.

  All personnel subject to hyperbaric exposure must possess a valid annual Fitness-to-Dive Medical Certificate

- **Training -** A formal course of study for a tender/Diver (entry-level) shall be completed at any accredited school, military school or equivalent whose curriculum at a minimum, conforms to current US Coast Guard recognized standards for commercial Diver training.

  Diving personnel should follow a US Coast Guard industry recognized Diver certification and training standard or matrix. In addition, other competencies or qualifications maybe required for some tasks; for example the use of specific tools or practices. The personnel included in diving personnel are:
  - Entry-Level Tender / Diver
  - Surface Supplied Air Diver
  - Surface Supplied Mixed-Gas Diver
  - Saturation Diver
  - Surface Supplied Air-Diving Supervisor
  - Surface Supplied Mixed-Gas Diving Supervisor
  - Saturation-Diving Supervisor
  - Life-Support Technician
  - Saturation Technician

EQUIPMENT; HOT WATER SYSTEMS

Finding - Current CFR does not define.
Recommendation – Current CFR does not define or address.

- A suit receiving hot water must have a Diver-operated bypass valve at the umbilical to divert excessively hot water.
- The source of a hot water system must be constructed so that the volume of controlled-temperature hot water supplied to the Diver allows sufficient time for the Diver to complete the environmental exposure portion of the dive.
- An adequate thermal support system must be in place to provide an amount of protection time equal to the bailout breathing gas supply time.
- A hot water system volume tank must be large enough to diffuse a sudden change in water temperature from reaching the Diver.
- The water temperature delivery system must change slow enough to allow for evasive action should the water supply temperature become detrimental to the Diver's health.
- Hot water shall have audio and visual temperature alarms.

HYPERBARIC EVACUATION FACILITY

Finding - Current CFR does not define or address.
Recommendation – Adopt the following:

- There shall be a Hyperbaric Evacuation Facility on site when performing Saturation Diving Operations.
- Adopt the IMCA Standard for Hyperbaric Evacuation Facility of Saturation Divers.
- Shall have a transportable means (Flyway Package) to support the environmental and gas requirement of the Hyperbaric Evacuation Facility during decompression.
- There shall be a written Emergency Hyperbaric Evacuation Plan on site.

LIVE BOATING INCLUDING MANNING REQUIREMENTS

Finding – Current CFR is not consistent and current with Industry Best Practices.
Recommendation – Adopt the following:

- Definition

  Live Boating is a diving technique where a single surface supplied Diver performs work underwater while the Diver's umbilical is being tended from the bow of a vessel which is manually operated by the vessel master and underway using its primary propulsion system. During live boating operations, the Person in Charge shall be experienced in live boating operations and familiar with the scope of work, as well as the depth and duration of the dive;
- The Person in Charge shall ensure that Diving is not conducted in seas that impede station-keeping ability of the vessel;

- Live boating operations are not conducted (i) in other than daylight hours; or (ii) During periods of restricted visibility;
- The primary propulsion system of the vessel is stopped before the Diver enters or exits the water; and
- A boat is ready to be launched with the crew in the event of an emergency; and
- The diving 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.
- Restricted visibility means any condition in which vessel navigational ability is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms, lack of daylight, sea states that disturb the water surface and impede the ability to visually see the Diver's bubble location, or any other similar causes.
- During live boating operations, the Diving Supervisor must be experienced and knowledgeable in live boating operations and the Diving Supervisor shall ensure that
- Diving is not conducted at depths greater than 130 FSW;
- Diving is not conducted in seas that impede Diver mobility or work function including water currents that impede Diver mobility;
- In addition to the tender, an additional mechanical device is required to ensure that the Diver's umbilical does not become entangled in the vessel's propeller(s) or primary propulsion system;
- A standby Diver is ready, available and appropriately dressed while a Diver is in the water;
- Diving is not conducted with in-water decompression obligations; and
- The person-in-charge is notified before a Diver enters or exits the water.
- During live boating operations, the minimum equipment shall be consist of
- Surface supplied diving equipment that is adequate for the depth of water;
- A third diving umbilical connected to the manifold for emergency use;
- Hard wired communications are utilized between the Diver and Dive Supervisor;
- A Diver worn reserve gas supply with a 5 minute breathing duration at depth;
- A method of clear communications between the vessel master and the Dive Supervisor,

