Appendix 3 - Site Specific Health & Safety Plan - Lake Champlain Waters

Champlain Hudson Power Express (CHPE)

Submarine Cable Installation
Lake Champlain Segment

Site Specific Health & Safety Plan

REVISION TABLE			
REV. #	**DESCRIPTION**	**DATE**	**APPROVED**
00	Creation	1/5/23	

SITE HEALTH & SAFETY PLAN APPROVAL

Thomas Ulisse, Project Executive Date
Caldwell Marine

Greg Gashlin, Project Manager Date
Caldwell Marine

Lucky Abernathy, EHS Director Date
Caldwell Marine

Attachments

1. Project Identification

Client: CHPE LLC.

Project Name: CHPE Lake Champlain Cable Installation

Contractor: Caldwell Marine International

Project Manager: Greg Gashlin

Project Engineer: Derek Merz

Site Superintendent: Ed Phillips

Site Safety Officer: Lucky Abernathy

1.1 General Scope of Work

Lake Champlain Cable Installation

The Lake Champlain Submarine Cable Segment will connect the southern end of the CHPE Canadian land cable route to the northern end of the US land cable route at Putnam Station. The route will lie within New York State waters for its entire length.

CMI's cable installation activities will commence at the CAN / US border in the waters of the Richelieu River. The installation route proceeds southward under the Route 2 Road Bridge (operational), then passes through an engineered opening in the Rouses Point Railroad Bridge (abandoned) where it leaves the Richelieu River and enters the waters of Lake Champlain.

Continuing south, the route passes to the west of Isle La Motte, North Hero Island, & Grand Isle before passing under Chimney Point Road Bridge (operational), to enter the narrower waters of the Lower Lake.

Within Lower Lake waters, the route passes through the Ticonderoga Ferry Crossing, past Fort Ticonderoga, to the west, and Chipman Point Marina to the east, before terminating at the Putnam Station HDD landing area.

The burial requirements for the Lake Champlain Submarine Cable segment are understood as minimum burial depth of 4-feet below the existing lake bottom (except in water deeper than 150 feet where the cable pair may be placed on the existing lake bottom).

The planned burial methodology for the Lake Champlain Submarine Cable segment is as follows. In the northern part of Lake Champlain the cable shall be buried via jet sled and in the Southern part of Lake Champlain, approx. MP71-96, the cable will be buried via shear plow. For shear plow operations, the jet sled will be converted into a shear by plugging jet ports and not engaging the water jets.

2. Introduction

2.1 Scope & Application of SSHASP

The purpose of this Site-Specific Health and Safety Plan (SSHASP) is to define the requirements and designate protocols to be followed by Caldwell Marine International (CMI) during construction activities.

Applicability extends to CMI personnel, subcontractors, governmental authorities/officials, and visitors that enter the site while construction activities are occurring. For the purposes of this SSHASP, the term “site” will be used to identify construction areas associated with and around the CMI work areas.

All site personnel, on-site contractors and subcontractors included (hereafter referred to as “project personnel”), will be provided with a site orientation including the site emergency response procedures and any potential fire, explosion, health, or safety and environmental hazards associated with the operations. The Site-Specific Orientation form in Attachment 12 will be completed for each orientation given. This SSHASP summarizes those hazards, and defines protective measures planned for the site. In the event that other potential hazards arise or are recognized after the project begins, the SSHASP will be updated accordingly as discussed in Section 2.3.

This plan must be reviewed by all project personnel, and an agreement to comply with the requirements contained herein must be signed by all project personnel and visitors who may enter the work areas prior to commencement of work. *See Attachment 1*.

During development of this plan, consideration was given to current safety standards as defined by OSHA; primarily in the Construction Industry Standards, 29 CFR 1926 and General Industry Standards, 29 CFR 1910, as applicable.

In addition to this SSHASP, CMI has established a comprehensive Corporate Health & Safety Manual based on past experience, sound engineering practices, employee training and enforcement of Safety and Health regulations, to prevent incidents and injuries. A copy of the Health & Safety Manual will be available on site.

2.2 Key EHS Performance Indicators

Measuring Key Performance Indicators (KPIs) is an important part of ensuring the effectiveness and efficiency of an EHS Management System. These KPIs allow EHS professionals and company leaders to collect data and communicate trends, which can then be used to identify where further improvements are needed.

A key performance indicator is a metric that is tied to a predetermined target and represents how far it exceeds or falls below that target. KPIs provide the company with objective data about their EHS performance, ensuring adequate feedback on the effectiveness of safety initiatives and policies.

KPIs should include leading and lagging indicators of performance to be most effective. KPIs will be developed for this project which include measures of safety performance, e.g., total recordable incident rate, lost time incident rate, number of restricted and days away from work; safety inspections and action items completed; safety training and meetings completed.

The Monthly EHS Report in *Attachment 10* will be completed for each month the project is in the field.

2.3 Applicability to Visitors & Authorities

In addition to this Site-Specific Health & Safety Plan, visitors to the site will be expected to comply with all Federal and State requirements. All project personnel, visitors, and authorities will provide and care for their own protective equipment or arrange to acquire PPE from their employer.

In the event that any project personnel, visitor, or authority does not adhere to the provisions of the SSHASP, he/she will be requested to leave the work site or area. All non-conformance incidents will be recorded in the log by Site Supervision, or his and will be reported to CMI management immediately.

2.4 Implementation of Changes to SSHASP

If the project team determines changes to the SSHASP are required, the SSHASP Revision Form, provided as Attachment 1, will be completed. The proposed revision will be reviewed by the CMI Project Manager and Site Safety Officer (SSO). If the revision is acceptable, it will be signed by the key project personnel and included in the control copy of the SSHASP as maintained by the SSO.

In addition, approved SSHASP revisions will be discussed during the next daily safety tailgate meeting by the SSO.

2.5 Safety Training & Education

Training is essential to assure employees or subcontractors recognize the hazards inherent in their work and understand the means and methods used to eliminate or control hazards, including engineering methods, administrative and work practices, warning systems, and personal protective equipment. Training will also be provided to assure that employees or subcontractors understand the proper use of work equipment and tools and how to maintain the equipment to assure continued safety.

Training will be provided before employees or subcontractors are assigned to new or different work activities and periodically to re-enforce their awareness. Where required, annual refresher training will be provided. Management is responsible for assuring safety training is made available to all employees or subcontractors as required by their specific work activities. It is the responsibility of Site Superintendent (SS) to assure that employees or subcontractors have the required training to perform their work safely. All employees and supervision will be required to attend New Hire/ Supervisor Training. This will include HSE induction and specific HSE training appropriate to the work being performed.

Employees or subcontractors will be required to have attended an initial OSHA 10- Hour class. Proof of training must be available in the form of an OSHA 10-hour “wallet” card, or a certificate of attendance submitted by the company providing the training (they must be an OSHA accepted trainer). Note: At the discretion of SSO, company employees who do not possess an OSHA 10hr card with be provided a reasonable amount of time to meet this requirement.

Initial and periodic refresher training will include at a minimum the following topics:

- Employee conduct
- Inspection of safety devices and protective equipment
- Exposure to hazardous substances
- Clothing
- Personal protective equipment
- Injuries and incident reporting
- Emergency information
- Housekeeping
- Smoking Policy
- Grounding
- Fall protection
- Excavation Safety
- Ladder Safety
- Welding, burning, cutting (i.e., Hot Work)

Daily “toolbox” talks will be held to discuss safety requirements for current work and to “refresh” awareness of general safety topics. The Site Superintendent in conjunction with safety personnel will select the most appropriate topics to review during the “toolbox” talks. Attendance at these meetings mandatory. All site personnel shall attend, and focus shall be to discuss that day’s work and associated risks and mitigations. The meeting shall be documented and signed by each attending person.

3. Identification of Key Personnel and Management

3.1 Key Site Personnel Contacts*

Title	Name	Telephone
General Manager	Brett Bailey	[O] 732-557-6100 [C] 732-620-8197
Project Executive	Tom Ulisse	[O] 732-557-6100 [C] 732-620-3470
Project Manager	Shane Libby	[O] 732-557-6100 [C] 732-620-8197
Project Manager	Greg Gashlin	[O] 732-557-6100 [C] 732-620-3133
Site Safety Representative	Lucky Abernathy	[O] 732-557-6100 [C] 908-433-3755

General Superintendent	Paul Larrabee	[O] 732-557-6100 [C] 732-620-3938
Deck Superintendent	Mike Shaw	[O] 732-557-6100 [C] 604-785-3745
Deck Superintendent	Ed Phillips	[O] 732-557-6100 [C] 732-620-4906
Deck Superintendent	Brett Bryant	[O] 732-557-6100 [C] 732-620-4214
Project Engineer	Derek Merz	[O] 732-557-6100 [C] 848-468-0815

* Subject to change

It is understood that the laborers/supervisors may change due to other company responsibilities.

3.2 Roles and Responsibilities

The following are in addition to the safety procedures found in the Caldwell Marine International, LLC Corporate Safety Manual.

Executive Management: Executive Management accepts the responsibility for leadership of the Safety and Health Program, for its effectiveness and improvement. Ensure that budgets reflect the safety program and adequate resources are available for its implementation.

Corporate Safety Director: The Corporate Safety Director is cognizant of his responsibilities to meet the appropriate safety and health standards, as established by regulatory and other government agencies. The Corporate Safety Director shall be responsible to ensure implementation of this program.

Certified Safety Professional: The Certified Safety Professional will work with the corporate Safety Director to help to monitor the implementation of this program. They will perform project inspections as necessary and help develop procedures to help ensure safe conditions.

Project Managers: Project Managers shall conduct documented safety inspections for each project under their control monthly. The results of the inspection shall be retained in the job files and distributed to the President.

Project Superintendents/Foremen: Project Superintendents/ Foremen shall conduct documented weekly safety inspections of the job site. Results of the inspections shall be retained at the job site.

Site Safety Representative: The Company shall designate a Site Safety Representative. The Site Safety Representative shall be capable of identifying potential sanitary, safety, and health exposures to employees and is empowered to take any action, including stop work, required to eliminate the unsafe condition or action. The Site Safety representative must be familiar with the HASP, assigned work and competent to instruct others.

Employees: As employees, you are responsible for wholehearted, genuine cooperation with all aspects of the Safety and Health Program, including compliance with all rules and regulations.

You must continuously practice safety while performing all daily duties. Employees shall identify unsafe conditions or actions to their supervisor immediately. All employees shall work in a safe and environmentally sound manner. All accidents, incidents, occupational injuries, or illnesses shall be reported to the company immediately.

CMI's safety oversight responsibilities shall extend to ensuring the safety of the following individuals or groups for tasks under the control of the contractor:

- pedestrians
- authorized employees
- motorists
- contractor and subcontract employees
- the environment

3.3 Subcontractor Responsibilities

OSHA Rules of Construction (29 CFR 1926.16)

Subcontractors will be pre-qualified to assure they meet the safety performance criteria, have policies and procedures for the tasks undertaken, and meet the training requirements for this project. All subcontractor's documentation will be reviewed and approved prior to being allowed to start their work.

Subcontractors are expected to follow all requirements of this SSHASP, their own SSHASP, as appropriate, and all Federal, State, and local health and safety requirements. If non-compliance or unsafe conditions or practices are observed, the work will be stopped. The subcontractor representative will be notified, and corrective action will be required. Work will not be allowed to continue until satisfactory mitigations have been implemented. The subcontractor will determine and implement necessary controls and corrective actions and provide documentation that corrective actions were taken within necessary timeframes. If repeat non-compliance/unsafe conditions are observed, the subcontractor will be required to stop affected work until adequate corrective measures are implemented.

4. Hazard Analysis/Risk Assessment

OSHA Recommended Practices for Safety and Health Programs

Work activities on this project have the potential to present hazards which can result in serious risks for injuries and/or illnesses to workers. This section reviews the potential hazardous materials and physical hazards that may be encountered when performing activities on this project and the measures to be taken to reduce the risks. Individual Job Hazard Analyses for each of the major tasks are provided in *Attachment 3*.

4.1 Toxic/Hazardous Substances

As with any construction site, potentially hazardous materials can be generated by typical worksite activities. Some common types may include:

- Carbon monoxide from vehicle and generator exhaust

- Fuel and lubricants (e.g., gasoline, diesel fuel, hydraulic oil)
- Miscellaneous hazardous materials, e.g., solvents, cleaning agents, pesticides, etc.)
- Silica from concrete cutting, breaking and demolition operations.

Exposures will be evaluated, and controls implemented to assure that site personnel are not exposed above allowable exposure limits to any hazardous materials used or generated on site. Engineering, administrative and personal protective equipment will be used to assure site personnel are protected. Respiratory protection will be provided, if deemed necessary, in accordance with 29 CFR 1926.134 and Section 73 of the CMI's Corporate Health & Safety Manual, (*See Attachment 6*).

Harmful silica dust may be generated from concrete cutting, breaking, demolition or other activities with materials containing crystalline silica and can cause lung damage and long-term illness. Exposure to silica containing materials, if applicable, will be assessed and controlled to avoid exposure. Wet techniques, and isolation barriers, if feasible, will be used to reduce generation of dust. Site personnel involved in these activities will be provided with adequate respiratory protection, e.g., N-95 or filtering face piece respirators with P-100 cartridges.

As this site may utilize various contractors/subcontractors, CMI will coordinate among its contractors/subcontractors to assure that all contractors receive information about the hazardous materials that may be used on this project. All contractors/subcontractors will be required to submit Safety Data Sheets (SDSs) to CMI for the chemicals they use on the site so the information may be communicated to all who may be affected. A complete inventory list of chemicals, including quantities of such chemicals that will be on site at all times.

4.2 Hazard Communication Program

OSHA Hazard Communication (29 CFR 1926.59)

A Safety Data Sheet (SDS) is required for all hazardous materials brought on site pursuant to 29 CFR 1926.59. The SSO will maintain a central file on site, accessible to all workers, which will contain an inventory of materials and SDSs for hazardous materials on site. *See Attachment 3*.

All site personnel working with hazardous materials will be trained, before first assignment, in accordance with 29 CFR 1926.59.

Each contractor and subcontractor will ensure that initial (at the time of assignment), and periodic, Hazard Communication Training will be provided to all employees or subcontractors regarding the hazardous chemicals in their work area. Whenever a chemical that poses a new or different type of hazard enters the work area it is the responsibility of each supervisor to ensure employees or subcontractors are trained. This training will include (but is not limited to) requirements of this program and a review of the SDS for that product for the following information:

a) Methods of detection and monitoring of the compound (including monitoring devices, appearance, and odor).

b) Each physical and health hazard that the material presents.

c) Personal protective equipment, work practices, and emergency procedures (i.e., fire, first aid, chemical spill, etc.) to be followed while handling.

d) The labeling system for hazardous materials will be legible and in English, but for non-English speaking employees or subcontractors the information will be presented in their language, as it relates to the material.

e) Location of the hazard communication program, listing of hazardous materials present, SDS's and host employees or subcontractors can obtain from the Site Safety Officer (SSO) and be uses to review the appropriate hazard information.

Task specific procedures for informing employees or subcontractors of the hazards of non-routine tasks, such as equipment maintenance or trailer pesticide application, etc., will be implemented whenever that task involves a hazardous chemical. Each Superintendent is responsible for either training each employee or scheduling such training with a responsible person prior to performing any non-routine task.

Training for non-routine tasks will include:

- Items (a) through (d) above.
- Special precautions for the non-routine task; and
- Other company safety procedures which are relevant to the operation, such as Lockout/Tagout and Hot Work Permits, etc.

It is the responsibility of the Superintendent to ensure that all employees or subcontractors working on site are informed of any hazardous chemicals that they may be exposed to while working on the project. This information will include:

- Existing hazardous chemicals
- Hazardous chemical emissions for processes involved in the work
- Precautions and personal protective equipment which must be worn in the area
- Where and how to safely store

The Project Manager will be responsible for all actions of the prime contractor employees or subcontractors and will ensure that the subcontractor employees or subcontractors follow all safety precautions that would be used by CMI employees or subcontractors.

4.3 Documentation of Training

Training must include labeling and SDS format including:

- Type of information the employee would expect to see on the new labels, including the Product identifier: how the hazardous chemical is identified. This can be (but is not limited to) the chemical name, code number or batch number. The manufacturer, importer or distributor can decide the appropriate product identifier. The same product identifier must be both on the label and in Section 1 of the SDS (Identification).

- Signal word: used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. There are only two signal words, "Danger" and "Warning." Within a specific hazard class, "Danger" is used for the more severe hazards and "Warning" is used for the less severe hazards. There will only be one signal word on the label no matter how many hazards a chemical may have. If one of the hazards warrants a "Danger" signal word and another warrants the signal word "Warning," then only "Danger" should appear on the label.
- Pictogram: OSHA's required pictograms must be in the shape of a square set at a point and include a black hazard symbol on a white background with a red frame sufficiently wide enough to be clearly visible. A square red frame set at a point without a hazard symbol is not a pictogram and is not permitted on the label. OSHA has designated eight pictograms under this standard for application to a hazard category.
- Hazard statement(s): describe the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard. For example: "Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin." All of the applicable hazard statements must appear on the label. Hazard statements may be combined where appropriate to reduce redundancies and improve readability. The hazard statements are specific to the hazard classification categories, and chemical users should always see the same statement for the same hazards, no matter what the chemical is or who produces it.
- Precautionary statement(s): means a phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling.
- Name, address and phone number of the chemical manufacturer, distributor, or importer. How an employee might use the labels in the workplace.
- Explain how information on the label can be used to ensure proper storage of hazardous chemicals.
- Explain how the information on the label might be used to quickly locate information on first aid when needed by employees or subcontractors or emergency personnel.
- General understanding of how the elements work together on a label.
- Explain that where a chemical has multiple hazards, different pictograms are used to identify the various hazards. The employee should expect to see the appropriate pictogram for the corresponding hazard class.
- Explain that when there are similar precautionary statements, the one providing the most protective information will be included on the label.
- Training on the format of the SDS must include information on standardized 16-section format, including the type of information found in the various sections. For example, the employee should be instructed that with the new format, Section 8 (Exposure Controls/Personal Protection) will always contain information about exposure limits, engineering controls and ways to protect yourself, including personal protective equipment.

- How the information on the label is related to the SDS. For example, explain that the precautionary statements would be the same on the label and on the SDS.

Whenever training is provided to employees or subcontractors or contractors in accordance with this policy, the individual(s) responsible for providing this training will collect the names (printed), signatures and Social Security numbers of all attending individuals, and the dates and times of the training. Utilize the training roster located at the end of this program. Note that OSHA requires the employee's SSN.

Equipment operators, general laborers, Superintendents, and management, etc., must be trained prior to being allowed to participate in or supervise field activities. The training should cover the use of personal protective equipment. The training should also cover work practices which minimize hazardous risks and safe use of engineering controls & equipment.

Upon completion of training, forward a copy of the training roster and copies of any additional training material used to the Safety Director. Certificates of training and/or wallet cards will be produced and sent back to the location where the training was performed. These should be presented to the employees or subcontractors for their personal records. Documentation of all training performed will be submitted to human resources for inclusion into the individual's personnel records. Maintain a copy of all training records and certificates at the facility or job site, as a record that training was performed as required by OSHA.

4.4 Labeling

It is the responsibility of each employee to ensure that, prior to use, all containers of potentially hazardous chemicals used are labeled, tagged, or marked with:

a) The identity of the hazardous material, i.e., common and/or chemical name, and Chemical Abstract Service (CAS) Registry Number, including the name that appears on the SDS

b) An appropriate hazard warning, which gives an immediate warning and summary of the more important information from the SDS. In those cases where non-English speaking employees or subcontractors are working at jobsites information will be presented in their language also.

c) Note: Chemical materials supplied to outside contractors by CMI must be labeled, tagged, or marked as identified above.

The outside shipping container label may contain the same information as the immediate chemical container unless that label conflicts with the label(s) required by the Department of Transportation (DOT) for the transportation of hazardous materials.

An employee may transfer or place a hazardous chemical into another "secondary use." That "secondary use" container must be labeled immediately to reflect the by the employee who transfers the product.

The contents of a chemical container that is not labeled appropriately may not be used or put into service, unless it is relabeled appropriately, or the user is given specific approval from a responsible person. Labels already on any chemical container at any location, and used for any purpose, may not be removed, or defaced unless the contents of the container changes.

Signs, placards, standard operating procedures (SOP's), or similar written material may be used instead of placing a label on stationary containers, as long as the written document conveys the same information as is required on a label and is readily accessible to each applicable employee during their normal working shift. This alternate labeling procedure will only be used after review by the Safety Director for each individual situation. Labels will be legible, in English. However, for non- English-speaking employees or subcontractors, information may be presented in their language as well.

4.5 Physical Safety Hazards

OSHA General Duty Clause, OSH Act of 1970, Section 5 (a)(1)

Construction sites may also present numerous potential physical safety hazards. As such, workers must be aware of these hazards and exercise caution at all times. All unsafe conditions must be reported immediately to the SSO. While it is important to identify and be aware of potential physical hazards and the means by which to reduce their risks, not all hazards can be predicted. Although a task-by-task analysis of potential hazards is included in the sections below, the recognition, evaluation, and control of site activities associated with the potential hazards is best accomplished by the development, use, and implementation of standard operating procedures and guidelines, as well as ongoing review of applicable standards and regulations. This Site-Specific Health & Safety Plan, as well as CMI's Corporate Health and Safety Manual (*Attachment 6*), provide safe operating procedures for activities covered by the scope of work for this project.

This section assesses the physical safety hazards that may be encountered on this project. These include, but are not limited to:

- Excavations, holes, ditches, trenches, and other subsurface work
- Sharp objects, such as nails, metal piping and shards, and broken glass
- Slips/Trips/Falls
- Working near heavy equipment (Backhoes, cranes, dump trucks and other material handling equipment), vehicular traffic
- Lightning
- Electrical
- Material handling
- Hand and power tools
- Noise
- Heat and cold stress
- Fire
- Confined Space
- Hot Work

Safety/physical hazards associated with work on this project are presented in detail below.

4.5.1 Electrical

OSHA Electrical (29 CFR 1926, Subpart K)

OSHA Electrical, Wiring design and protection (29 CFR 1926.404)

Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if contacted or severed during site operations. A minimum distance of 10 feet will be present between overhead wires and equipment. This distance will vary according to voltage; the greater the voltage, the greater the clearance between any part of the equipment and the power line Refer to Table 4 - Minimum Clearance from Energized Overhead Electrical Lines. When required, a spotter will be utilized to maintain a safe distance between equipment and overhead wires. The basic rule is "Don’t locate equipment in a position where it can come in contact with overhead power lines." Maintain the required distance from the lines. Overhead electrical power lines will be considered energized unless the person owning such line or operating officials of the electric utility supplying the line assures that it is not energized, and it has been visibly grounded.

Table 1 - Minimum Clearance from Energized Overhead Electrical Lines

Nominal System Voltage	Minimum Rated Clearance
0 to 50 kV	10 Feet (3 m)
50 to 200 kV	15 Feet (4.5 m)
200 to 350 kV	20 Feet (6 m)
350 to 500 kV	25 Feet
500 to 750 kV	35 Feet
751 to 1000 kV	45 Feet
>1000 kV	(As established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

There are various means of insulating the wires, as well as barriers and alarms that may be available to reduce the risk of injury to workers, but the use of such devices does not change the requirements of any other applicable standards or laws. In addition, these, and other measures (such as grounding the equipment itself) may not be fully effective but may create a false sense of security. Only the utility company is authorized to de- energize, insulate, or handle the lines. No one else may attempt these operations.

Electrically powered equipment and tools may also pose a hazard. Whenever possible, workers will use low-voltage equipment with ground-fault circuit interrupters (GFCIs) and watertight, corrosion-resistant connecting cables to help minimize this hazard.

No employee will be permitted to work in the proximity of any part of an electrical power circuit unless the person is protected against electric shock by de-energizing the circuit and grounding it, or it has been locked and tagged out.

4.5.2 Heavy Equipment/Vehicle Traffic

OSHA Equipment (29 CFR 1926.600)

OSHA Operator Training, Certification, and Evaluation (29 CFR 1926.1427)

Considerations for controlling the movement of personnel and equipment in a construction area are vitally important to any project, as injuries may occur while working with or adjacent to such equipment. This category includes all operations that utilize moving heavy equipment: excavators, loaders, graders, dozers, and delivery/supply trucks. Site workers will take every precaution necessary to ensure the safety of the public and the on-site personnel during traffic movement operations.

Site workers will adhere to all applicable standards and regulations while operating heavy equipment at the site. Operators will be trained and experienced in the use and maintenance of the equipment they are operating. Equipment will be inspected on a daily basis to identify any worn parts, and/or unsafe conditions. Any unsafe equipment will be removed from service until safety defects can be corrected. Equipment operators will not leave their machine unattended while it is running. Keys will be removed when equipment is not in use. All equipment will have electronic backup alarms. Each piece of equipment will be equipped with a minimum 5 lb. ABC fire extinguisher. No vehicles or equipment will be operated in a careless or unsafe manner. Personnel will wear high visibility reflective vests when working around equipment/vehicles. All personnel will stay a minimum of 4 ft clear of the operational area of the equipment.

During construction activities, it is often necessary to have a worker direct the operator. In these cases, close communication between the operator and the laborer is of critical importance. One designated person will give signals to the operator of both equipment and vehicles in the work area. Workers should not take any action unless they have made eye contact with the operator and clearly communicated their intentions. In addition, all machines will be equipped with back-up alarms, which are checked daily and repaired immediately. Truck traffic will be controlled by a competent flagger/spotter, as required.

4.5.3 Material Handling

OSHA Reference 29 CFR 1926.251

OSHA Electrical, Wiring design and protection (29 CFR 1926.404)

Various materials and equipment may be handled manually during project operations. Care should be taken when lifting and handling heavy or bulky items to avoid back and other joint injuries. At induction, the following fundamentals will be addressed in regard to the proper lifting techniques that are essential in preventing back injuries:

- The size, shape, and weight of the object to be lifted must first be considered. Multiple employees or subcontractors or the use of mechanical lifting devices are required for heavy objects.
- Based off the NIOSH Lifting Equation, the Occupational Safety and Health Administration (OSHA) recommends the weight limit for individual lifting be 50 pounds. When lifting

more than 50 pounds, it is recommended to use a lifting device or two or more people. Don't hold your breath while lifting.

- The anticipated path to be taken by the lifter should be considered for the presence of slip, trip, and fall hazards.
- The feet will be placed far enough apart for good balance and stability (typically shoulder width).
- The worker will get as close to the load as possible. The legs will be bent at the knees.
- The back will be kept as straight as possible and abdominal muscles should be tightened.
- Twisting motions should be avoided when performing manual lifts.
- To lift the object, the legs are straightened from their bending position.
- A worker will never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered. When two or more workers are required to handle the same object, workers will coordinate the effort so that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each worker, if possible, will face the direction in which the object is being carried. In handling bulky or heavy items, the following guidelines will be followed to avoid injury to the hands and fingers:
    - A firm grip on the object is essential; leather work gloves will be used unless it is a sharp object. If sharp, cut resistant gloves will be used.
    - The hands and object will be free of oil, grease, and water which might prevent a firm grip, and the fingers will be kept away from any points that could cause them to be pinched or crushed, especially when setting the object down.
    - The item will be inspected for metal slivers, jagged edges, burrs, and rough or slippery surfaces prior to being lifted.

4.5.4 Hand and Power Tools

Hand and power tools will be used for various site activities. Procedures for using hand and power tools are as follows:

- Persons using power tools will be trained in their use.
- Ground Faults must be present on all electrical tools.
- Only tools in good condition will be used.
- Tools will be kept clean.
- Guards and shields will be kept on all tools.
- Air couplings will be secured with pins or tie-wire.
- Non-sparking tools will be used in hazardous areas, i.e., where flammables may be present.
- Task specific eye protection is critical when using power tools. At a minimum, safety glasses will be required during site operations. If projectiles are possible, full-face shields will be utilized in addition to the glasses.

4.5.5 Noise Exposure

OSHA Electrical, Wiring design and protection (29 CFR 1926.404)

Noise is generated during construction activities in such operations as transportation of materials, operation of heavy construction equipment and other construction equipment, e.g., compressors. Noise has been defined as unwanted sounds. The human ear can tolerate a certain amount of sound without any harmful effects. The OSHA standard allows 90 dB (A) for a full 8 hours and for a lesser time when the levels exceed 90 dB (A). It is usually safe to assume that if you need to shout to be heard at arms-length, the noise level is at 90 dB (A) or above. Hearing protection will be utilized by personnel operating or working around construction equipment or power tools or in marked and designated areas.

4.5.6 Excavation Safety/Protection of Underground Facilities

OSHA Specific Excavation Requirements (29 CFR 1926.651)

OSHA Requirements for Protective Systems (29 CFR 1926.652) Pipeline Awareness Color Code Chart

This section outlines the basic hazards associated with excavation. Section 13 of CMI's Corporate Health & Safety Manual, incorporated by reference in *Attachment 6* of this SSHASP, provides detailed procedures for excavation and trenching safety.

A competent person will be assigned for each excavation. The competent person will be trained and capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees or subcontractors. The competent person will have the ability and authority to take prompt corrective measures to eliminate these conditions. The competent person will perform the following:

1. Have a complete understanding of the applicable safety standards and any other data provided.
2. Assure the proper locations of underground installations or utilities, and that the proper utility companies have been contacted.
3. Conduct soil classification tests and reclassify soil after any condition changes.
4. Determine adequate protective systems (sloping, shoring, or shielding systems) for employee protection.
5. Conduct all air monitoring for potential hazardous atmospheres if anticipated. Conduct daily and periodic inspections of excavations and trenches. Approve design of structural ramps, if used.

Prior to beginning any excavation work with mechanical equipment, the site must be marked out by the facility owner in compliance with NYS Industrial Code 753. The Site Superintendent will call in for marks At least **2 to 10 working days prior** to any mechanized work (does not include the date of the call) notice must be provided to the One-Call Notification System, which will transmit the project information to involved members so that they can mark the location of any facilities at the excavation site. Call for remarks every 10 days thereafter. The One Call Number inside New York State is 811 or 800-962-7962. Notification of cancellations must be made no later than the day of the scheduled work and no earlier than 24 hours before the scheduled work date. Confirmation numbers will be kept by the Project Manager in the main office on a running log. Dig Safely New York currently allows excavators to submit Survey and Design Requests via Exactix or by calling the operations center at 1-800-962-7962.

Callers must still contact the affected companies directly; however, Dig Safely New York will identify those affected companies and inform them of the design request, and provide the caller with a contact number for those affected companies. These contacts are often engineering departments that may be able to supply "as-built" maps and charts, which are more accurate.

Utility installations, such as sewer, telephone, fuel, electric or water line, etc. that may be encountered during excavation work must be delineated prior to opening an excavation and protected, supported, removed, or relocated as per standards, as directed by the on- site Representative, and as necessary to safeguard workers while the excavation is open.

The primary hazard encountered during soil excavation is the cave in of excavation sides with possible burial or crushing of workers. Causes of cave-ins may include: (a) absence of shoring, (b) misjudgment of stability, (c) defective shoring, and (d) undercut sides. Other potential hazards include falling during access/egress, while monitoring or dismounting equipment, or stumbling into excavation. An overhead hazard can result from material, tools, rock, and/or soil falling into the excavation. When applicable, adequate shoring or sloping of sides of the excavation will be provided. Excavation/trenches will be inspected daily for changing conditions.

Excavation spoils will be kept at least 2 feet from the sides of trenches. Excavation/trenches will be protected to avoid the possibility of someone falling into them. The use of raised berms, caution signs and caution tape will be instituted to protect both the public and other personnel on the site. The excavation area will be delineated with caution tape during operations and barricaded/secured with safety fence at the end of each workday. Adequate means of exit, such as ladders, steps, ramps, or other safe means of egress, will be provided and be within 25 feet of lateral travel.

Where personnel are required to enter excavations over 4 ft in depth, sufficient stairs, ramps, or ladders will be provided to require no more than 25 ft. of lateral travel. At least two means of exit will be provided for personnel working in excavations. Where the width of the excavation exceeds 100 ft. two or more means of exit will be provided on each side of the excavation.

Adequate precautions will be taken to avoid creating hazards due to accumulating water. Surface water will be diverted to prevent it from entering the excavation. Site personnel will not be allowed to work in excavations with accumulating water unless specific measure is taken to correct conditions. The competent person will monitor conditions and assure adequate measures are taken.

Support systems such as shoring, bracing, or underpinning will be used to assure the stability of adjacent structures, sidewalks, and pavements to protect site personnel.

Barricades, guardrail systems, fences or similar equipment will be used to guard open excavations that are over 6 feet in depth to protect site personnel from falls.

Not expected for this project, however, for trenches over 20 feet in depth a shop drawing and design calculations, certified by a Professional Engineer, will be provided.

4.5.7 Slips/Trips/Falls

OSHA Walking-Working Surfaces (29 CFR 1910.28) OSHA Fall Protection (29 CFR 1926, Subpart M)

Slip/trip/hit/fall injuries are among the most frequent of all injuries to workers. They occur for a wide variety of reasons, but all injuries can be prevented by the following prudent practices:

- Spot-check the work area to identify hazards.
- Establish and utilize a pathway, which is most free of slip and trip hazards.
- Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain.
- Carry only loads, that you can see over.
- Keep work areas clean and free of clutter, especially in storage rooms and walkways.
- Communicate hazards to on-site personnel
- Secure all loose clothing, ties, and remove jewelry while around machinery.
- Report and/or remove hazards.

- Keep a safe buffer zone between workers using equipment and tools

Fall protection is required at elevations of **6 ft. or greater**. Examples of areas where employees or subcontractors may have to be protected include but are not limited to the following:

  - Leading edges
  - Hoist areas
  - Holes in walk surface
  - Framework and reinforcing
  - Ramps, runways, and other walkways
  - Excavations
  - Working over dangerous equipment/water
  - Roofing work on low or steep sloped roofs
  - Precast concrete construction
  - Wall openings
  - Scaffolds
  - Aerial lifts

4.5.8 Confined Spaces

OSHA Confined Spaces in Construction (29 CFR 1926, Subpart AA)

A Confined Space is a space that is large enough and so configured that an employee can bodily enter and perform assigned work and has limited or restricted means for entry or exit (i.e., tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry/egress) and is not designed for continuous employee occupancy. Entry means the action by which a person passes through an opening into a confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon **as any part of the entrant's body breaks the plane of an opening into the space**.

Concrete vaults, RPZ drains, and basins are potential confined spaces. In the event that site personnel are required to enter a confined space, the confined space procedures in Section 12 of CMI's Corporate Health & Safety Manual will be followed. Procedures include hazard assessment and control, permitting, training for personnel working on confined space entries, pre-job briefing, atmospheric testing and ventilation, personal protective equipment, rescue equipment and plans. A Confined Space Entry Permit form is provided in *Attachment 7*.

Copies of personnel training records, rescue equipment/procedures and proof of rescue arrangements will be submitted to CMI's SSO prior to all confined space entries.

The following personnel and roles will be assigned to each confined space entry:

1. **Entry Superintendent:** CMI employees or subcontractors or contractors assigned to entry Superintendent duties must be trained and qualified in CMI confined space procedures. Certification of training in hazardous atmosphere testing equipment must be obtained.
2. **Attendant (Safety Observer):** The attendant (safety observer) must be trained, qualified, and designated by to perform the duties of an entry attendant. Note: One attendant is typically required for each specific confined space; attendants are not authorized to attend multiple confined space entries unless specific provisions are made prior to entry.

3. **Authorized Entrants:** Entrants into confined space must be trained, qualified, and authorized.

DUTIES OF ENTRY SUPERINTENDENT:

1. The Entry Superintendent must know the hazards faced during entry, including information on the mode, signs, and symptoms and consequences of exposure. An SDS or similar written material must be kept at the work site for any material to which the authorized entrant may be exposed.
2. The Entry Superintendent must verify that the appropriate entries have been made on the confined space entry permit and that all specified tests have been conducted.
3. Verifies, by checking, that all procedures and equipment specified by the permit are in place, before signing the permit and allowing entry.
4. Terminates the entry and cancels the permit if the confined space hazard or conditions outside the confined space pose a hazard to the entrants.
5. Verifies that rescue services are available and that the communication with rescue services is readily available.
6. Removes unauthorized individuals who enter or who attempt to enter the confined space.
7. Reviews the confined space operation at intervals dictated by the hazard and the operation to ensure compliance with this policy.
8. Determines when responsibility for a permit space entry operation is transferred.
9. Reviews the permit-required confined space work, prior to commencement with the attendant and entrants.
10. Designates qualified individuals to act as entrants and attendants.
11. Monitor the space and inform the entrants of the potential hazards and results; they must participate in the permit review and signing. Ventilation must be used & testing must be conducted before entry & during work.

DUTIES OF ATTENDANT:

1. The attendant must know the hazards that may be faced during entry, including information on the mode, signs, symptoms, and consequences of exposure.
2. An attendant must be on duty outside the confined space for the duration of entry operations.
3. The attendant must be aware of possible behavioral effects of hazard exposure in authorized entrants.
4. The attendant must maintain an accurate count of authorized entrants in the permit space and ensure that the entrants are properly identified and authorized on the permit.
5. The attendant must ensure, by head count, that all authorized entrants have departed the confined space prior to closing out the permit or departing the confined space.
6. The attendant will contact emergency responders utilizing 9-1-1 if the attendant feels the entrants may need assistance to escape from hazards or may have displayed the effects of the hazards of the confined space.
7. The attendant will prevent unauthorized entry to the confined space.
8. The attendant will not attempt to rescue by entry into the confined space. Non-entry rescue attempt only is allowed.
9. The attendant will not vacate the area, for any reason, or perform any duty, which would prevent or inhibit the ability to communicate with the entrants.
10. The attendant will evacuate the confined space if:

a. The attendants detect a condition outside (i.e., an alarm, leak, etc.) which may endanger the entrants or any alarm condition on continuous monitoring equipment
b. The attendant detects a behavioral or symptomatic change in the entrant(s).
c. The attendant must leave the site or cannot comply with all the duties listed in this section.
d. The attendant cannot effectively communicate with the entrants.
e. The attendant is advised to vacate the confined space by a client representative or CALDWELL MARINE Superintendent.
f. The attendant determines that the entrant (s) is (are) not complying with personal protective equipment practices or safe work practices.