- A method of clear communications between the Dive Supervisor and the Tender Diver;
- An emergency shutdown device for the main propulsion system;
- A mechanical device to prevent dive umbilical entanglement in the primary propulsion system; and
- A means to provide a stable platform for the Diver for in-water decompression for emergency purposes

MANNING LEVELS

SURFACE – SUPPLIED AIR DIVING

Finding - Current CFR is not consistent and current with Industry Best Practices

Recommendation – Adopt the following:

- Scuba Diving not recommended for Commercial Diving Operations.
- Surface Supplied-Shallow Air Diving – Shallow air diving to be conducted in depths from 0 – 35 feet.
    - No planned decompression.
    - Minimum manning levels
        - The minimum personal to conduct surface supplied-shallow air diving operations is five (5), with the following requirements;
            - One (1) diving supervisor
                - Must be a designated, qualified, non- diving supervisor who is not required or allowed to dive, and has the qualifications of Surface Air Dive Supervisor; whose main responsibility is to ensure the safety of the divers;
            - Two (2) divers
                - Qualified for the type of work being conducted;
            - Two (2) Tender / Divers
            - Each diver is to be continuously tended while in the water.
            - When a diver is in a physically confined space another diver is stationed at the underwater point of entry and is line tending the diver. This would require one (1) additional diver and one (1) additional Tender / Diver to be on the job.

SURFACE SUPPLIED-DEEP AIR DIVING

Finding – Current CFR is not consistent and current with Industry Best Practices

Recommendation – Adopt the following:

- Surface Supplied-Deep Air Diving – Deep air diving to be conducted in depths from 34 – 165 feet.
- Minimum 1 double lock decompression chamber.
- Minimum manning levels
    - The minimum personal to conduct surface supplied-deep air diving operations is five (5), with the following requirements;
    - One (1) Diving Supervisor
        - Must be a designated, qualified, Non- Diving Supervisor who is not required or allowed to dive, and has the qualifications of Surface Air Dive Supervisor; whose main responsibility is to ensure the safety of the Divers;
    - Two (2) divers
        - Qualified for the type of work being conducted;
    - Two (2) Tender / Divers
        - Qualified to operate decompression chamber
    - Each diver is to be continuously tended while in the water.
    - When a diver is in a physically confined space another diver is stationed at the underwater point of entry and is line tending the diver. This would require one (1) additional diver and one (1) additional Tender / Diver to be on the job.

SURFACE – SUPPLIED MIXED-GAS DIVING (HeO_2)

Finding – Current CFR is not consistent and current with Industry Best Practices

Recommendation – Adopt the following**:**

- Minimum manning levels
    - The minimum personal to conduct Surface Supplied-Deep Air Diving Operations is six (6), with the following requirements;
        - One (1) Diving Supervisor
            - Must be a designated, qualified, Non-Diving Supervisor who is not required or allowed to dive, and has the qualifications of Surface Supplied Mixed-Gas Diver Supervisor; whose main responsibility is to ensure the safety of the Divers;
        - One (1) Mixed-Gas Manifold Operator (Rack Operator);
            - Must be a designated qualified Non-Diving, Gas Manifold Operator/Life Support Technician, who is not

required or allowed to dive. Whose two main responsibilities are to insure that the proper gas mixtures are supplied to the Diver and all in water decompression is properly completed;

- Two (2) Divers
  - Qualified for the type of work being conducted;
- Two (2) Tenders / Divers
  - Qualified to operate decompression chamber
- Each Diver is to be continuously tended while in the water.
- When a Diver is in a physically confined space another Diver is stationed at the underwater point of entry and is line tending the Diver. This would require one (1) additional Diver and one (1) additional Tender / Diver to be on the job.

SURFACE SUPPLIED-NITROGEN/OXYGEN MIXED-GAS DIVING

Finding – Current CFR does not contain Surface Supplied Nitrogen/Oxygen Mixed-Gas Diving Guidelines.

Recommendation – Adopt the following:

- Minimum manning levels
  - The minimum personal to conduct Surface Supplied-Deep Air Diving operations is six (6), with the following requirements;
    - One (1) Diving Supervisor
      - Must be a designated, qualified, Non-Diving Supervisor who is not required or allowed to dive, and has the qualifications of Surface Supplied Mixed-Gas Diver Supervisor; whose main responsibility is to ensure the safety of the Divers;
    - Two (2) Divers
      - Qualified for the type of work being conducted;
    - Two (2) Tenders / Divers
      - Qualified to operate decompression chamber
    - Each Diver is to be continuously tended while in the water.
    - One (1) Life Support Technicians is required if gas is being mixed on location.
    - When a Diver is in a physically confined space another Diver is stationed at the underwater point of entry and is line tending the Diver. This would require one (1) additional Diver and one (1) additional Tender Diver to be one (1) the job.

MAXIMUM DEPTH

Finding – Current CFR is not consistent and current with Industry Best Practices

Recommendation - Adopt the following:

- Scuba Diving (Not Recommended for Commercial Diving Operations)
  - 30 FSW (It should be restricted to 30 FSW for minor shallow inspection applications).

- Surface Supplied Air Diving
  - 165 FSW
- Surface Supplied Mixed-Gas (HeO_2) Diving
  - 250 FSW (Requirement for an open bottom bell with onboard emergency gas for all HeO_2 diving applications)
- Surface Supplied NITROX (N_2 O_2) Diving
  - Maximum 1.3 PPO_2
- Saturation Diving
  - No limits

RESERVED GAS SUPPLY (BAILOUT BOTTLE OR RGS)

Finding – Current CFR is not consistent and current with Industry Best Practices and does not require RGS in less than 130 FSW.

Recommendation - Adopt the following:

- Require Reserved Gas Supply on all dives.
- Must be able to supply a minimum of five (5) minutes breathing supply to the Diver at depth.
- RGS must contain the same gas as the Divers Bottom Mix.

SPECIFIC DIVING MODE PROCEDURES

Finding – Current CFR does not contained Saturation Diving Procedures.

Recommendation – Add Saturation Diving Procedures:

Recommend CFR should include specific requirements for Saturation Diving.
Propose draft text on Saturation Diving for inclusion in the CFR, as follows:
The Diving Supervisor shall insure that—

- When Saturation Diving is conducted, a suitable living habitat is present for Divers to live. The living habitat shall consist of shower, sleeping, eating and the toilet receptacle with a raised vented seat to ensure a seal cannot be created.
- A closed bell with Transfer Under Pressure (TUP) capacity is available.
- Each bell shall have two forms of retrieval in the event of a parted lifting or malfunctioning apparatus.
- A hyperbaric facility, Self-Propelled Hyperbaric Life Boat (SPHLB), or Hyperbaric Rescue Chamber (HRC), shall be available which is capable of evacuating the Divers and attaining the maximum storage depth of the Saturation Dive. Additionally, Dive Supervisors must ensure an evacuation plan is in place to take into account available recompression facilities to safely ascend divers following any incident.
- A Standby Diver is available when the closed bell leaves the dive location until the Divers have returned to the Saturation System.
- A qualified dive team member shall be available at the dive location to assist in the recovery of the closed bell or its occupants.

- Follow the established Dive Plan Procedure for obtaining medical support in the event of an accident, either for a diving or non-diving related incident. Ensure a DMT / EMT is present and available.
- Validate the Dive Plan for sufficient Breathing Mixtures, Supplies, and Equipment.
- Verify that all personnel meet the necessary qualification to perform the assigned task.
- A Standby Diver is available when the closed bell leaves the dive location until the Divers have returned to the saturation. There should be a 'Dive Intervention Plan' in place. There shall be a suitable supply of treatment gas available for each individual storage depth of the Saturation System.
- Each diving operation shall have a primary and secondary breathing gas supply meeting the proposed established requirements.
- The lockout duration from seal to seal shall take into consideration fatigue, physiological effects, including type of work being undertaken.

Phase II

Hyperbaric Evacuation Systems

Finding - Current CFR does not define or address.

Recommendation – Adopt the following:

Saturation diving is a mode of diving where the diver is subjected to an ambient pressure greater than atmospheric pressure to the degree that his or her tissues become saturated with the inert breathing medium. Once saturated, the diver is committed to a set decompression procedure no matter how long he or she remains at depth. This obligation to decompression requires additional planning to provide `

A hyperbaric rescue unit (HRU) must be provided for evacuation of the divers with life support for a minimum of 72 hours. A site specific hyperbaric evacuation plan (HEP) must be in place to ensure the HRU and its occupants are taken to a designated location where they may be safely decompressed to atmospheric pressure.