DUTIES OF THE AUTHORIZED ENTRANT:

1. The authorized entrant must know the hazards that may be faced during entry, including information on the mode, signs and symptoms and consequences of the exposure.
2. Properly use protective equipment and monitoring devices as specified.
3. Establish and maintain open communications with the attendant.
4. Alert the attendant if the entrant detects a prohibited or hazardous condition.
5. Alert the attendant and other entrants if the entrant notices any warning sign or change in behavior or symptom of exposure in any other entrant. The entrant will notify the entry Superintendent of the condition changes. The Superintendent will then cancel the existing permit and re-evaluate the space.
6. The entrant will immediately take action to evacuate the confined space if the entrant:
    a. Is directed to do so by the attendant, entry Superintendent or designated client representative.
    b. Detects a failure to comply with personal protective equipment requirements.
    c. Is unable to maintain effective communication with the attendant.
    d. Detects any alarm on continuous monitoring equipment.

A Confined Space Entry Permit (*Attachment 7*) will be completed as needed.

4.5.8.1 Permit Required Confined Space Preparation for Entry:

A. Isolation: The confined space must be removed from service and completely protected against the release of energy and material into the space.
B. All energy sources must be locked out.
C. All lines, pipes, hoses, intake vents, ducts, etc., leading to or from the confined space must be broken away in a manner which would prevent intake or through put of hazardous materials or energy: blanked, blinded, or sections removed.
D. Rotating equipment must be de-energized and locked out.
E. The confined space must be purged, flushed, ventilated, cleaned or inert to eliminate or control the hazardous atmosphere (Note: Inert Atmospheres create a hazard by displacing oxygen with an inert. Special care and ventilation prior to testing and entry must be exercised prior to entry. A SDS must also be provided and kept at the site for chemical- cleaning agents used in confined spaces. Confined spaces purged with steam or cleaned with hot water must be allowed time to cool to acceptable levels prior to the onset of entry).
F. Barriers to prevent pedestrian or vehicle entry, which could pose a hazard to entrants, must be erected.

G. Determine if the cover (if any) can be safely removed by the following:
    1. Conduct exterior visual examination for existence of hazards, i.e., liquid, etc.
    2. Test the atmosphere around the cover to determine the presence of hydrocarbons or toxic vapors.
    3. Slowly open the cover to ensure no existence of pressure, fluids, etc. If possible, atmospheric testing should be conducted.
    4. Remove cover and visually inspect from the outside for the presence of hazards.
    5. Conduct atmospheric testing in this exact manner

    (**Note:** Ventilation systems must be off for a minimum of 30 minutes prior to testing):

    a. Test atmosphere outside of confined space for oxygen content.
    b. Test atmosphere inside of confined space for oxygen content.
    c. Compare reading, a difference of –1% oxygen content inside of the confined space may represent 10,000 PPM or a toxic material.
    d. Oxygen content must be above 19.5% and below 23.5% for entry.
    e. Test for combustible gases must be below 2% LFL for entry.
    f. Test for toxic gases or vapors must read 0 Parts Per Million (PPM)
    g. If testing falls outside of the parameters established above, a permit cannot be issued without elimination of hazard and retest.
    h. Entrants or their representatives are to be given an opportunity to review and participate in the review and calibration of air monitoring data before entering.
    i. Entrants must also be given the opportunity to participate in the permit review and signing.

H. Designate attendant and entrants as described in this procedure.

I. Provide all personal protective equipment.

J. Provide ventilation, (Refer to Section on Welding and Burning).

K. All lighting and electrical tools used in confined spaces must be connected to GFCI or reduced to 12 volts

L. All air-operated tools must be connected to breathing air quality air sources.

M. Discuss job requirements, emergency procedures and hazards with entrants, attendants, and client-designated representatives. Secure / issue proper confined space entry permit and appropriate work permit for confined space work (if required by client). Note: In spaces where multi employers are working in the same space, all of the above information will be discussed with those individuals entering the space and information gathered/discussed as to their purpose of entering the space. If for any reason it would increase the hazards to employees or subcontractors entering the space an effort to schedule different entry periods will be made.

N. Post copies of the permits; permit required confined space entry procedure, SDS and emergency procedures plan at the work site.

O. A permit required confined space may be declared and certified as a non- permit required confined space by following the procedures outlined in the Non-Permit Required Confined Space Procedure.

P. Periodic hazardous atmosphere monitoring will be conducted and logged on the confined space entry permit form.

Q. If the confined space is vacated, unattended, or recovered, visual inspection and re-testing of the space for hazardous atmosphere must be conducted.

R. CAUTION:

1. Hazards, such as welding fumes, electrical shock, flammable and toxic vapors, may be introduced to the confined space by work in the confined space.
2. Welding and cutting torches may not be left on and unattended. The source must be isolated prior to departing the confined space.
3. Adequate ventilation must be provided for welding, cutting, and burning work inside of confined spaces.

Employees or subcontractors or their representatives are entitled to request additional monitoring at any time.

RESCUE EQUIPMENT/PROCEDURES:

CMI uses a tripod retrieval device in which the employee entering the space is “tied in” with a harness and lanyard system. The individual can be retrieved from the space by cranking the retrieval arm, therefore, hoisting the individual from the space. Under no circumstances is an individual to go inside the space to retrieve an individual. Typically, the space can be illuminated with flashlights carried by the occupying party. If not possible, other lighting arrangements will be made.

It should be noted that every time the individual leaves the confined space, testing procedures for the reentry must take place before the individual re-enters the space. These occurrences are to be documented as part of the entry permit and times including atmospheric readings are to be recorded.

The following equipment is to be provided to the crew:

- Testing and monitoring equipment including multi-gas detector (minimum: LEL/O2/CO/H2S) needed to determine if hazardous condition exist.
- Ventilation equipment to maintain gas and particulates below occupational exposure limits.
- Communication between personnel involved in the entry operation.
- Personal protective equipment insofar as feasible engineering and work practice controls does not adequately protect employees or subcontractors.
- Lighting equipment needed to enable employees or subcontractors to see well enough to work safely and to exit the space quickly in an emergency. Barriers and shields as required protecting the workers from pedestrian and vehicular traffic.
- Ladders, needed for safe ingress and egress by authorized entrants.
- Rescue, Retrieval and Emergency equipment needed to extract or treat injured personnel, except to the extent that the equipment and or service are provided by rescue services that are immediately amiable.
- Any other equipment necessary for safe entry into and rescue from permitted spaces at our facility.
- Other equipment: Air Compressor (as required); Air Purifying Respirators (as required); Body Harness; Emergency escape breathing apparatus (as needed); Escape ladders for depths of 4 ft. or below; Extraction cable and lanyards; eye protection equipment; first aid kits; hand tools; head protection equipment; hearing protection equipment; Intrinsically safe lighting equipment (if in potential flammable/combustible atmosphere); lock out/tag out equipment (as required); Personal Protective clothing.

Arrangements will be made with public or private rescue services prior to beginning any permit required confined space work.

4.5.8.2 Non-Permit Required Confined Space Entry Procedure

Determination of Permit-Required or Non-Permit Required Confined Space: For permit-required confined spaces, CMI must ensure that all exposed employees or subcontractors are made aware by posting signs or by any other effective means, of the existence and location of the danger posed by the permit-required space.

CMI employees or subcontractors must consider all confined spaces meeting the definition of a confined space as a permit-required confined space, until a determination has been made by a trained, competent entry Superintendent or CMI SSO.

CMI employees or subcontractors will not enter the confined space until a determination has been made. Certification of non-permit required confined space determination will be provided to the CMI, employees or subcontractors assigned to enter and must be kept at the job site.

Under no circumstances will CMI, employees or subcontractors enter a Permit-Required Confined Space without a properly issued permit for entry. Work will not begin in the permit-required confined space until additional permits, e.g., hot work, have been issued.

The following steps must be taken, and the attached form be completed in determining the status of the confined space by the CMI Entry Superintendent.

1. Entry covers must be safely removed.
2. A visual inspection, if possible, without entry must be performed to establish the absence of recognized hazards.
3. Install proper railing or temporary barrier that will prevent accidental fall through the opening.
4. Test internal atmosphere with a calibrated direct reading instrument for the following conditions.
5. NOTE: AIR MOVERS MUST BE TURNED OFF DURING ATMOSPHERIC TESTING AND THE TESTING MUST BE ACCOMPLISHED IN THE EXACT ORDER PRESENTED BELOW.
   a. Oxygen content – must be above 19.5% and below 23.5%.
   b. Test for flammable gases and vapors – must be below 10% flammable limit (LFL).
   c. Visually ascertain that no airborne combustible dust is present.
   d. Test for the presence of H_2S or other toxic contaminants.
   e. If you are in doubt of results, contact CMI SSO for further instructions

The CMI Entry Superintendent must complete the attached form and leave the form at the work site. In the event that multiple sites are involved, each site must be tested, and the results posted on the attached forms.

Ladders must be provided for egress and entry.

Coordinating entry operations for multi employers so that employees or subcontractors of one employer do not endanger the employees or subcontractors of any other employer.

A safety observer (attendant) must be assigned with clear communications capability with the non-permit confined space entrants. THE ATTENDANT WILL NOT ATTEMPT TO RESCUE ENTRANTS WITHIN THE CONFINED SPACE BY ENTERING INTO THE CONFINED SPACE.

The attendant must be knowledgeable of how to summon emergency response personnel.

Non-Permit Required Confined Spaces that are vacated for a period of 1 hour, suspended for any purpose, or suspected to have any change in atmosphere or condition, must be re-tested and the results annotated on the attached form.

Non-Permit Required Confined Spaces must be periodically monitored for changes in conditions by the Entry Superintendent.

Reviews of the permit space program, using the canceled permits retained for at least one year after each entry and revise the program as necessary, to ensure that employees or subcontractors are protected.

Failure of any re-test or changes in condition requires reclassification of the confined space as a Permit-Required Confined Space and must be noted on the attached form.

4.5.9 Welding and Cutting

OSHA 1926 Subpart J - 1926.350 Gas Welding and Cutting

OSHA 1926 Subpart J - 1926.351 ARC Welding and Cutting

OSHA 1926 Subpart J - 1926.352 Fire Prevention

OSHA 1926 Subpart J - 1926.353 Ventilation & Protection in Welding, Cutting and Heating

OSHA 1926 Subpart J - 1926.354 Welding, Cutting and Heating in Way of Preservative Coatings

Welding and cutting may be performed during the course of the project. When performed, the following requirements will be followed:

A. Fire Prevention:
   1. Objects to be welded, cut, burned, or heated should be moved to a designated safe location when practical.
   2. First aid equipment will be available at all times.
   3. If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guard’s shields, fire blankets, etc. will be used to confine the heat, sparks, and slag and to protect the immovable fire hazards. Welding, cutting, burning, or heating operations must not be performed where the application of flammable paints, compounds or heavy dust accumulation will present a hazard.
   4. The proper fire extinguishing equipment and fire watch must be in place prior to the onset of work.
   5. Gas supplies to torches must be shut off at a point, (preferably the source) outside of confined spaces.
   6. Torches and hoses must not be left in confined spaces and excavations overnight.
   7. Welding and cutting on used drums are prohibited unless the drums have been properly cleaned and purged of hazardous materials.
   8. Hollow spaces, cavities and containers must be vented and purged with an inert gas before preheating, welding, or cutting.
   9. In areas where either a flammable atmosphere or combustible materials may be present fire watch will be designated and will remain at the operation, plus a ½ hour after completion The fire watch is required during the following:
      a. Locations where other than a minor fire might develop.

b. Combustible materials closer than 35ft. (10.7M) to the point of operation.
c. Combustibles that are 35ft. (10.7M) or more away but are easily ignited.
d. Wall or floor openings within 35ft. (10.7M) radius expose combustible materials.
e. Combustible materials are adjacent to the opposite side of metal partitions, ceilings, or roofs.

Note 1. All persons performing fire watch duties will be trained in the proper use of fire extinguishing equipment and general fire watch duties.

Note 2. If the area has the potential for a flammable or explosive atmosphere LEL readings will be continuously monitored with a pre-calibrated instrument for that purpose.

Note 3. If fire hazards cannot be moved or guarded, welding and cutting operations will NOT be performed.

10. Hot work permits (*Attachment 8*) will be required for all burning, cutting, and welding operations by the Superintendent or designated SSO. A copy of the permit is attached to the end of this section.

B. Gas Welding, Cutting, and Burning:

1. When transporting gas cylinders, they must be secured on a cradle.
2. The cylinders must be secured and transported in a vertical position with the valve protective caps in place.
3. Unless cylinders are firmly secured on a special carrier intended for the purpose, regulators must be removed, and protective caps must be in place prior to movement.
4. An approved cylinder truck or chain must be sued to steady the cylinders while in use or storage.
5. The cylinder valve may be opened only when work is being performed.
6. All gas cylinders must be kept away from the actual welding or cutting operation and protected from sparks, hot slag, or flames.
7. Cylinders may not be placed where they may become a part of an electrical circuit.
8. Oxygen cylinders must be stored in an upright position, with regulators removed and safety caps installed.
9. Oxygen cylinders must be separated from fuel cylinders by a minimum of 20 feet.
10. All cylinders must be properly labeled with content and hazard warnings.
11. Cylinders must have fixed had wheels, keys, handles or a non- adjustable wrench on the valve stem.
12. Acetylene cylinders must never be opened more than 1 and 1/2 turns of the spindle
13. Before connecting a regulator to a cylinder valve, crack the valve open slightly and close to ensure tight stop and no leakage. Do not stand in front of the valve when opening.
14. Fuel gas hose and oxygen hose must be easily distinguishable from each other. (Red hose for fuel gases, green hoses for oxygen and non-combustible gases black hose for inert gas and air).
15. All regulators, hoses, and valves must be kept free and clear of oil and other materials.
16. Parallel sections of oxygen and fuel hose that have been taped together must be taped with not more than 4 inches of tape each 12 inches.

17. Hoses in with noticeable or suspected defect must not be used.
18. All hoses, cables and other equipment must be kept clear of walkways and roadways.
19. Torches must be inspected each day for leaking shut off valves, hose couplings and tip connections.
20. Torches may be lit by friction lighters only.
21. All gauges, valves and pressure regulators must be in proper working order.
22. Cutting, welding, and burning may not be performed on surfaces with protective coatings applied without proper breathing zone ventilation or appropriate respiratory protection.
23. Proper protective equipment must be worn when performing welding, cutting, or burning.
24. Hoses must not be wrapped around an individual’s body.
25. Workers in charge of oxygen or fuel-gas supply equipment (including distribution piping systems and generators) must be instructed and judged competent for such work.

C. Arc Welding and Cutting

1. Employees or subcontractors assigned to operate arc welding equipment must be properly instructed and qualified to operate such equipment.
2. SDS for welding rods must be available in the CMI HAZCOM program.
3. Positive ventilation must be provided when welding and cutting are performed in a confined space, or respiratory protection must be provided. Proper ventilation or respiratory protection procedures must be used when evolution of hazardous fumes, gases, or dust is possible.
4. All ground connections will be inspected to ensure that they are mechanically sound and properly rated for the required current.
5. A ground return cable must have a safe current carrying capacity equal to or exceeding the specified maximum output of the arc- welding unit.
6. The frames of all arc welding machines must be grounded either through a third wire in the cable containing the circuit conductor or through a separate wire that is grounded at the source of the current.
7. Gasoline or propane fueled portable welding machines and auxiliary generators must have a positive ground before placing them in service.
8. Arc welding and cutting operations with must be screened with non- combustible or flameproof screens wherever possible.
9. Use only manual electrode holders specifically designed for arc welding and cutting.
10. All current carrying parts must be fully insulated against the maximum voltage encountered to ground.
11. All arc welding cables must be capable of handling the maximum current requirements of the work being accomplished.
12. Cables must be equipped with standard insulated connectors of a capacity at least equivalent to that of the cable.
13. Proper eye and face protection must be used when performing arc welding or cutting.

Note 1. All employees or subcontractors assigned arc welding and cutting duties must be familiar with 29 CFR 1910.254, 29 CFR 252 (a), (b) and (c), and with fire prevention and protection, health protection and ventilation, and protection of personnel.

Note 2. Operators of equipment should report any equipment defect or safety hazards and discontinue use of equipment until its safety has been assured. Repairs will be made only by qualified personnel.

Note 3. Burners, welders and fire watch personnel should be licensed in accordance with jurisdiction of authority.

4.5.10 Weather & Lightning

OSHA Emergency Action Plans 1926 Subpart C 1926.35

OSHA Emergency Preparedness

OSHA Lightning Safety

OSHA Tornado Preparedness and Response

The procedures provided below will be used to protect site personnel from weather and lightning related injuries.

CMI will consult the publicly available weather forecasts on a daily basis for the operation. Estimated operational limits for specific phases are shown in Table 7-1 of the Installation Manual. Lightning Safety Procedures are provided in *Attachment 12*.

Training

During one of the daily safety meetings weather emergencies will be discussed. This will be done to increase awareness to the hazards and prevention of weather and lightning related incidents.

Detection of Lightning

The Site Superintendent will be proactive in monitoring conditions that may produce thunderstorms and lightning. The weather forecast will be tracked and communicated to site personnel as often as necessary. When signs of impending storms, i.e., increasing wind, darkening skies, or lightening appear, local weather monitoring will be increased. The National Weather Service (www.nws.noaa.gov/) should be consulted frequently. Personnel will be notified when thunderstorms may impact the site.

The "flash/bang" (f/b) technique of measuring the distance to lightning will be reviewed with all personnel. The f/b technique is defined as: for each five seconds from the time of observing the lightning flash to hearing the associated thunder, the lightning is approximately one mile away.

Suspension/Resumption of Activities

All outside activities will be suspended when a lightning flash is immediately in the area, or a f/b of 20 seconds (4 miles away) is noted. Personnel may continue indoor work activities. Outdoor activities will resume when 30 minutes have passed since the last observable f/b is 20 seconds or greater.

Lightning Protection

When notification is given, all outside work activities will stop and personnel will gather in the support area for a head count and further instructions. Indoor work will continue, except for the use of electrical equipment, telephones, and computers. When a safe location is not present and personnel are caught by a sudden lightning event, employees or subcontractors should seek the lowest possible area, away from large objects which might attract lightning or fall over, e.g., trees, utility poles. The employee should assume a crouching position with their head lowered and hands over their ears. AVOID: WATER, HIGH GROUNDS, HEAVY EQUIPMENT AND TALL, ISOLATED OBJECTS.

First Aid

An employee that is struck by lightning needs immediate medical assistance (call 911). The body will not carry an electrical charge but receives a severe electrical shock and may be burned. Personnel certified in first aid/CPR should inspect for shock and burns around fingers, toes, buckles, and jewelry. Stay with the injured employee until medical help arrives.