There are two acceptable types of HRU. One is a self-propelled hyperbaric lifeboat (SPHL) and the other is a hyperbaric rescue chamber (HRC). The difference between these is basic; the SPHL is a PVHO fitted in a conventional lifeboat hull, making it capable of maneuvering under its own power with the ability to accommodate a support crew and the HRC is a PVHO that must be towed and has no capability to accommodate a support crew.

Each HRU must have a life support package (LSP) which can be mated to the HRU. The details of the LSP, including what it is comprised of and where it is located, must be included in the HEP.

Details of where the final decompression will be carried out must be included in the HEP, such as a designated hyperbaric rescue facility (HRF). The HRF is a designated rescue saturation complex where divers can decompress and receive medical attention following a disaster that required evacuation from the host. A risk assessment should be carried out to determine if the length of decompression or the medical needs of the divers outweigh the risks associated with an additional transfer to the HRF.

If the HRF is identified in the HEP, then there should be a fit test of the HRU to that HRF to ensure that no issues are encountered. This test should be carried out at least once, and every time a modification is made to the HRU that would change how it would fit to the HRF.

Recommend adding the following 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 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 capable of accepting an HRU where the divers can be transferred under pressure to receive medical attention and safely complete decompression.

Safe Haven

It should be understood that it may not always be possible, or practical, for an HRU to travel to a land based HRF. Contingency plans should include an alternate site. This could be a saturation Diving Support Vessel, a platform, a vessel with sufficient crane capacity or another clearly identified option. This site will provide a safe haven to carry out the decompression and provide logistical support.

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. This is 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.

Recommend adding a section into the CFR for Hyperbaric Evacuation Planning Requirements When Saturation Diving.

Saturation Diving Operation Requirements

Hyperbaric Rescue Unit (HRU) required

- Is not the primary diving bell
- Has sufficient capacity for evacuation of all divers under pressure
- Has sufficient breathing gas to sustain the maximum capacity of divers for a minimum 72 hours
- Dedicated life support package
  - Is capable of being at the HRU and operational within 24 hours.
  - Is capable of regulating thermal balance.
- Has safe launch capability independent of host, or vessel, power.
  - A float off style or crane dependent launch style of HRU is not permitted.
- Is fitted with seating restraints and crash helmets for all occupants.

Hyperbaric Evacuation Plan (HEP)

- Provides a means to evacuate the total number of divers under pressure to a place where a suitable planned decompression can be carried out.
  - The place where decompression is to be carried out shall be clearly identified. A contingency option should be in the plan to address unforeseen or special circumstances.
    - It should be understood that it may not always be possible, or practical, for an HRU to travel to a land based HRF. An alternative, or contingency, should be identified. This could be a saturation Diving Support Vessel, a platform, a vessel with sufficient crane capacity or another clearly identified option.
- Has a risk assessment completed which is specific to the project and location where operations are being carried out.
  - The risk assessment must identify a sufficient number of competent people to implement the HEP from the onset of the emergency to the completion of decompression.
    - Competent people must be adequately trained and knowledgeable.

    - The risk assessment must identify sufficient equipment (such as vessels, cranes and trucking) available to carry out the HEP from the onset of the emergency to the completion of decompression.
        - Equipment must be kept in safe working condition and be fit for purpose.
- Provides a description of the phases of the HEP which has been agreed upon by both the diving contractor and the client.
    - Must identify who is responsible for ensuring that the plan is carried out in all phases.
    - Identifies that the Designated Person In Charge (DPIC) of Diving Operations has the ultimate authority on launch of the HRU.

Drills

- General
    - Drills shall be documented. The documentation, as a minimum, should include a list of the drill participants, the type of drill used, drill duration, and that the drill results were discussed and deficiencies addressed.
        - The designated diving supervisor shall ensure drills are conducted at the correct interval with the safety of all personnel in mind.
        - Drills should test the individual elements of the HES.
        - Site/location hazards, environmental hazards and types of operations being conducted/job specific hazards should be taken into account and addressed.
- Drills and Frequency
    - HRC/SPHL Launch and recovery drill will be on an annual basis and will not be a table top exercise.
    - Hyperbaric rescue evacuation of divers should be conducted within the first 24 hours of beginning a new project.
    - Life support package exercise will be conducted annually.
        - The LSP must be connected to the HRU to ensure functionality.
        - Mobilization of LSP to HRU can be done through a table top exercise.
    - HRF
        - The HRU must be physically connected to the HEP referenced HRF at least once and a table top exercise for transit to the HRF will be held annually.

Components

- Table top drills:
    - May be full scale/live, tabletop simulation, seminar or a combination of;
    - Shall have key persons in attendance/participating; and
    - Shall test communication, notification procedures, elements of coordination, resource availability, and response.
- Drills can be combined with other appropriate drills.

- Drill frequency should take into account personnel changes.
- Drills are a test of the HES capability and must include participation of the diving crew, diving support crew and appropriate vessel crew.

Surface Chamber Operations and Decompression Competency Criteria

Finding Current CFR only language that speaks to any level of competency on this subject is in 46 CFR 197.410(8)(iii) which states:

"A dive team member, other than the diver, is trained and available to operate the decompression chamber;"

Commercial Diving Contractors shall be responsible for ensuring the designated person in charge (diving supervisor) has appropriate decompression schedules and treatment tables on site. The Contractor shall further ensure all diving personnel engaged in surface chamber operations have completed training to the American National Standards Institute (ANSI) Standard for Commercial Diver Training or industry recognized equivalent and have demonstrated competency to Contractor's Standards. Contractor shall document and retain chamber operations training and competency records for each applicable employee.

Recommendation – Adopt the following

Contractor's Chamber Operations competency for diving personnel engaged in surface chamber operations shall include:

- Operating a double-lock decompression chamber and medical lock, if installed.
- Setting up and breaking down of the decompression chamber using Contractor checklists and industry-recognized documentation.
- Selecting, following, and charting appropriate decompression tables and schedules.
- Demonstrating knowledge of the signs, symptoms, and treatments for diving-related injuries.
- Selecting and following appropriate flowcharts, treatment tables and schedules for diving-related injuries.
- Demonstrating knowledge of hyperbaric safety precautions and sanitation procedures.
- Demonstrating knowledge of safe and proper handling of oxygen and oxygen delivery equipment.
- Tending a diver inside a decompression chamber.

Equipment – Diving Systems

Finding: CFR is not consistent and current with industry best practices.

Recommendation: Define and adopt the following:

Surface Supplied-Shallow Air Diving – conducted in depths from 0 – 35 feet.

Minimum Equipment Requirements

- Three independent air sources plumbed to dive panel
  - Main Air, compressor with volume tank
  - Stand By Air compressor, with volume tank
  - Emergency Air, Regulated High Pressure Air Bank (Could be three separate High Pressure Regulated Banks)
- One double-lock decompression chamber and adequate air source to recompress the chamber to 165 feet sea water (fsw).
- Adequate supply of gasses for the planned dive profile and a potential treatment.
- Two hose groups consisting of[1]:
  - Air hose.
  - Strength member/strain relief.
  - Communication cables.
  - Pneumofathometer hose.
- One set of decompression and treatment tables.
- One control station consisting of:
  - Communication systems; main diver and stand by diver radios
  - 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[2]:
  - Diver-worn Bailout Bottle
  - Helmet or mask.
  - Weight belt if needed.
  - Protective clothing.
  - Safety harness.
  - Knife.
- There must be two ways to recover the diver from all dives.
  - Dive Ladder, Davit & Stage, Lars, Crane & Stage etc.
- Emergency Call Sheet, log books, dive sheets, safe practices manual, first aid handbook and written JHA applicable to job in dive control

[1] All hoses, fittings, gauges, analyzers and regulators will meet or exceed Association of Diving Contractors or International Marine Contractors Association accepted practices.

[2] Any thermal protection system used on any dive should keep the diver in thermal equilibrium throughout the dive profile.

Surface Supplied-Deep Air Diving – 36 – 165 feet.