4.5.11 Fires

If required, the SSO will establish areas approved for welding, cutting, and other hot work. Hot work must comply with the following Hot Work Procedures. A Hot Work Permit will be obtained from the SSO, if required. All personnel will be protected from welding radiation, flashes, sparks, molten metal, and slag. All welding, burning, and cutting equipment will be inspected daily by the operator. Defective equipment will be tagged and removed from service, replaced, or repaired, and re-inspected before being placed back in service. All welders will be properly trained in the safe operation of their equipment, safe welding/cutting practices, and welding/cutting respiratory and fire protection.

Where practical, all combustible material will be relocated at least 35 feet away from the hot work site. Where relocation is impractical, combustibles will be protected with flame proofed covers or otherwise shielded. At a minimum, two fully charged and operable fire extinguishers, appropriate for the type of possible fire (e.g., 10 lb. ABC), will be available at the work area. A fire watch will be required whenever hot work is performed and a minimum of 30 minutes after hot work is complete.

A hot work permit will be completed by the SSO, reviewed with personnel who will perform the hot work, and posted near the work area. The hot work permit is good only for the date issued and is valid only for the eight-hour shift for which it is issued. If at any time during the hot work operation a change in conditions at the work site is suspected, such as a release of flammable gases or vapors in the work area, work will be stopped immediately and the SSO will be notified. Such work stoppage invalidates the hot work permit, and a new permit will be completed after inspections and tests have been performed by the SSO.

4.5.12 Dust Control

Control measures will be implemented for all operations where dust is likely to be generated. Careful planning and implementation of controls will reduce potential dust emissions. There are a number of possible construction practices which will reduce levels of airborne particulates. These include:

- Providing for a misting spray during excavation activities.
- Applying water on and sweeping haul roads.
- Spraying mist on buckets during material handling and dumping.
- Hauling materials in properly tarped or watertight containers.
- Reducing the active work area surface and limiting the number of concurrent operations.
- Avoiding dry sweeping.

4.5.13 Noise Control

Noise levels will be controlled to meet applicable OSHA standards for workers. Applicable noise ordinances will be observed nearby residents and off-site community.

5. Safety Training and Education

5.1 OSHA Training

All site personnel will have the required OSHA training pertaining to the work they are conducting. Copies of training certificates will be available upon request. The CMI Site Superintendent will have a minimum of the OSHA 30 Hour Construction training. All laborers will have a minimum of the OSHA 10 Hour Construction training.

Content for new hire and periodic training is outlined in Section 2.4 of this Plan.

All contractors and visitors at this site are expected to comply with all applicable government safety, health, and environmental regulations, as well as company policies. Worker protection standards include, but are not limited to:

OSHA Construction Standards (29 CFR 1926), such as:

- Subpart C - General Health & Safety Provisions
- Subpart D - Occupational Noise Exposure (1926.52)
- Subpart E - Personal Protective and Life Saving Equipment
- Subpart F - Fire Protection
- Subpart G - Signs, Signals and Barricades
- Subpart J - Welding & Cutting
- Subpart M - Fall Protection

Should there be a conflict between this plan and any of the above-mentioned standards, the more stringent provisions will be followed until a proper evaluation can be made to determine the appropriate course of action.

SITE SAFETY ORIENTATION:

All site personnel and visitors will be provided with a Site Safety Orientation when they arrive on site and before they enter a work zone. The Site Safety Orientation will be conducted by the SSO or designee and will be documented on the form in *Attachment 11*. The Site Safety Orientation will generally include an overview of the project, current activities, emergency procedures/evacuation routes, assembly areas and notification, PPE requirements, and general site rules.

5.2 Toolbox Safety Meetings

Site Safety Meetings, also called Toolbox Safety Meetings, will be presented to all site personnel just prior to the onset of each initial work activity and performed daily at the beginning of each shift. It will be the responsibility of the SSO or designated representative to conduct these meetings. Toolbox Safety Meetings are mandatory for all project personnel. At the conclusion of the meeting, each individual will be required to sign the Field Safety Meeting attendance log.

The SSO and SS will determine the topics based on activities to be conducted that day and any incidents or items identified during previous days. These topics will include, but are not limited to, PPE requirements, chemical hazards, physical hazards, emergency procedures, weather concerns (if applicable), injury/incidents and trends, and any other special considerations.

6. Personal Protective Equipment

OSHA Personal Protective Equipment

The SSO will assure personal protective equipment is regularly inspected by the user (e.g., before each use) and in accordance with manufacturers' recommendations. Equipment that fails inspection will be removed from service immediately and replaced with equivalent equipment.

Site personnel wearing protective equipment will be trained in the proper use, inspection, and maintenance of the equipment.

Activities on this project have been assessed for PPE requirements. Minimum personal PPE on this site includes eye protection, work boots, hard hat, and reflective vest at all times. Specific requirements include:

- Hard hat
- Safety glasses with side shields
- Face shield (when exposed to projectiles)
- Safety work boots (e.g., composite toe)
- High visibility reflective warning vest
- Hearing protection (working around heavy/noisy equipment)
- Work gloves

The need for respirators will be assessed prior to exposure to dust producing materials, e.g., concrete/silica. Workers requiring use of respirators will be evaluated to assure they are medically cleared to wear respirators and fit tested to assure an effective seal. N-95 filtering facepiece respirators, where appropriate, will be used to minimize exposure. Respirators will be maintained, and filters will be changed as necessary to assure they remain effective in protecting site personnel.

Fall protection is required at elevations of 6 ft. or greater. Requirements for fall protection are listed in Section 4.2.7.

The SSO will ensure that each worker who is exposed to the hazards of flames (hot work) or electric arcs does not wear clothing that could increase the extent of injury. Flame retardant/resistant clothing will be designed and maintained in accordance with ASTM 1506 or NFPA 1975 requirements. Clothing made from the following types of fabrics, either alone or in blends, are prohibited: acetate, nylon, polyester, rayon. Proper inspection of PPE requires several steps depending upon specific type of PPE and its frequency of use. The different steps of inspection are as follows:

- Inspection and operational testing of equipment received from the factory or distributor.
- Inspection of equipment as it is issued to workers.
- Inspection before each use

- Inspection after use or training and prior to maintenance.
- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise.
- Inspection for tears and punctures.

7. Emergency Action Plan & Procedures

OSHA Emergency Action Plans (29 CFR 1910.38)

This section describes contingencies and emergency planning procedures to be implemented at the site. Attachment 10 of this plan includes Emergency Action Plans for the project.

Directions to the hospital will be posted on site when this SSHASP is in effect. Emergency procedures will be posted and covered in daily site briefings.

7.1 Pre-Emergency Planning

The Site Superintendent will ensure that the appropriate lines of communications have been established with local hospitals, government agencies and other emergency response organizations prior to site activities. Site workers and visitors will be notified of the emergency response plan, communication systems, and evacuation routes during orientation.

7.2 Personnel Roles and Lines of Authority

The Site Superintendent and SSO have primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measure to ensure the safety of site personnel and the public. Possible actions may involve evacuation of adjacent personnel. Additionally, they are responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow up investigation reports completed. All incidents involving injury to site personnel (beyond first aid), or the public and significant property damage will be reported to CMI management and Engineer in Charge within 8 hours of occurrence. Major incidents involving hospitalization or fatality will be reported immediately.

7.3 Emergency Contacts & Notification Systems

The following table provides names and telephone numbers for emergency contact personnel. It will be posted where the nearest phones are located. In the event of any emergency situation including but not limited to Fire, Medical, Haz Mat Spill, ETC. Emergency Services will be notified so the appropriate response personnel can be activated.

All incidents involving injury to site personnel (beyond first aid), or the public and significant property damage will be reported to CMI management, NKT and Engineer in Charge within 8 hours of occurrence. Major incidents involving hospitalization or fatality will be reported too all personnel listed above immediately. Initial Incident Investigation reports will be completed within 24 hours.

Organization/Responsibility	Contact	Telephone
Police	N/A	9-1-1
Fire	N/A	9-1-1
Hospital	See Emergency Action Plans	See Emergency Action Plans
US Coast Guard	VHF-FM Channel 16 (156.8 MHz), dial 911 Northern New England – Lake Champlain Emergency: (207) 767-0303 Sector New York – Hudson River Emergency: (718) 354-4353	
Project Manager	Greg Gashlin	(732) 557-6100
Site Superintendent	Ed Phillips	(732) 620-4906
Site Safety Officer	Lucky Abernathy	(908) 433-3755
Project Engineer	Derek Merz	(732) 557-6100

7.4 Emergency Equipment & Facilities

The following emergency equipment will be available:

- First aid kit
- Fire extinguishers near areas of welding and torch burning; outside flammable liquid storage areas
- Portable eye wash near any areas of chemical use or splashing
- Mobile phone and/or two-way radio
- Oil absorbing spill pads and booms

Successful communications between personnel on site is essential. The following communications systems may be used to communicate in the event of an emergency.

- Two-way radios on appropriate channel
- Air horns (see below)
- Cellular phone or hardwired phone

AIR HORN ALERTS:

Signal	Definition
One long blast	Attention
Two long Blasts	Leave when possible
Three long Blasts	Leave area IMMEDIATELY (EMERGENCY Situation)
Repeated Short Blasts	Send Backup Support

Fire and Other Emergency Events

WHEN A FIRE OR EMERGENCY EVENT IS DISCOVERED:

- Activate the nearest fire alarm (if installed) or sound the emergency signal on the project by **three long blasts** of the air horn.
- Notify the local Fire Department by calling 9-1-1. Notify your Superintendent immediately.

FIGHT THE FIRE ONLY IF:

- The Fire Department has been notified.
- The fire is small and is not spreading to other areas.
- Escaping the area is possible by backing up to the nearest exit.
- The fire extinguisher is in working condition and personnel have been trained to use it.

UPON BEING NOTIFIED ABOUT THE EMERGENCY, SITE PERSONNEL MUST:

Leave the affected area using the designated evacuation routes. Assemble in the designated area established in advance. Remain outside the affected area until the Superintendent and or designated authority announces that it is safe to reenter. The Superintendent or supervisor will account for all employees or subcontractors using the project's employee roster or attendance record to ensure all employees or subcontractors evacuated the area.

In the event an employee is unaccounted for, the emergency response agency will be notified of the missing employee.

7.5 Directions to Hospital

Emergency action plans (EAPs) with directions to the nearest hospital is displayed in *Attachment 4*. Copies of the map will be posted in the site trailer. The SSO or designated alternative will drive the hospital route before field activities begin to verify that the route is acceptable and unobstructed by other construction activities.

7.6 First Aid and Medical Attention

Medical personnel will be made available for advice and consultation on matters of occupational health and provisions will be made prior to beginning the project for prompt medical attention in case of serious injury.

First aid supplies will be available at the project trailer and made available as needed. The contents of the first aid kit will be in a weatherproof container with individual sealed packages for each type of item and will be checked before being sent out to the job site and at least weekly to ensure that the expended items are replaced.

A telephone for contacting necessary ambulance service will be provided.

A portable eye wash will be maintained in any area where employees or subcontractors may be exposed to corrosive materials or materials which could injure the eyes.

8. Fire Protection & Prevention

OSHA 1926 Subpart J - 1926.352 Fire Prevention

8.1 General Requirements

A fire protection program will be maintained throughout all phases of the project. Access to all available firefighting equipment will be maintained at all times and will be conspicuously located. All firefighting equipment will be periodically inspected and maintained in operating condition. Defective equipment will be immediately replaced.

A “NO SMOKING ON-SITE” policy is in effect on this site for all personnel. Failure to comply with this policy will result in action to assure that future non- conformances will not occur. There will be no designated smoking areas on the site.

8.1.1 Fire Extinguishers

A fire extinguisher, rated not less than 10B, will be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles. Travel distance from any point of the protected area to the nearest fire extinguisher will not exceed 100 feet and will be protected from freezing.

Portable fire extinguishers will be inspected periodically and maintained in accordance with Maintenance and Use of Portable Fire Extinguishers, NFPA No. 10 and OSHA 1926.150. Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory (e.g., UL, FM Global), will be used.

The Site Superintendent or designee will conduct a visual inspection of fire extinguishers on at least a monthly basis.

8.1.2 Fire Alarm Devices

An alarm system, e.g., cell phone, will be established on the site so the local fire department can be alerted for an emergency. Site personnel will be alerted via 3 long blasts on an air horn. The alarm code and reporting instructions will be conspicuously posted at phones and at employee entrances.

8.1.3 Ignition Hazards

Electrical wiring and equipment for light, heat, or power purposes will be installed in compliance with the requirements of OSHA 1910.26, Subpart K, Electrical.

Internal combustion engine powered equipment will be located so that the exhausts are well away from combustible materials.

Smoking will be prohibited at or in the vicinity of operations which constitute a fire hazard and will be conspicuously posted: "No Smoking or Open Flame."

Portable battery powered lighting equipment, used in connection with the storage, handling, or use of flammable gases or liquids, will be of the type approved for the hazardous location.

8.1.4 Open Yard Storage

Combustible materials will be kept stable and no higher than 20 feet. Method of piling will be solid wherever possible and in orderly and regular piles. No combustible material will be stored outdoors within 10 feet of a building or structure.

Driveways between and around combustible storage piles will be at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other articles or materials. Driveways will be so spaced that a maximum grid system unit of 50 feet by 150 feet is produced.

The entire storage site will be kept free from accumulation of unnecessary combustible materials. Weeds and grass will be kept down, and a regular procedure provided for the periodic cleanup of the entire area. When there is a danger of an underground fire, that land will not be used for combustible or flammable storage.

Portable fire extinguishing equipment, suitable for the fire hazard involved, will be provided at convenient, conspicuously accessible locations in the yard area. Portable fire extinguishers, rated not less than 2A, will be placed so that maximum travel distance to the nearest unit will not exceed 100 feet.

8.2 Flammable and Combustible Liquids

8.2.1 General Requirements

Only approved containers and portable tanks will be used for storage and handling of flammable and combustible liquids. Approved metal safety (e.g., UL, FM Global) cans will be used for the handling and use of flammable liquids in quantities greater than one gallon, except that this will not apply to those flammable liquid materials which are highly viscid (extremely hard to pour), which may be used and handled in original shipping containers. For quantities of one gallon or less, only the original container or approved metal safety cans will be used for storage, use, and handling of flammable liquids.

Flammable or combustible liquids will not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

8.2.2 Storage Outside Buildings

Storage of containers (not more than 60 gallons each) will not exceed 1,100 gallons in any one pile or area. Piles or groups of containers will be separated by a 5-foot clearance. Piles or groups of containers will not be nearer than 20 feet to a building.

Within 200 feet of each pile of containers, there will be a 12-foot-wide access way to permit approach of fire control apparatus.

The storage area will be graded in a manner to divert possible spills away from buildings or other exposures or will be surrounded by a curb or earth dike at least 12 inches high. When curbs or dikes are used, provisions will be made for draining off accumulations of ground or rainwater, or spills of flammable or combustible liquids. Drains will terminate at a safe location and will be accessible to operation under fire conditions.

Outdoor portable tank storage:

i. Portable tanks will not be nearer than 20 feet from any building. Two or more portable tanks, grouped together, having a combined capacity in excess of 2,200 gallons, will be separated by a 5-foot-clear area. Individual portable tanks exceeding 1,100 gallons will be separated by a 5- foot-clear area.

ii. Within 200 feet of each portable tank, there will be a 12-foot-wide access way to permit approach of fire control apparatus.

Storage areas will be kept free of weeds, debris, and other combustible material not necessary to the storage.

Portable tanks, not exceeding 660 gallons, will be provided with emergency venting and other devices, as required by chapters III and IV of NFPA 30-2018, The Flammable and Combustible Liquids Code.

Portable tanks, in excess of 660 gallons, will have emergency venting and other devices, as required by chapters II and III of The Flammable and Combustible Liquids Code, NFPA 30-2018.

At least one portable fire extinguisher having a rating of not less than 20-B units will be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.

At least one portable fire extinguisher having a rating of not less than 20-B:C units will be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.

8.2.3 Dispensing Liquids

Areas in which flammable or combustible liquids are transferred at one time, in quantities greater than 5 gallons from one tank or container to another tank or container, will be separated from other operations by 25-feet distance or by construction having a fire resistance of at least 1 hour. Drainage or other means will be provided to control spills. Adequate natural or mechanical ventilation will be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.

Transfer of flammable liquids from one container to another will be done only when containers are electrically interconnected (bonded).

Flammable or combustible liquids will be drawn from or transferred into vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self-closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited.

The dispensing units will be protected against collision damage. Dispensing devices and nozzles for flammable liquids will be of an approved type.

8.2.4 Handling Liquids At Point of Final Use

Flammable liquids will be kept in closed containers when not actually in use.

Leakage or spillage of flammable or combustible liquids will be disposed of promptly and safely.

Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation unless conditions warrant greater clearance.

8.2.5 Service and Refueling Areas

Flammable or combustible liquids will be stored in approved closed containers, in tanks located underground, or in aboveground portable tanks.

The tank trucks will comply with the requirements covered in the Standard for Tank Vehicles for Flammable and Combustible Liquids, NFPA No. 385- 2022.

The dispensing hose will be an approved type, and the dispensing nozzle will be an approved automatic-closing type without a latch-open device.

Clearly identified and easily accessible switch(es) will be provided at a location remote from dispensing devices to shut off the power to all dispensing devices in the event of an emergency.

Heating equipment of an approved type may be installed in the lubrication or service area where there is no dispensing or transferring of flammable liquids, provided the bottom of the heating unit is at least 18 inches above the floor and is protected from physical damage.

Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, will be of an approved type for garages, and will be installed at least 8 feet above the floor.

There will be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting smoking will be posted.

The motors of all equipment being fueled will be shut off during the fueling operation.

Each service or fueling area will be provided with at least one fire extinguisher having a rating of not less than 20-B:C located so that an extinguisher will be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service area

9. Security, Illumination, and Housekeeping

OSHA General Duty Clause

9.1 Illumination

Site operations will cease in time to permit personnel to exit the work area and secure the site prior to dusk. Conversely, operations will not begin until lighting is adequate at dawn. If work schedules require work outside of these parameters, then portable light plants sufficient to provide adequate lighting will be provided. (Headlights from vehicles and equipment generally do not provide sufficient illumination to conduct work safely.)

Construction areas, ramps, runways, corridors, offices, shops, and storage areas will be lighted to not less than the minimum illumination intensities listed in the Table below.

MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-Candles	Area of Operation
5	General construction area lighting.
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exit ways.
5	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights will be acceptable for use in the tunnel heading)
7	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active storerooms, mess halls, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

For areas or operations not covered above, refer to the American National Standard A11.1- 1965, R1970, or latest edition, *Practice for Industrial Lighting*, for recommended values of illumination.

9.2 Housekeeping & Sanitation

To minimize potential accidents the site will be maintained in a generally clean condition. Waste materials will be disposed of in approved waste containers or roll- offs.

The site will be set up so as to be reasonably free from significant safety hazards. Wires and hoses will be positioned so they do not obstruct or present a safety hazard in walkways and evacuation routes.

An adequate supply of potable water will be provided. Portable containers used to dispense drinking water will be capable of being tightly closed and equipped with a tap. Any container used to distribute drinking water will be clearly marked as to the nature of its contents and not used for any other purpose. Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups will be provided.

Toilets will be provided for employees or subcontractors according to the following table:

Number of employees or subcontractors	**Number of Toilets**
20 or less	1
20 or more	1 toilet seat and 1 urinal per 40 workers.
200 or more	1 toilet seat and 1 urinal per 50 workers.

Under temporary field conditions, provisions will be made to assure not less than one toilet facility is available. The requirements for sanitation facilities will not apply to mobile crews having transportation readily available to nearby toilet facilities. Washing facilities will be maintained in a sanitary condition with adequate soap or hand sanitizer.

10. Inspection Program

Work areas will be inspected on a periodic basis. The SSO or alternate will utilize a checklist when performing these inspections. Inspections will be documented at least weekly and kept available for inspection with the SSO records. Site should be inspected for hazards daily by all personnel and reported as per policy. A Construction Safety Inspection Checklist form is included in *Attachment 9*.

11. Traffic Control

Manual on Uniform Traffic Control Devices (MUTCD)

Protection of the public and site personnel working on roadways during this project are of the highest concern. Minimizing impacts to traffic is also a primary concern. Objectives for maintaining safety and reducing traffic concerns include:

1. Providing a high level of safety for workers, motorists, pedestrians, bicyclists and persons with disabilities in the highway work zone
2. Minimizing congestion and community impacts by maintaining acceptable levels of service as close as possible to preconstruction levels.

3. Providing a feasible design of highway traffic control during highway operations.
4. Providing contractors with access to the roadway that is adequate to complete the work efficiently while meeting the quality requirements of the contract.
5. Keeping the cost as low as possible, consistent with safety and an appropriate degree of convenience for the public.

11.1 Flagger Training

New York State Department of Transportation requires that all flaggers be adequately trained in flagging operations by recognized training programs, including the American Traffic Safety Services Association, the National Safety Council, unions, or construction industry associations, or by an individual who holds a current certification as a flagger

training instructor from such a program. Prior to the start of flagging operations, CMI or its subcontractors will provide to a list of certified flaggers to be used in the operation, identifying the source of flagger training for each individual. When requested, flaggers will demonstrate their competency in flagging procedures. Flaggers not competent in flagging procedures will be retrained or replaced at once.

12. Material Handling, Storage, Use and Waste Disposal

EPA Land, Waste and Cleanup Topics

The following procedures provide a process for waste management planning and promote the development of more coherent and appropriate waste management. It is the responsibility of each individual on site to follow CMI policies and procedures for managing waste.

1. CMI will estimate the waste that will be generated prior to work being performed so that the need for containers and waste removal can be determined. Trash and scrap materials will be considered waste.
2. Waste materials will be properly stored and handled to minimize the potential for a spill or impact to the environment. During outdoor activities, receptacles will be covered with a tarp to prevent dispersion of waste materials and to control the potential for run-off.
3. CMI will properly segregate waste materials to ensure opportunities for reuse or recycling.
4. All site personnel will be instructed on the proper disposal method for wastes. This will include general instruction on disposal of non-hazardous wastes, trash, scrap materials, and waste oils. If wastes generated are classified as hazardous, employees or subcontractors will be trained to ensure proper disposal. This training will be conducted during the site orientation and conducted by the Site Superintendent or his designee.
5. Waste management planning will be continuously reviewed and revised to assure site safety and to meet regulatory requirements.

Section 8 of this SSHASP outlines storage and handling requirements for potentially flammable and combustible materials to prevent the possibility of fires.

General materials storage and disposal requirements for this project include the following:

1. All materials stored in tiers must be stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling or collapse.
2. When a difference in road or working levels exist, means such as ramps, blocking or grading will be used to ensure safe movement of vehicles between two levels.

3. Non-compatible materials will be segregated in storage.
4. All bagged materials will be stacked by stepping back the layers and cross keying the bags at least every 10 bags high.
5. All used lumber will have all nails withdrawn before stacking.
6. All structural steel, poles, pipe, bar stock and other cylindrical materials, unless racked, will be stacked, and blocked to prevent spreading or tilting.
7. All scrap lumber, waste materials and rubbish will be removed from the immediate work area, as the work progresses.
8. Disposal of waste material and debris by burning is forbidden.
9. Storage areas will be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage.
10. Vegetation control will be exercised when necessary. The work area will be surrounded by a silt fence. Specific procedures for handling of spoil piles, HDD cuttings, and Drilling Fluids are provided in the CMI project Installation Manual.

Section 74 of CMI's Corporate Health & Safety Manual (*Attachment 6*) provides detailed procedures for rigging and hoisting of materials. All such procedures will be closely adhered.

13. Signs, Signals and Barricades

OSHA Specifications for accident prevention signs and tags (29 CFR 1910.145)

Signs, signals, and barricades are important, if not critical, to the safety of the construction workers. Several important definitions are applicable to this subpart:

- Barricade means an obstruction to deter the passage of persons or vehicles.
- Signs are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.
- Signals are moving signs, provided by workers, such as signalers, or by devices, such as flashing lights, to warn of possible or existing hazards.
- Tags are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

13.1 Accident Prevention Signs and Tags

13.1.1 General

Signs and symbols will be visible at times when work is being performed and will be removed or covered promptly when the hazards no longer exist.

13.1.2 Danger Signs

Danger signs will be used only where an immediate hazard exists.

Danger signs will have red as the predominating color for the upper panel; black outline on the borders; and a white lower panel for additional sign wording (see accompanying figure).

13.1.3 Caution Signs

Caution signs will be used only to warn against potential hazards or to caution against unsafe practices.

Caution signs will have yellow as the predominating color; black upper panel and borders; yellow lettering of "caution" on the black panel; and the lower yellow panel for additional sign wording. Black lettering will be used for additional wording.

Standard color of the background will be yellow, and the panel, black with yellow letters. Any letters used against the yellow background will be black. The colors will be those of opaque glossy samples as specified in Table 1 of American National Standard ANSI Z53.1-1967 (see accompanying figure).

13.1.4 Exit Signs

Exit signs, when required, will be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters will be at least three-fourths inch in width.

13.1.5 Safety Instruction Signs

Safety instruction signs, when used, will be white with green upper panel with white letters to convey the principal message. Any additional wording on the sign will be black letters on the white background (see accompanying figure).

13.1.6 Directional Signs

Directional signs, other than automotive traffic signs specified in the paragraph below, will be white with a black panel and a white directional symbol. Any additional wording on the sign will be black letters on the white background.

13.1.7 Traffic Signs

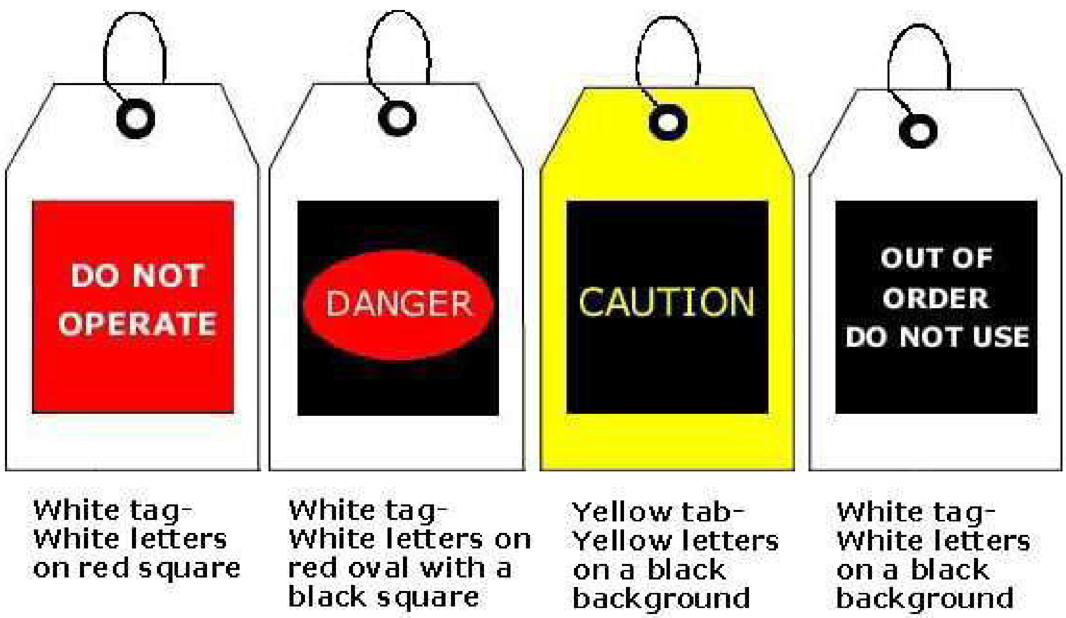
Construction areas will be posted with legible traffic signs at points of hazard.

All traffic control signs, or devices used for protection of construction workers will conform to AASHTO MUTCD 2010 Edition, *Manual on Uniform Traffic Control Device.*

13.1.8 Accident Prevention Tags

Accident prevention tags will be used as a temporary means of warning employees or subcontractors of an existing hazard, such as defective tools, equipment, etc. They will not be used in place of, or as a substitute for, accident prevention signs.

Specifications for accident prevention tags similar to those shown below will apply.



Basic Stock (Background)	Safety Colors (Ink)	Copy Specification (Letters)
White	Red	Do Not Operate
White	Black and Red	Danger

Yellow	Black	Caution
White	Black	Out of Order Do Not Use

13.1.9 Additional Rules

American National Standards Institute ANSI Z35.1-1968, Specifications for Accident Prevention Signs, and ANSI Z35.2-1968, Specifications for Accident Prevention Tags, contain rules which are additional to the rules prescribed in this section. The employer will comply with these ANSI standards with respect to rules not specifically prescribed in this subpart.

13.2 Signaling

13.2.1 Signalers

When operations are such that signs, signals, and barricades do not provide the necessary protection on or adjacent to a highway or street, signalers or other appropriate traffic controls will be provided.

Signaling directions by signalers will conform to *AASHTO MUTCD 2010 Edition, Manual on Uniform Traffic Control Devices*

Hand signaling by signalers will be by use of red flags at least 18 inches square or sign paddles, and in periods of darkness, red lights.

Signalers will be provided with and will wear a red or orange warning garment while flagging. Warning garments worn at night will be of reflectorized material.

13.2.2 Crane and Hoist Signals

Regulations for crane and hoist signaling will be found in applicable American National Standards Institute standards and CMI Safety Manual.

13.3 Barricades

Barricades for protection of employees or subcontractors will conform to AASHTO MUTCD 2010 Edition, Manual on Uniform Traffic Control Devices, portions relating to barricades. Pedestrian barricades will be of the type pictured below or equivalent.

ATTACHMENT 1
Plan Acknowledgement & Revision Forms

ATTACHMENT 1

The following individuals acknowledge that they have read and understand this Site-Specific Health and Safety Plan:

Print Name	Signature	Company	Date

The following individuals acknowledge that they have read and understand this Site-Specific Health and Safety Plan:

Print Name	Signature	Company	Date

Site Specific Health & Safety
Plan Revision Form

Project Name: ______________________________ **Project No.** ________________

Amendment No. ________________________________ **Date:** ______________________

Amendment Revises: Page:_________________________ **Section:** ___________________

Task(s) Amendment Affects*:

____

____

*(*Attach new/revised Job Safety Analyses*)

Reason For Amendment:

____

____

____

____

Amendment:

(Attach separate sheet(s) as necessary)

____

Completed by: ______________________________ **Approved by:** ______________________

______________________________ ______________________

ATTACHMENT 2
Job Safety Analyses

ACTIVITY: GENERAL PROJECT ACTIVITIES

STEP	HAZARD	CONTROLS
General Hazards - Certain hazards potentially exist throughout virtually all phases of the project. These hazards and preventative measures designed to minimize or eliminate the risk of these hazards are presented in the table below.		
Use of heavy tools, bending and lifting activities.	Back strain	• Workers will be instructed and are expected to use proper lifting techniques. • More than one employee will be used for tasks involving large, heavy or awkward equipment. • Sufficient rest breaks will be taken by employees to prevent excessive fatigue. • Lifting requirements per activity will be reviewed at each morning safety meeting.
Extreme temperatures, especially in conjunction with work activities and use of personal protective equipment.	Heat stress - loss of fluid, inability to concentrate, heat exhaustion, heat stroke. Cold stress - hypothermia	• Heat exposure will be monitored by the HSO when temperatures exceed 80 degrees F. • Heat and Cold stress management techniques will be implemented as needed. • More frequent rest breaks and fluids will be provided during warm weather. • PPE will be selected with heat/cold exposure in mind, when possible. • Signs and symptoms of heat or cold illnesses will be reviewed at morning safety meetings
Obstacles on work surfaces (e.g., pipes, wires, hoses); mounting /dismounting vehicles; slippery surfaces; uneven terrain; working at elevations	Slips, trips and falls	• Good housekeeping will be implemented – work areas will be kept clean and uncluttered. • Aisles will be maintained free of obstructions and accumulated water. • Wiring, hoses, etc., will be kept untangled. • Walkways or fixed ladders will be kept clear of equipment, debris and other objects. • Be alert and observe terrain while walking to minimize slips and falls. • Emergency equipment and lifesaving equipment must always have a clear path for use as well.
Vehicle Traffic Control	Struck by vehicle	• CMI will follow their Corporate procedures for Uniformed Traffic Control • Appropriate signage will be utilized for oncoming traffic. • Workers will wear reflective vests • Appropriate Stop and Caution signs will be utilized by flagmen to direct traffic

STEP	HAZARD	CONTROLS
Flying objects and debris during use of chain saws nail guns, etc. (e.g., sawdust, nails, dirt), and splashing liquids during dispensing of fuels, pressure washing etc.	Eye injuries caused by flying or splashing objects and materials.	• Safety glasses with side shields will be used whenever in any project work area. • Goggles, or face shield will be used as indicated in Section 6 for chemical protection. • Personnel not directly involved in subject tasks will keep clear. • Employees exposed to chips and the like will utilize goggles (or face shields as appropriate). • Employees must wear safety glasses at all times. Face shields are required for cutting or grinding.
Severe Weather (ex: lightning)	Struck by lightning	• Workers will stop work and proceed to safe area if severe weather is approaching.
Falling or rolling heavy objects and equipment; sharp objects on walking surfaces.	Foot injuries - crushed or broken toes, punctures and abrasions on soles of feet.	• Work boots with steel toes will be used for all work tasks.
Frayed, cracked or broken electrical cords; water in contact with electrical circuits and equipment.	Electrical hazards (shock, electrocution, burns)	• Lockout/tagout procedures will be used to prevent the start-up or release of energy from electrical, mechanical, hydraulic or pneumatic equipment. • GFCI electrical outlets will be used for all outdoor work and wherever water is/may be present. • Employee is responsible for inspecting electrical cords and tools prior to each use. If cord is deemed defective, cord will be cut up and disposed of.
Elevated equipment and work platforms	Falling hazards; falling objects	• Fall protection to prevent personal injuries due to falls will be used when employees work in areas where fall hazards cannot be eliminated by reasonable means due to the location or nature of the work area. Fall protection is required at heights of 6 feet or greater. • OSHA-required overhead protection will be provided on heavy equipment which will not obscure the vision of the operator. • Visible barriers will be placed around all openings. • Floor, wall and manhole opening guarding procedures will be followed to permit the safe passage

STEP	HAZARD	CONTROLS
		of workers or equipment across or near an opening in a work surface or wall large enough to admit a worker's limb or equipment wheel.
Working with flammable liquids and compressed gases (e.g., acetylene); possible chemical contaminants present at the site.	Fire hazards - burns, damage to equipment, explosion.	• Air monitoring for flammable atmospheres prior to the startup of any hot work or use of spark producing equipment in areas of potential flammable chemical contamination. Ongoing real time monitoring shall be conducted if the atmosphere is likely to change. • Combustible/flammable liquids will be stored in UL or NFPA-approved containers. Protected storage areas (e.g., flammable liquid cabinet) will be provided for bulk storage when necessary. • Compressed gases will be stored upright and secured to immovable objects when not in use. • Proper storage and signage as per 29 CFR 1926. Subpart J
Operation of heavy equipment, generators, power tools.	High noise levels.	• Noise monitoring will be performed when deemed necessary by the SSO. • Hearing protection may be required in some operations as determined by the SSO, such as working on or near heavy equipment
Night-time work; working in areas with restricted sunlight	Working in dark. Inability to adequately see the work or task at hand, as well as other site hazards.	• Adequate temporary lighting will be provided, where appropriate, when work proceeds in the dark or poorly illuminated areas.

ACTIVITY: MOBILIZATION / DEMOBILIZATION

STEP	HAZARD	CONTROLS
Receive/Load/Unload Equipment		
Pre starting deck Equipment	Injury to operator, by standers, damage to equipment and property	• Before any machinery or mechanized equipment is placed in use it shall be inspected and tested by a competent person and certified to be in a safe operational condition. All machinery and equipment shall be inspected daily and when the machinery is found to be in a unsafe condition that affects the safe operation the equipment shall be remove from service until the unsafe condition has been corrected. The equipment inspections shall be documented by the SSR.
Securing Cargo	Injury to personnel, damage to equipment and materials	• Equipment and Materials are secured to the barge by welding the unit to the deck of the barge with dogs and wedges or secured to the deck with chains and binders or heavy duty straps connected to pad eyes that have been welded to the deck of the barge.
Hauling of equipment to staging area	Rollover and overhead hazard, Injury to personnel and equipment	• Be aware of load and trailer height and turning radius of truck and trailer. Always look above to make sure there is no overhead hazard when hauling. The mobilization yards for Caldwell Marine are designed for the specific purpose and do not pose any overhead hazards.
Vehicle operation	Ejection Hazard	• Seat Belts shall be worn on all motor vehicles that have them installed.
Offloading equipment from the trucks	Rollover, injury to personnel and equipment	• Cranes and hoisting equipment shall be operated only by designated qualified personnel. Proof of qualification shall be in writing. All equipment shall be chocked from movement during loading and unloading and the operator will not be in the vehicle during loading and unloading. • Tag lines will be required when need to keep loads under control at all times.

STEP	HAZARD	CONTROLS
Hooking up the loads to lift off of the trucks	Loss of load Injury to personnel	• Rigging equipment shall be inspected as specified by the manufacturer, by a competent person before each shift and as necessary during it use to ensure that it is safe. Defective rigging shall be removed from service.
Barge deck lay out	Trips, slips, fall. General unsafe working environment.	• While work is in progress, offices, facilities, access ways, working areas, construction roads, etc., shall be lighted. In the event lighting becomes an issue there are office facilities, access ways, working areas roads leading up to the loading area.
Working on the barge	Working on and near water.	• All personnel to wear PFD at all times while working in shipyard or on barge. A recovery boat shall be kept in the water while personnel are working in or near water. Ladders for allowing exit from water should be maintained and left clear on dock and on barge. If for any reason there is a platform from the barge to the recovery boat it shall be maintained within all applicable USGC Regulations.
Maintain good housekeeping during mobilization	Unsafe / unsanitary working environment, spread of disease, rodent habitation	• Places of employment shall be kept as clean as possible, taking into consideration the nature of the work. Regular cleaning shall be conducted in order to maintain safe and sanitary conditions in the workplace.
Hookup/unhook loads from crane rigging	Slips, Trips and Falls	• Ladders shall be restricted to their intended use. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design. Ladders shall comply with all applicable requirements as specified for land use.