Minimum Equipment Requirements

- Three independent air sources plumbed to dive panel
  - Main Air, compressor with volume tank
  - Stand By Air compressor, with volume tank
  - Emergency Air, Regulated High Pressure Air
- Dive station emergency air source.
- One double-lock decompression chamber and adequate air source to recompress the chamber to 165 feet sea water (fsw).
- Adequate supply of gasses for the planned dive profile and a potential treatment.
- Three hose groups consisting of[3]:
  - Air hose.
  - Strength member/strain relief.
  - Communication cables.
  - Pneumofathometer hose.
- One set of decompression and treatment tables.
- One 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 Bailout Bottle.
- One control station consisting of:
  - Communication systems; main diver and stand by diver radios
  - 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[4]:
  - Diver-worn Bailout Bottle with proper mix for depth of dive.
  - Helmet or mask.
  - Weight belt if needed.
  - Protective clothing.
  - Tools as required.
  - Safety harness.
  - Knife.
- There must be two ways to recover the diver from all dives.

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[3] All hoses, fittings, gauges, analyzers and regulators will meet or exceed Association of Diving Contractors or International Marine Contractors Association accepted practices.

[4] Any thermal protection system used on any dive should keep the diver in thermal equilibrium throughout the dive profile.

- Dive Ladder, Davit & Stage, Lars, Crane & Stage etc.
- Emergency Call Sheet, log books, dive sheets, safe practices manual, first aid handbook and written JHA applicable to job in dive control.

Surface Supplied-Mixed Gas Diving (HeO_2) – 120 – 240 feet.

Minimum Equipment Requirements

All (HeO_2) Surface Diving operations will require an open bell to be used.

- Five independent air sources plumbed to dive panel
  - Main Air, compressor with volume tank
  - Stand By Air compressor, with volume tank
  - Emergency Air, Regulated High Pressure Air Bank
  - Main High Pressure mixed gas bank.
  - Standby mixed gas bank.
- One double-lock decompression chamber and adequate air source to recompress the chamber to 165 feet sea water (fsw).
- Adequate supply of gasses for the planned dive profile and a potential treatment for the diver and the standby diver.
- Three umbilical groups consisting of[5]
  - Air hose.
  - Strength member/strain relief.
  - Communication cables.
  - Pneumofathometer hose.
- 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:
  - Communication systems with back up (helium scrambler recommended)
  - Depth gauges and gas distribution system with the capability to supply and control two divers 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
- 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:[6]
  - Diver-worn Bailout Bottle with proper mix for depth of dive.
  - Helmet or mask.
  - Weight belt if needed.

[5] All hoses, fittings, gauges, analyzers and regulators will meet or exceed Association of Diving Contractors or International Marine Contractors Association accepted practices

[6] Any thermal protection system used on any dive should keep the diver in thermal equilibrium throughout the dive profile

- Protective clothing.
- Safety harness.
- Knife.

- There must be two ways to recover the diver from all dives.
  - Dive Ladder, Davit & Stage, Lars, Crane & Stage etc.
- Emergency Call Sheet, log books, dive sheets, safe practices manual, first aid handbook and written JHA applicable to job in dive control.

Surface Supplied-Nitrogen/Oxygen Mixed Gas Diving

Cleaning for N^2O^2 Services:

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 of O^2 at low delivery pressures without formal O^2 cleaning. However all equipment that is dual purpose, air diving and N^2O^2, must 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.

Minimum Equipment Requirements

All (HeO_2) Surface Diving operations will require an open bell to be used.

- Five independent air sources plumbed to dive panel
  - Main Air, compressor with volume tank
  - Stand By Air compressor, with volume tank
  - Emergency Air, Regulated High Pressure Air Bank
  - Main High Pressure N^2O^2 bank.
- One double-lock decompression chamber and adequate air source to recompress the chamber to 165 feet sea water (fsw).
- Adequate supply of gasses for the planned dive profile and a potential treatment.
- Three hose groups consisting of[7]
  - Air hose.
  - Strength member/strain relief.
  - Communication cables.
  - Pneumofathometer hose.
- One set of decompression and treatment tables.
- For planned in water decompression:
  - One diving stage or other support platform.

[7] All hoses, fittings, gauges, analyzers and regulators will meet or exceed Association of Diving Contractors or International Marine Contractors Association accepted practices

  - Third source of diver's emergency air supply, in addition to diver's umbilical and Bailout Bottle.
- 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:[8]
  - Diver-worn Bailout Bottle with proper mix for depth of dive.
  - Helmet or mask.
  - Weight belt if needed.
  - Protective clothing.
  - Safety harness.
  - Knife.
- There must be two ways to recover the diver from all dives.
  - Dive Ladder, Davit & Stage, Lars, Crane & Stage etc.
- Emergency Call Sheet, log books, dive sheets, safe practices manual, first aid handbook and written JHA applicable to job in dive control.

Surface Supplied Diving (Shallow Air, Deep Air, Surface Gas and N^2O^2)

Finding: CFR is not consistent and current with industry best practices.

Recommendation: Adopt the following:

- Scuba Diving not recommended for Commercial Diving Operations
- Equipment; Must be include for any depth if Hot Water is being used to keep diver's thermal equilibrium. Recommendation – sent forward from NOSAC to Coast Guard phase 1
- A suit receiving hot water must have a Diver-operated bypass valve at the umbilical to divert excessively hot water.
- The source of a hot water system must be constructed so that the volume of controlled-temperature hot water supplied to the Diver allows sufficient time for the Diver to complete the environmental exposure portion of the dive.
- An adequate thermal support system must be in place to provide an amount of protection time equal to the bailout breathing gas supply time.
- A hot water system volume tank must be large enough to diffuse a sudden change in water temperature from reaching the Diver.
- The water temperature delivery system must change slow enough to allow for evasive action should the water supply temperature become detrimental to the Diver's health.

[8] Any thermal protection system used on any dive should keep the diver in thermal equilibrium throughout the dive profile

- Hot water shall have audio and visual temperature alarms

Accountability

Finding: Currently, there are no accountability provisions in the 46 CFR Part 197, Subpart B

Recommendation: To propose and recommended accountability provisions for offshore Commercial diving. Currently, there are no accountability provisions in the 46 CFR Part 197, Subpart B. The only language currently provided can be found in 46 CFR 197.208, which discusses the Designation of person-in-charge and states: ***(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;* and in 46 CFR 197.210, which discusses the Designation of Dive Supervisor and states: *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*.

Duties to Ensure Compliance

All commercial diving personnel shall ensure that 46 CFR Part 197, Subpart B is complied with.

The Commercial Diving Contractor and Those Contracting the Work

The commercial diving contractor shall ensure the diving operations includes:

- A full Risk Assessment, consisting of Hazard ID; Risk Assessment, and Job Safety Analysis.
- Is planned, managed and conducted in a manner which protects the health and safety of all persons taking part in that commercial diving defined scope of work**,** and complies with 46 CFR Part 197, Subpart B.
- All entities or individuals engaged in a diving defined scope of work, shall be authorized to issue a stop work order for the safety of those engaged in the diving defined scope of work.

Supplies & Equipment for Commercial Diving Operation

Documentation for supplies and equipment required for commercial diving operations shall be available for inspection at the dive site location. This documentation shall include:

- Certificates of Compliance
- Log Books
- Maintenance Records
- Testing Records

Duties of a Dive Supervisor

The commercial diving supervisor shall be designated in writing and ensure 46 CFR Part 197, Subpart B is complied with. The designated commercial diving supervisor shall not dive during operations; unless relieved by another commercial diving supervisor qualified and designated in writing.

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Duties of and Qualification for Commercial Divers

All commercial divers shall comply with the appointed commercial dive supervisor's lawful instructions under 46 CFR Part 197, Subpart B, and be

- Certified and competent commercial diver.
- Shall have a valid annual medical fitness dive certificate.
- Have knowledge and understand the scope of work to be performed.
- Maintain a detailed and accurate record of each working dive performed.

ADDITIONAL RECOMMENDATION:

Jurisdiction

In addition to the accountability provisions proposed above, we respectfully submit for consideration the consolidation of investigations of incidents through the United States Coast Guard. And, propose the following language:

- The Coast Guard shall be responsible for the investigation of all incidents, related to injuries, deaths or violations of CFRs, occurring on all navigable waterways, as a result of a diving defined scope of work.

Incident Database

- The United States Coast Guard create an accessible online database of all records relating to any diving injuries, deaths and/or violations of the CFRs, occurring on all navigable waterways, as a result of a diving defined scope of work.

Variance Request

Issue: Under 46 CFR 197.206, Substitute for required equipment materials apparatus, arrangement, procedures, or test) there is no clear process

Recommendation:

- The variance request time requires takes several days to weeks for review and approval.
- Unclear to which USCG office to route a variance request.
- Unclear of format and information required for submittal of variance.

Respectfully Submitted by:

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