STEP	HAZARD	CONTROLS
STORAGE OF MATERIALS		
Barge mobilization	Caught between struck by	• All Material in bags, containers, bundles or stored in tiers shall be stacked, blocked, interlocked, and limited in height so that it is stable and secured against sliding or collapsed. The maximum height limit will be determined by the Site Safety Representative.
Barge mobilization	Explosion, Fire	• Only store fuel in OSHA approved, spring loaded top, metal safety cans. Regularly inspect cans for leaks and dents. Immediately dispose of dysfunctional cans. Store fuel in a well-ventilated, safe, and secure area. Do not store near other combustibles or possible spark or ignition sources. All oils including Hydraulic and motor oils must be stored in a safe and secure area. Do not store near other flammables and combustibles. Also keep away from possible ignition sources. All fuel storage shall be in a flammable storage cabinet and vented as per manufacturers specifications.
Storage of Compressed Gas Cylinders	Explosion, Fire	• When storing, disconnect all torches, make sure all valves are closed, and replace black thread cap. Do not store near other combustibles or possible spark or ignition sources. Oxygen and Acetylene tanks are to be stored in the upright position in approved brackets and or cages and separated 20 feet. Inspect all valves, gauges, and hoses to make sure there are no leaks or damage. Immediately dispose of non-functional or damaged equipment.
Barge mobilization	Explosion, Fire, Toxic fumes	• Non-compatible materials shall be segregated in storage. Always read MSDS sheets for the product being handled / stored for proper handling instructions.
Cutting and welding operations	Equipment Damage	• Replace caps and secure bottles before travel. Before moving the truck, make sure the gauges and hoses have been taken off the bottles.

STEP	HAZARD	CONTROLS
Storage of aerosols	Explosion, Fire	• Store aerosols in a safe and secure place away from any heat sources, as well as sparks or open flames. Store in area away from other combustibles and hazardous materials including sharp points. Puncture will cause explosion.
Waste management	Personal Injury	• Dispose of empty can properly. Store in well-ventilated area. Always keep cap on when not in use.
Material Compatibility	Explosion	• Do not store different flammables, combustibles, or hazardous materials close to each other or close to ignition or possible puncture sources. Make sure to store in well vented area.
Hazard Communication	Personal Injury	• Make sure you know and have access to MSDS (Material Safety Data Sheets) On all items to be used on the project. Properly label all containers with appropriate labels which should state product name and possible hazards. Use all proper safety equipment and procedures when handling or storing any Hazardous materials.
Stowing boxes and small equipment	Personal Injury	• Use of safe lifting practices – proper body mechanics when lifting and placing conduits. Multi-person lifts for heavy or awkward loads / Use of machinery for heavy lifts, use of hand-lines to lower items into and remove from manholes/trenches.
DECK LOAD OUT		
Crane operations	Injury to personnel, damage to equipment and materials	• Cranes that are loaded onto barges have to abide by the same rules as cranes on land. Cranes on a barge need to be as level as possible and secured to the deck per 1926.1437. The list of a barge is accounted for during the actual lift in the load charts for marine operations. All signalers will be properly trained and verification of training will be provided.
Crane operations (continued)	Injury to personnel, damage to equipment and materials (continued)	• Crane operators shall be able to communicate effectively with the lift supervisor, rigger(s) flagmen and other effected personnel on the job site.

STEP	HAZARD	CONTROLS
(Continued above)	(Continued above)	• Tag lines will be required to keep loads under control.
Crane operations (continued)	Injury to personnel, in pinch points, strikes from counterweight damage to equipment and materials	• The lift and swing path is clear of obstructions and adequate clearance is maintained from electrical sources and all persons are clear of the swing radius of the counterweight.
Lifting equipment off the trucks and placing equipment on the barge	Falling Hazard, Injury to personnel	• Riding on loads, hooks hammers, buckets, material hoists or other hoisting equipment not meant for personnel is prohibited.
Placing equipment on the deck of the barge	Struck by	• Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm. The minimum adequate clearance is 16 in. The Site Safety Representative will monitor and enforce. The clearance areas shall be clearly marked as to prevent caught between hazards on the barge.
Equipment pre-start	Damage to Equipment	• All machinery and equipment shall be inspected daily and when the machinery is found to be in an unsafe condition that affects the safe operation the equipment shall be remove from service until the unsafe condition has been corrected.
Entering the cab of the crane	Slip Trips and Falls	• Platforms, foot walks, steps, handholds, guardrails, and toe boards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.
Move the rigging around the deck of the barge	Personal Injury	• Use of safe lifting practices – proper body mechanics when lifting and placing conduits. Multi-person lifts for heavy or awkward loads / Use of machinery for heavy lifts.
Use of small hand tools	Eye Injury, Hearing Loss, Personnel Injury, Electrical Hazard	• Power tools shall be of a manufacture listed by a nationally recognized testing laboratory for the specific application for which they are to be used, inspected, and maintained in accordance with the manufacturer's instructions.

STEP	HAZARD	CONTROLS
Climbing up on equipment/container to secure them to the deck of the barge	Falls	• Ladders shall be restricted to their intended use. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design. Ladders shall not be moved, shifted, or extended while occupied. • Shall follow all applicable USCG Regulations concerning ladders on a barge
WELDING		
Hot Work	Burns, Fire Hazard, Combustion Hazard, Electrical Hazard, Injury to personnel, damage to equipment and materials	• Welders, cutters, and their supervisor shall be trained in the safe operation of their equipment, safe welding/cutting practices, and welding/cutting respiratory and fire protection. • All welding equipment shall be inspected before each use to ensure that all required safety devices and ancillary equipment are in place and properly functioning. Defective equipment shall be removed from service, replaced or repaired, and re-inspected before again being placed in service. • Welding cylinders and their use and maintenance shall meet applicable requirements. • Cable, hoses, and other equipment shall be kept clear of passageways, ladders, and stairways. • Before welding, cutting, or heating is commenced on any surface covered by a preservative coating whose flammability is not known, a test shall be made to determine its flammability. Caldwell Marine will issue a Hot Work Permit in house per agreement with the DEP due to the location of the actual work.
Hot Work (continued)	Burns, Fire Hazard, Combustion Hazard, Electrical Hazard, Injury to personnel, damage to equipment and materials (continued)	• All structural welding performed on critical items, such as scaffolding, shoring, forms, ladders, piling, etc., shall only be performed by welders certified in accordance with American Welding Society (AWS) standards using qualified and approved welding practices and procedures (AWS certification or

STEP	HAZARD	CONTROLS
		approved equivalent organization which trains to AWS standards). Before heat is applied to a drum, container, or hollow structure, a vent or opening shall be provided and purged for the release of any built-up pressure generated during the application of heat as well as to ensure atmospheric contaminants of concern are of acceptable levels. Employees performing welding, cutting, and heating work shall be protected by PPE appropriate for the hazards that they may encounter and based upon the results of an AHA conducted specifically for the welding, cutting, or heating operation that they will be performing. All required respiratory, eye and face, noise, head, foot, and skin protection equipment shall be used.

ACTIVITY: SITE PREPARATION

STEP	HAZARD	CONTROLS
Operation of Equipment	Operation of equipment, lacerations, punctures or bruises from pinch points between equipment and objects in motion;	• Guards must be maintained and kept in place on all equipment as appropriate. Never operate equipment with guards removed. • Employees will wear warning vests. • Heavy equipment will be equipped with operational backup alarms. • The operator should not wear loose clothing or a vest while operating to avoid getting caught on the controls
Operation of Equipment (continued)	High noise levels.	• Hearing protection may be required in some operations. High noise levels by OSHA standards are 85 dB and above. • The SSHO will utilize his/her professional judgment and experience, along with knowledge of previous measurements of similar equipment to determine hearing protection needs.
Disturbance / Movement of Materials	Construction debris and dust inhalation	• P100 dust masks if excessive dust levels are noted • Eye protection • Safety shoes
Welding, cutting and brazing of metals.	Inhalation of fumes; contact with hot material; cuts from sharp metal edges; damage to retina of the eye from ultraviolet light	• Shaded eye protection, face and head protection, and appropriate respiratory protection will be worn during welding, cutting or brazing.
Use of cranes, derricks, backhoes and other elevated equipment near overhead power lines, wires and structures.	Potential contact with overhead wires with possibility of fire and electrocution.	• Spotters will be present during all uses of heavy equipment to warn the driver of hazardous conditions or the proximity of other equipment or individuals. • Cables, chains and loads will be inspected before lifting by a competent person. • No personnel are permitted underneath the radius of crane arms during operation.
Use of cranes, derricks, backhoes and other elevated equipment near overhead power lines, wires and structures.	Potential contact with overhead wires with possibility of fire and electrocution.	• When working near overhead power lines. The boom and cables of equipment should be kept at least ten (10) feet away from all electric wires, regardless of their voltage. • For lines rated 50 kV or below, the minimum clearance between the lines and any part of the crane must be 10 feet. • For lines rated over 50 kV, the minimum clearance between the lines and any part of the crane must be either 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than 10 feet.

STEP	HAZARD	CONTROLS
(Continued above)	(Continued above)	• In transit and with no load and boom lowered, the clearance should be a minimum of 4 feet. Cage type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices should not operate to alter the requirements as spelled out above. • Any overhead wire should be considered an energized line until either the person who owns the line, or the electric utility authorities indicate that it is not energized, and it is tagged and marked as such.
Lifting and winching operations	Cuts or amputations from pinch or nip points; snapping cables or slings while moving equipment	• Winches, cables, slings and equipment will be inspected by the operator prior to each day of use.

ACTIVITY: GENERAL DIVING OPERATIONS

STEP	HAZARD	CONTROLS
Diving Operations	Trapped diver, Loss of communication Loss of air supply Drowning Mechanical injury on the bottom Slips and Falls Hypothermia Arterial Gas Embolism	• Employees working over or near water, where the danger of drowning exists, shall be provided with USCG approved life jacket or work vest. Life vest will be inspected before each use. • Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet. • An Emergency Bill will be on the dive site with the following information: Location and phone number of nearest operational recompression chamber if not located at the dive site; Location and phone number(s) of nearest hospital(s); Location and phone number of nearest USCG Rescue Coordination Center, where appropriate • Keep deck clear of all trip hazards at all times. Tender support diver while moving on the deck of the dive boat • Diver to approach bottom location with care to ensure there are on unforeseen fouling hazards Diver to carry sharp knife to cut themselves free • Ensure the water entry location is clear before entering the water.
Diving Operations (continued)	Trapped diver, Loss of communication Loss of air supply Drowning Mechanical injury on the bottom Slips and Falls Hypothermia Arterial Gas Embolism,	• Diver to carefully inspect the work site for debris that may be a cutting or puncture hazard • Tender to support diver while undressing • Diver is to sit down during the clean time after the dive for 15 minutes • Standby diver will have the same diving capabilities / duration the diver • The standby diver will be tended from the surface with a tending line attached to the diver and not his gear that may have to be ditched in an emergency
Diving Operations (continued)	Drowning	• Diving operation in accordance with Caldwell Marine International, LLC Safe Diving Practices Manual which is included in the HASP as an attachment.

STEP	HAZARD	CONTROLS
Diving Operations (continued)	Trapped diver, loss of communication, struck by swinging load, pinch points drowning	• Surface-supplied air (SSA) shall be used whenever possible in accordance with the practical constraints of diving operations. • Each dive location shall have a reserve breathing air supply integral or in-line with the primary air source sufficient to safely terminate the dive and recover the diver(s) in the event of loss of the primary air supply. • All working dives requiring communications between the divers and topside to direct crane load movements, etc., shall be performed in SSA mode. • A tender/diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces. • The second diver will be stationed at the opening of whatever the first diver is penetrating.
Diving Operations (continued)	Loss of communication with the diver, lost or trapped diver, omitted decompress, unconsciousness, suffocation, drowning	• Each diver shall be continuously tendered while in the water, with one diver per tender, regardless of depth; • An underwater tender/diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces; c. Each diving operation shall have a primary breathing air supply sufficient to support divers for the duration of the planned dive, including decompression; A SSA standby diver will be dressed out and readily available when a diver is in the water (the standby diver may remove his or her head gear after it is tested for proper operation
Diving Operations (continued)	Loss of air supply, omitted decompress, unconsciousness, suffocation, drowning	• Each diver must have a reserve breathing supply available that can be turned on immediately by the diver in the event of loss of air. The reserve breathing air supply shall be of sufficient capacity to safely terminate the dive in the event of loss of primary air.
Transporting a stricken diver to nearest recompression chamber	Arterial Gas embolism, Type I DCS, Type II DCS	• An Emergency Bill will be on the dive site with the following information: Location and phone number of nearest operational recompression chamber if not located at the dive site; Location and phone number(s) of nearest hospital(s); Location and phone number of nearest USCG Rescue

STEP	HAZARD	CONTROLS
(Continued above)	(Continued above)	Coordination Center, where appropriate. • If a chamber is not on location three modes of transportation could be used depending on the severity of the incident. Small craft to the beach, into an ambulance to the nearest chamber or lift flight to the nearest chamber. In any case 911 would be the first call made

ACTIVITY: CABLE INSTALLATION

STEP	HAZARD	CONTROLS
Tug Boat Operations		
Operating the vessel – over 26 feet in length	Improper operation causing accident / injury	• Officers and crew shall be in possession of a current, valid USCG license, which shall be posted in a public area on board the vessel, or correctly endorsed document as required by the USCG. • Notice to Mariners for all marine operations will be submitted and kept up to date with the USCG.
Marine Operations Severe Weather	Collision, drowning, loss or damage to equipment to property	• Where floating plant may be endangered by severe weather (including sudden and locally severe weather, storms, high winds, hurricanes, and floods) plans shall be made for removing or securing plant and evacuation of personnel in emergencies.
Towing Equipment to and from job site	Collision, drowning, loss or damage to equipment to property	• Floating Plant movement shall be preceded by an evaluation of weather reports and conditions by a responsible person to ascertain that safe working conditions exist and safe refuge of personnel is assured.
Vessel Communication	Collision, drowning, loss or damage to equipment to property	• Vessels normally engaged in or near a channel or fairway in operations that restrict or affect navigation of other vessels and required by law to be equipped with radios, radar and AIS Transponders.
Fire protection.	Fire, personal injury, loss or damage to equipment	• An ABC Rated Fire Extinguisher of at least 20lbs shall be provided based off of exposure.
Working on or near the water	Falling into water; drowning	• Employees working over or near water, where the danger of drowning exists, shall be provided with USCG approved life jacket or work vest. Life vest will be inspected before each use.
Floating plant inspection and certification.	Falling in water drowning, environmental hazards, damage and lost equipment.	• All barges and vessels not subject to USCG inspection and certification or not having a current ABS classification shall be inspected in the working mode annually by a marine surveyor.

STEP	HAZARD	CONTROLS
Floating plant inspection and certification.	Falling in water drowning, environmental hazards, damage and lost equipment.	• Floating plant found in an unsafe condition shall be taken out of service and its use prohibited until unsafe conditions have been corrected.
Access to/from vessels	Falling into water, personal injury, drowning	• Safe means for boarding or leaving a floating plant shall be provided and guarded to prevent persons from falling or slipping thereon. (Examples): Can consist of the following: Steel frame ladders welded to the side of the barge; Rope ladder and or gang ways (Ramps).
Crew Boat Operations		
Operating the vessel – over 26 feet in length	Improper operation causing accident / injury	• Officers and crew shall be in possession of a current, valid USCG license, which shall be posted in a public area on board the vessel, or correctly endorsed document as required by the USCG. • Notice to Mariners for all marine operations will be submitted and kept up to date with the USCG.
Marine Operations Severe Weather	Collision, drowning, loss or damage to equipment to property	• Where floating plant may be endangered by severe weather (including sudden and locally severe weather, storms, high winds, hurricanes, and floods) plans shall be made for removing or securing the crew boat and evacuation of personnel in emergencies.
Vessel Communication	Collision, drowning, loss or damage to equipment to property	• Vessels normally engaged in or near a channel or • fairway in operations that restrict or affect navigation of other vessels and required by law to be equipped with radios, radar and AIS Transponders
Fire protection	Fire, personal injury, loss or damage to equipment	• An ABC Fire Extinguisher will be provided based off of exposure.
Working on or near the water	Falling into water; drowning	• Employees working over or near water, where the danger of drowning exists, shall be provided with USCG approved life jacket or work vest. Life vest will be inspected before each use. • Ring buoys with at least 90 feet of line shall be provided and readily

STEP	HAZARD	CONTROLS
		available for emergency rescue operations.
Crew Boat inspection and certification.	Sinking, capsizing, drowning, environmental hazards, damage and lost equipment.	• All floating plant that are regulated by the USCG shall have current inspections and certificates issued by the USCG before being placed in service and a copy shall be posted in a public area on board the vessel.
PLGR		
Lifting, and placing of Grapnels	Rollover, personal injury loss or damage to equipment	• Land cranes and derricks mounted on barges or pontoons shall have a maximum allowable list or trim of 5º or the maximum allowed by the crane manufacture A boom angle indicator readable from the operator's station shall be provided on all floating cranes. A diver will be needed for this task.
Crane operations	Rollover, personal injury loss or damage to equipment	• Only those operators qualified to operate a particular type of crane or derrick may operate that type of machinery: proof of qualification shall be in writing. The operator shall not engage in any activity that will divert his/her attention while operating the crane. The operator shall not leave the controls while a load is suspended. Before leaving the crane unattended, the operator shall: Land any load, bucket, or other device; Disengage the master clutch; Set travel, swing, boom brakes, and other locking devices; Put the controls in the off or neutral position; Secure the crane against accidental travel; and Stop the engine. The operator shall respond to signals from the person who is directing the lift or an appointed signal person.
Rigging	Roll over, loss of load, personal injury, struck by, pinch point,	• The rigger shall ensure that: The crane is level and, where necessary, blocked; The load is well secured and balanced in the sling or lifting device before it is lifted more than a few inches; The lift and swing path is clear of obstructions and All persons are clear of the swing radius of the counterweight. The lead rigger shall ensure that all rigging personnel are wearing proper PPE.

STEP	HAZARD	CONTROLS
Rigging	Personal injury, struck by, loss of load, damage to equipment	• Rigging equipment shall be inspected as specified by the manufacturer, by a competent person, before use on each shift and as necessary during its use to ensure that it is safe.
CFE Deployment		
Lifting, and placing CFE into positions	Rollover, personal injury loss or damage to equipment	• Land cranes and derricks mounted on barges or pontoons shall have a maximum allowable list or trim of 5º or the maximum allowed by the crane manufacture A boom angle indicator readable from the operator's station shall be provided on all floating cranes. A tag line shall be utilized for the placement of the plow above water. No divers are required to be in the water during this operation.
Crane operations	Rollover, personal injury loss or damage to equipment	• Only those operators qualified to operate a particular type of crane or derrick may operate that type of machinery: proof of qualification shall be in writing. The operator shall not engage in any activity that will divert his/her attention while operating the crane. The operator shall not leave the controls while a load is suspended. Before leaving the crane unattended, the operator shall: Land any load, bucket, or other device; Disengage the master clutch; Set travel, swing, boom brakes, and other locking devices; Put the controls in the off or neutral position; Secure the crane against accidental travel; and Stop the engine. The operator shall respond to signals from the person who is directing the lift or an appointed signal person.
Rigging	Roll over, loss of load, personal injury, struck by, pinch point,	• The rigger shall ensure that: The crane is level and, where necessary, blocked; The load is well secured and balanced in the sling or lifting device before it is lifted more than a few inches; The lift and swing path is clear of obstructions and All persons are clear of the swing radius of the counterweight. The lead rigger shall ensure that all rigging personnel are wearing proper PPE.

STEP	HAZARD	CONTROLS
Rigging	Personal injury, struck by, loss of load, damage to equipment	• Rigging equipment shall be inspected as specified by the manufacturer, by a competent person, before use on each shift and as necessary during its use to ensure that it is safe. The rigging is stored in the tool containers.
Cable Handling		
Walking in Static Tanks	Slips, Trips and Falls	• Proper footwear with adequate ankle support must be worn at all times.
Gantry Work	Falls; Personal Injury	• 100% use of full body harness attached by shock absorbing lanyards "cradle to cradle"
Linear Cable Engine	Pinch points, crushing,	• Daily inspections to ensure proper guards are in place and danger zones are properly identified.
Small Boat Operations	Capsizing, drowning, loss or damage of equipment	• Each boat shall have sufficient room, freeboard, and stability to safely carry the cargo and number of persons allowed with consideration given to the weather and water conditions in which it will be operated Employees working over or near water, where the danger of drowning exists, shall be provided with USCG approved life jacket or work vest. Life vest will be inspected before each use. Minimum required equipment on board is PFD's for all personnel on board, VHF radio, fire extinguishing equipment, anchor with sufficient line for the depth of water and oars.

ATTACHMENT 3
Safety Data Sheets

(Added as Brought to the Project)

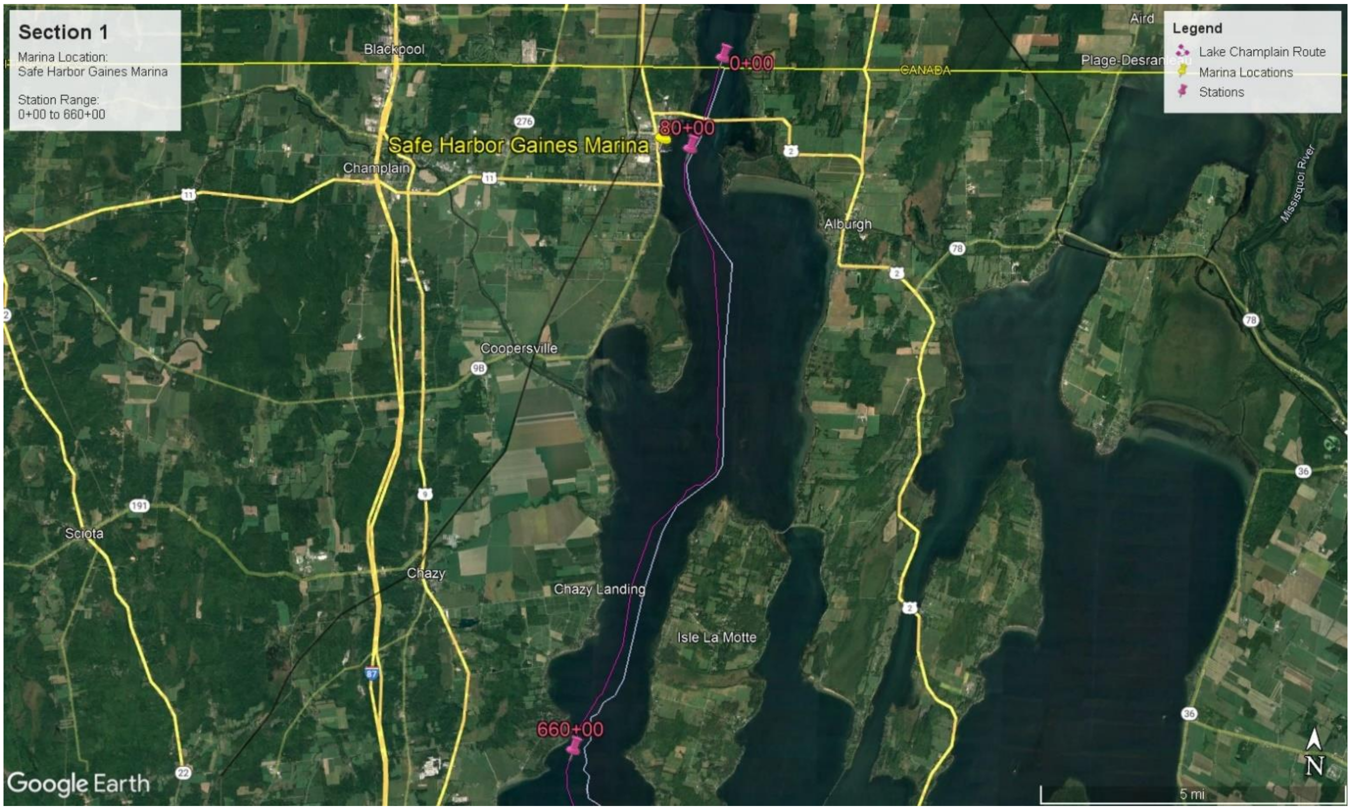
ATTACHMENT 4
Directions to Hospital

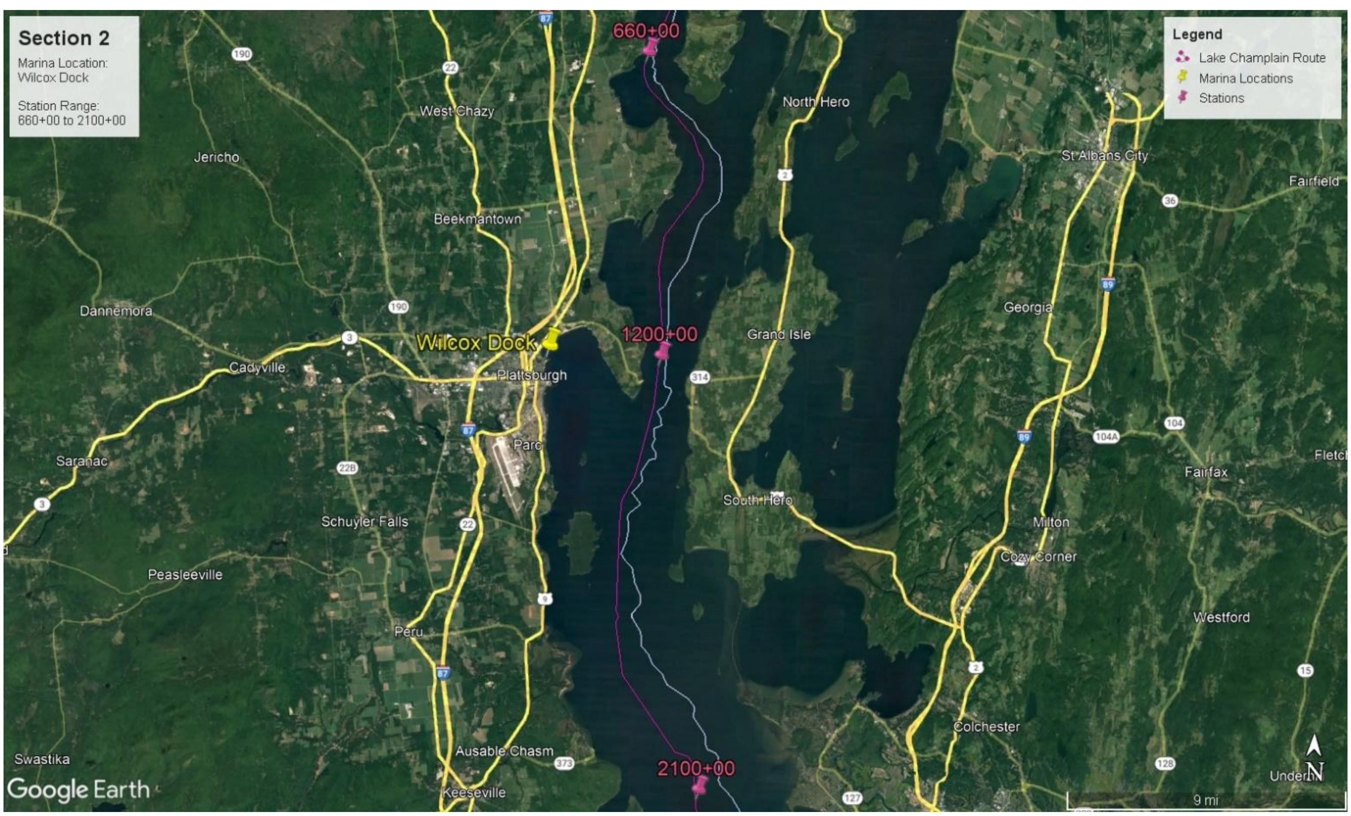
(See Emergency Action Plans)

Emergency Action Plans

List of Marinas

Marina Location	Address	Section No.	Job Emergency Action Plan
Safe Harbor Gaines Marina	141 Lake St Rouses Point, NY 12979	1	Follow location specific Job EAP
Wilcox Dock	90 Cumberland Ave Plattsburgh, NY 12901	2	Follow location specific Job EAP
Essex Marina	2272 Lake Shore Rd Essex, NY 12936	3	Follow location specific Job EAP
Bridgeview Harbor Marina	54 Harbour Ln Port Henry, NY 12974	4	Follow location specific Job EAP
Monitor Bay Marina	17 Monitor Bay #1 Crown Point, NY 12928	5	Follow location specific Job EAP
Chipman Point Marina	68 Chipman Point Rd Orwell, VT 05760	6	Follow location specific Job EAP


Section 1
Marina Location:
Safe Harbor Gaines Marina
Station Range:
0+00 to 660+00
Legend
Lake Champlain Route
Marina Locations
Stations
0+00
80+00
660+00
Safe Harbor Gaines Marina
Blackpool
Champlain
Aird
Plage-Desran
CANADA
Alburgh
Missisquoi River
Coopersville
Sciota
Chazy
Chazy Landing
Isle La Motte
5 mi
N
Google Earth


Section 2
Marina Location:
Wilcox Dock
Station Range:
660+00 to 2100+00
Legend
Lake Champlain Route
Marina Locations
Stations
660+00
1200+00
2100+00
Wilcox Dock
West Chazy
North Hero
St Albans City
Fairfield
Jericho
Beekmantown
Dannemora
Georgia
Grand Isle
Cadyville
Plattsburgh
Saranac
Fairfax
South Hero
Schuyler Falls
Milton
Cozy Corner
Peasleeville
Westford
Peru
Colchester
Ausable Chasm
Keeseville
Swastika
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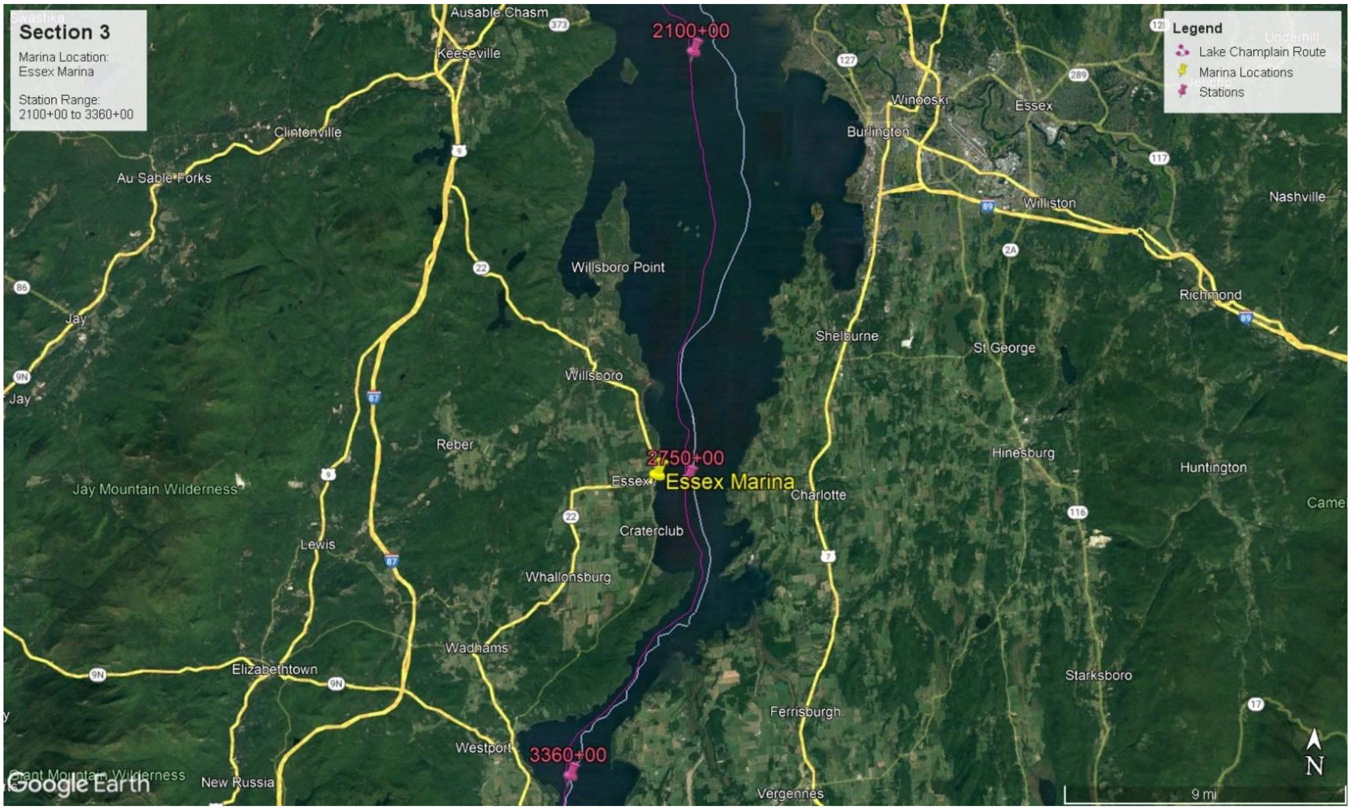
Google Earth


Section 3
Marina Location:
Essex Marina
Station Range:
2100+00 to 3360+00
Legend
Lake Champlain Route
Marina Locations
Stations
2100+00
2750+00
Essex Marina
3360+00
Ausable Chasm
Keeseville
Clintonville
Au Sable Forks
Winooski
Essex
Burlington
Williston
Nashville
Willsboro Point
Richmond
Shelburne
St George
Jay
Willsboro
Reber
Hinesburg
Huntington
Jay Mountain Wilderness
Essex
Charlotte
Craterclub
Lewis
Whallonsburg
Wadhams
Elizabethtown
Starksboro
Ferrisburgh
Westport
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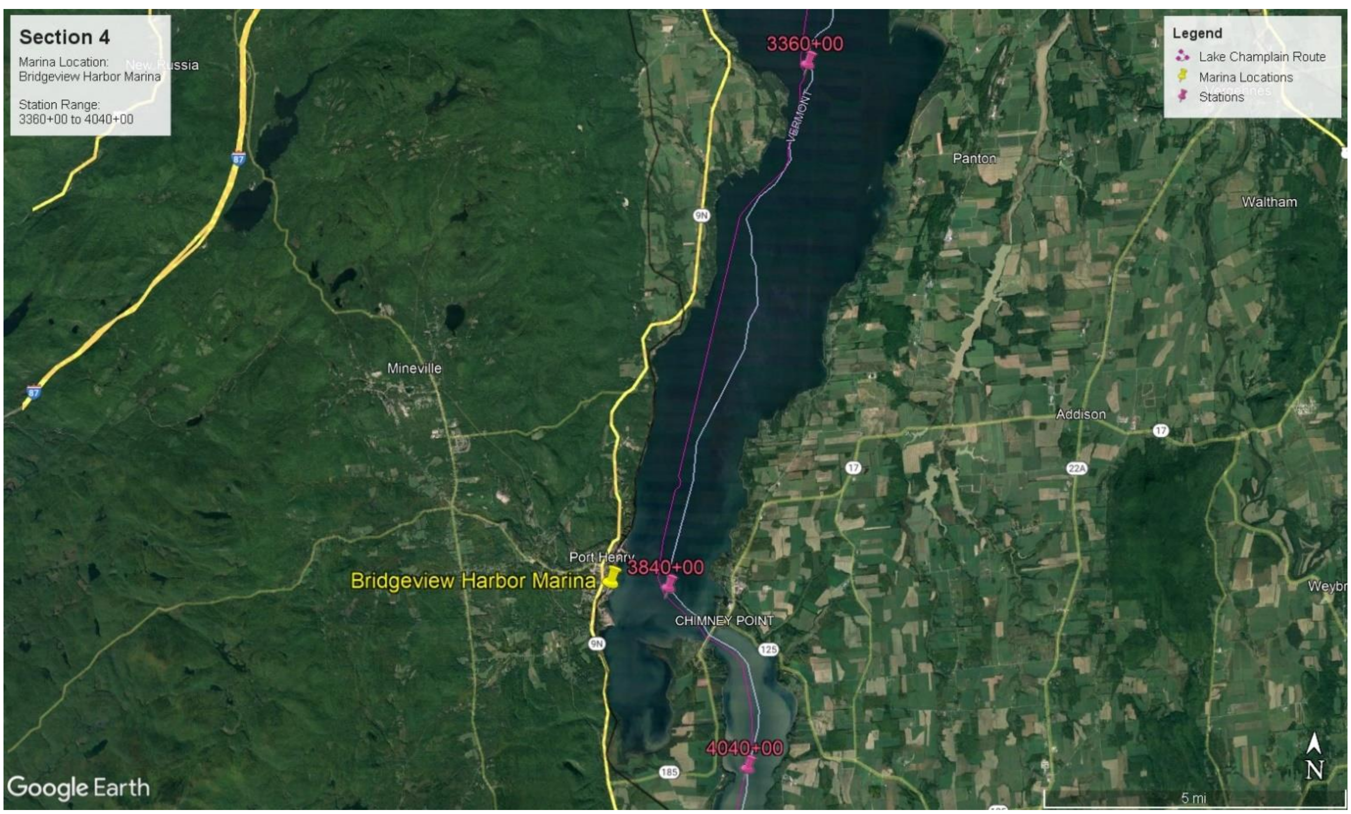

Section 4
Marina Location:
Bridgeview Harbor Marina
Station Range:
3360+00 to 4040+00
Legend
Lake Champlain Route
Marina Locations
Stations
3360+00
VERMONT
Panton
Waltham
Mineville
Addison
Port Henry
Bridgeview Harbor Marina
3840+00
CHIMNEY POINT
4040+00
Google Earth
5 mi
N

JOB EMERGENCY ACTION PLAN

JOBSITE DETAILS			
Date: 06/01/2023	Project Owner: CHPE, LLC	Contractor: Caldwell Marine International	
Project Name - Location: CHPE – Safe Harbor Gaines Marina			Job No: NKT 1233
Project Address: 141 Lake St, Rouses Point, NY 12979			
PM: Thomas Ulisse	Cell: 732 620 3470	Supt:	Cell:

EMERGENCY CALLING INFORMATION – 911 (Local numbers are required, even if 911 is used.)

Department	*Name*	*Telephone Number*
POLICE	Clinton County Sheriff's Office.	911 (518) 565-4300
FIRE DEPARTMENT	Chazy Volunteer Fire Dept.	911 (518) 846-7326
FIRST AID/ NON-EMERGENCY	Wellnow Urgent Care	(518) 536-3071
HOSPITAL / EMERGENCY	CVPH	(518) 561-2000.
POISON CONTROL	NY Poison Control	800 222 1222
SPILL RESONSE	US Ecology	800 899 4672
OSHA	** Corporate Safety Director will Initiate Any/All Contact with OSHA**	
DIVE HOSPITAL	See Dive Hospital Posting	
GPS Coordinates: Chazy Landing – Long Point Cottage 44°54'42.34" N 73°22'36.71" W		

OWNER / CONTRACTOR CALLING INFORMATION

Role	*Name- Address*	*Telephone*
OWNER	CHPE, LLC 600 Broadway Albany, NY 12207.	(800) 991-2473
OWNER'S ENGINEER		
GENERAL CONTRACTOR	Fredrik Hallsten NKT Inc.	(919) 836 3522
SUBCONTRACTOR	Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(732) 557-6100
SITE SAFETY MANAGER	Jhayllien Monette Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(936) 263-8139
CORPORATE SAFETY DIRECTOR	Lucky Abernathy JAG Companies 1333 Campus Pkwy Wall Township, NJ 07753	(908)-433-3755

DIVERS ALERT NETWORK

DIVE HOSPITALS

Facility Hôpital du Sacré-Cœur-de-Montréal (Hyperbaric Unit)

Address 5400 Blvd Gouin Ouest
Montreal, QC H4J 1C5
CA

Phone
Business: +1-514-338-2777
24/7: +1-514-338-2000
Hospital: +1-514-338-2000

View on Google Maps™

Facility Jacobi Hyperbaric Center (Hyperbaric Medicine)

Address 1400 Pelham Parkway South
Room 1 West 20/J
Bronx, NY 10461
US

Phone
Business: +1-718-918-7521
24/7: +1-718-918-5800 ER
Hospital: +1-718-918-5000

View on Google Maps™

Facility Phelps Hospital-Northwell Health (Department of Hyperbaric Medicine)

Address 701 North Broadway
Sleepy Hollow, NY 10591
US

Phone
Business: +1-914-366-3690 7a-4p
24/7: +1-914-366-6665; +1-914-804-8671 Dr. O
Hospital: +1-914-366-3000

View on Google Maps™

Facility Upstate University Hospital, Syracuse NY (Hyperbaric Medicine Unit (SUNY))

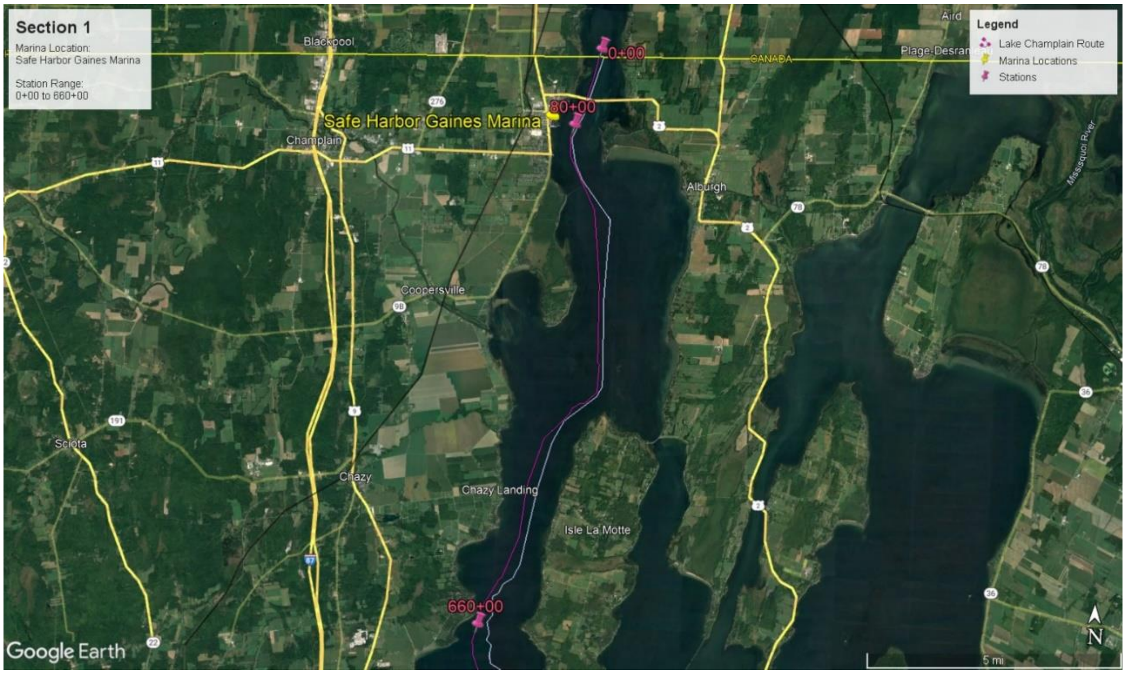
Address 750 East Adams Street
Rm. 1528
Syracuse, NY 13210
US

Phone
Business: +1-315-464-4910 8am-4pm
24/7: +1-315-464-5449 (trans ctr)
Hospital: +1-315-464-5540

View on Google Maps™

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)



JOB EMERGENCY ACTION PLAN

HOSPITAL – Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

CVPH (20 Minutes from Work Area)
214 Cornelia St, Plattsburgh NY 12901.
(518) 561-2000.

After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

JOB EMERGENCY ACTION PLAN

Occupational Doctor – NonEmergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider:

Wellnow Urgent Care. (20 Mins Away from Work Area)
474 State Rte., Plattsburgh, NY 12901.
(518) 536-3071.

After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

JOB EMERGENCY ACTION PLAN

General Provisions within the Emergency Action Plan(EAP)

1. Common sources of emergencies identified in this Emergency Action Plan (EAP) include – injury/illness, fire, explosion, weather, toxic material releases, and workplace violence.
2. A hazard assessment has been conducted of the workplace to identify any physical or chemical hazards that may exist and could cause an emergency and is included in the SSHASP for this project.
3. This EAP includes a list of current key personnel and their contact phone numbers and provides for emergency communications by cell phone as well as handheld VHF radio via channel #73.
4. Medical treatment needs, whether minor or of a more serious nature, shall be reported to the person in charge who will then take/make the appropriate arrangements for treatment i.e. First aid, evacuation for off-site medical treatment, etc. Note: Caldwell Marine will maintain a compliment of employees trained in first aid and CPR at every work location as well as maintain at least one fully stocked 25-person First Aid Kit and AED which will be kept readily available.

Evacuation Policy and Procedures

1. A location map/diagram which include locations of exits, assembly points and equipment (such as fire extinguishers, first aid kits, AED, spill kits) will be posted in appropriate locations.
2. The types of situations that will require an evacuation of this workplace could/may include injury/illness, fire, explosion, weather, toxic material releases, and or workplace violence. The extent of evacuation may be different for different types of hazards.
3. All employees have "Stop Work Authority" The Superintendent, foreman, and or the site Safety representative are authorized to all for an evacuation when required. The daily JAG will be used.
4. The superintendent and or foreman will direct/designate additional employee accordingly during an emergency i.e., support checking offices/lunchrooms/bathrooms, securing/turning off machines/equipment, escorting visitors, etc.
5. At least two (2) designated evacuation points will be identified (work location permitting).
6. All visitors will receive an indoctrination identifying the location of first aid equipment, evacuation points, project specific requirements, go-no-go locations, etc.

Alerting Employees in an Emergency

1. In the event of an emergency, employees will notify the superintendent or foreman who will make the appropriate notification to emergency services, if/and necessary.
2. The superintendent, foreman and or designated employee(s) will be tasked with ensuring all employees are notified in the event of an emergency or evacuation.

Employee Training and Drills

1. General training/instruction will be given to employees and include -Role and responsibilities. Threats, hazards, and protective actions. -Notification, warnings, and communication procedures. -Emergency response procedures. -Evacuation shelter, and accountability procedures, Location, and use of emergency equipment. -Emergency shutdown procedures.
2. A review of these emergency requirements will be provided annually.

JOB EMERGENCY ACTION PLAN

JOBSITE DETAILS			
Date: 06/01/2023	Project Owner: CHPE, LLC	Contractor: Caldwell Marine International	
Project Name - Location: CHPE – Wilcox Dock			Job No: NKT 1233
Project Address: 90 Cumberland Ave, Plattsburgh, NY 12901.			
PM: Thomas Ulisse	Cell: 732 620 3470	Supt:	Cell:

EMERGENCYCALLING INFORMATION – 911	(Local numbers are required, even if 911 is used.)	
Department	*Name*	*Telephone Number*
POLICE	Plattsburgh Police Dept.	911 (518) 563-3411
FIRE DEPARTMENT	Plattsburgh Fire Dept.	911 (518) 561-3780
FIRST AID/ NON-EMERGENCY	Wellnow Urgent Care	(518) 536-3071
HOSPITAL / EMERGENCY	CVPH	(518) 561-2000.
POISON CONTROL	NY Poison Control	800 222 1222
SPILL RESONSE	US Ecology	800 899 4672
OSHA	** Corporate Safety Director will Initiate Any/All Contact with OSHA**	
DIVE HOSPITAL	See Dive Hospital Posting	
GPS Coordinates: Chazy Landing – WILCOX DOCK	- 44°42’24.56”N	73°26’48.00”W

OWNER / CONTRACTOR CALLING INFORMATION		
Role	*Name- Address*	*Telephone*
OWNER	CHPE, LLC 600 Broadway Albany, NY 12207.	(800) 991-2473
OWNER’S ENGINEER		
GENERAL CONTRACTOR	Fredrik Hallsten NKT Inc.	(919) 836 3522
SUBCONTRACTOR	Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(732) 557-6100
SITE SAFETY MANAGER	Jhayllien Monette Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(936) 263-8139
CORPORATE SAFETY DIRECTOR	Lucky Abernathy JAG Companies 1333 Campus Pkwy Wall Township, NJ 07753	(908)-433-3755

DIVE HOSPITALS

Facility Hôpital du Sacré-Cœur-de-Montréal (Hyperbaric Unit)

Address 5400 Blvd Gouin Ouest
Montreal, QC H4J 1C5
CA

Phone
Business: +1-514-338-2777
24/7: +1-514-338-2000
Hospital: +1-514-338-2000

View on Google Maps™

Facility Jacobi Hyperbaric Center (Hyperbaric Medicine)

Address 1400 Pelham Parkway South
Room 1 West 20/J
Bronx, NY 10461
US

Phone
Business: +1-718-918-7521
24/7: +1-718-918-5800 ER
Hospital: +1-718-918-5000

View on Google Maps™

Facility Phelps Hospital-Northwell Health (Department of Hyperbaric Medicine)

Address 701 North Broadway
Sleepy Hollow, NY 10591
US

Phone
Business: +1-914-366-3690 7a-4p
24/7: +1-914-366-6665; +1-914-804-8671 Dr. O
Hospital: +1-914-366-3000

View on Google Maps™

Facility Upstate University Hospital, Syracuse NY (Hyperbaric Medicine Unit (SUNY))

Address 750 East Adams Street
Rm. 1528
Syracuse, NY 13210
US

Phone
Business: +1-315-464-4910 8am-4pm
24/7: +1-315-464-5449 (trans ctr)
Hospital: +1-315-464-5540

View on Google Maps™

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)

JOB EMERGENCY ACTION PLAN

HOSPITAL – Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

CVPH (8 Minutes from Work Area)
214 Cornelia St, Plattsburgh NY 12901.
(518) 561-2000.

After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

JOB EMERGENCY ACTION PLAN

Occupational Doctor – NonEmergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider:

Well now Urgent Care. (10 Mins Away from Work Area)
474 State Rte., Plattsburgh, NY 12901.
(518) 536-3071.

After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

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JOB EMERGENCY ACTION PLAN

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Evacuation Policy and Procedures

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2. A review of these emergency requirements will be provided annually.

JOB EMERGENCY ACTION PLAN

JOBSITE DETAILS			
Date: 06/20/2023	Project Owner: CHPE, LLC	Contractor: Caldwell Marine International	
Project Name - Location: CHPE – Essex Marina			Job No: NKT 1233
Project Address: 2272 Lake Shore Rd., Essex, NY 12936			
PM: Thomas Ulisse	Cell: 732 620 3470	Supt:	Cell:

EMERGENCY CALLING INFORMATION – 911 (Local numbers are required, even if 911 is used.)

Department	*Name*	*Telephone Number*
POLICE	Ticonderoga Police Dept.	911 (518) 585-3456
FIRE DEPARTMENT	Ticonderoga Fire Dept	911 (518) 547-9982
FIRST AID/ NON-EMERGENCY	Elizabethtown Community Hospital	(518) 585-2831
HOSPITAL / EMERGENCY	Columbia Memorial Health	(518) 828-7601
POISON CONTROL	NY Poison Control	800 222 1222
SPILL RESONSE	US Ecology	800 899 4672
OSHA	** Corporate Safety Director will Initiate Any/All Contact with OSHA**	
DIVE HOSPITAL	See Dive Hospital Posting	
GPS Coordinates:		

OWNER / CONTRACTOR CALLING INFORMATION

Role	*Name- Address*	*Telephone*
OWNER	CHPE, LLC 600 Broadway Albany, NY 12207.	(800) 991-2473
OWNER'S ENGINEER		
GENERAL CONTRACTOR	Fredrik Hallsten NKT Inc.	(919) 836 3522
SUBCONTRACTOR	Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(732) 557-6100
SITE SAFETY MANAGER	Jhayllien Monette Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(936) 263-8139
CORPORATE SAFETY DIRECTOR	Lucky Abernathy JAG Companies 1333 Campus Pkwy Wall Township, NJ 07753	(908)-433-3755

DIVE HOSPITALS

Facility Hôpital du Sacré-Cœur-de-Montréal (Hyperbaric Unit)
Address 5400 Blvd Gouin Ouest
Montreal, QC H4J 1C5
CA
Phone
Business: +1-514-338-2777
24/7: +1-514-338-2000
Hospital: +1-514-338-2000

View on Google Maps™

Facility Jacobi Hyperbaric Center (Hyperbaric Medicine)
Address 1400 Pelham Parkway South
Room 1 West 20/J
Bronx, NY 10461
US
Phone
Business: +1-718-918-7521
24/7: +1-718-918-5800 ER
Hospital: +1-718-918-5000

View on Google Maps™

Facility Phelps Hospital-Northwell Health (Department of Hyperbaric Medicine)
Address 701 North Broadway
Sleepy Hollow, NY 10591
US
Phone
Business: +1-914-366-3690 7a-4p
24/7: +1-914-366-6665; +1-914-804-8671 Dr. O
Hospital: +1-914-366-3000

View on Google Maps™

Facility Upstate University Hospital, Syracuse NY (Hyperbaric Medicine Unit (SUNY))
Address 750 East Adams Street
Rm. 1528
Syracuse, NY 13210
US
Phone
Business: +1-315-464-4910 8am-4pm
24/7: +1-315-464-5449 (trans ctr)
Hospital: +1-315-464-5540

View on Google Maps™

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)

NORTHEAST REMSCO Construction

CaldwellMarine INTERNATIONAL

HUXTED TRENCHLESS

JOB EMERGENCY ACTION PLAN

HOSPITAL – Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

Elizabethtown Community Hospital (25 Minutes from Work Area)

1019 Wicker St, Ticonderoga NY 12883.

(518) 585-2831.

After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

NORTHEAST REMSCO Construction CaldwellMarine INTERNATIONAL HUXTED TRENCHLESS

JOB EMERGENCY ACTION PLAN

Occupational Doctor – NonEmergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider:

Inter-Lakes Health. (25 Mins Away from Work Area)
1019 Wicker St, Ticonderoga NY 12883.
(518) 943-9100.

(Next To Hospital. See Map Above)

After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

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JOB EMERGENCY ACTION PLAN

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2. A review of these emergency requirements will be provided annually.

JOB EMERGENCY ACTION PLAN

JOBSITE DETAILS			
Date: 06/01/2023	Project Owner: CHPE, LLC	Contractor: Caldwell Marine International	
Project Name: CHPE – Bridgeview Harbor Marina			Job No: NKT 1233
Project Address: 54 Harbour Ln., Port Henry, NY 12974			
PM: Thomas Ulisse	Cell: 732 620 3470	Supt:	Cell:

EMERGENCY CALLING INFORMATION – 911	(Local numbers are required, even if 911 is used.)	
Department	*Name*	*Telephone Number*
POLICE	Ticonderoga Police Dept.	911 (518) 585-3456
FIRE DEPARTMENT	Ticonderoga Fire Dept	911 (518) 547-9982
FIRST AID/ NON-EMERGENCY	Elizabethtown Community Hospital	(518) 585-2831
HOSPITAL / EMERGENCY	Columbia Memorial Health	(518) 828-7601
POISON CONTROL	NY Poison Control	800 222 1222
SPILL RESONSE	US Ecology	800 899 4672
OSHA	** Corporate Safety Director will Initiate Any/All Contact with OSHA**	
DIVE HOSPITAL	See Dive Hospital Posting	
GPS Coordinates: Ticonderoga Boat Ramp. 43°51’15.52” N 73°23’08.46		

OWNER / CONTRACTOR CALLING INFORMATION		
Role	*Name- Address*	*Telephone*
OWNER	CHPE, LLC 600 Broadway Albany, NY 12207.	(800) 991-2473
OWNER’S ENGINEER		
GENERAL CONTRACTOR	Fredrik Hallsten NKT Inc.	(919) 836 3522
SUBCONTRACTOR	Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(732) 557-6100
SITE SAFETY MANAGER	Jhayllien Monette Caldwell Marine INTL 1333 Campus Pkwy Wall Township, NJ 07753	(936) 263-8139
CORPORATE SAFETY DIRECTOR	Lucky Abernathy JAG Companies 1333 Campus Pkwy Wall Township, NJ 07753	(908)-433-3755

DIVERS ALERT NETWORK

DIVE HOSPITALS

Facility Hôpital du Sacré-Cœur-de-Montréal (Hyperbaric Unit)

Address 5400 Blvd Gouin Ouest
Montreal, QC H4J 1C5
CA

Phone
Business: +1-514-338-2777
24/7: +1-514-338-2000
Hospital: +1-514-338-2000

View on Google Maps™

Facility Jacobi Hyperbaric Center (Hyperbaric Medicine)

Address 1400 Pelham Parkway South
Room 1 West 20/J
Bronx, NY 10461
US

Phone
Business: +1-718-918-7521
24/7: +1-718-918-5800 ER
Hospital: +1-718-918-5000

View on Google Maps™

Facility Phelps Hospital-Northwell Health (Department of Hyperbaric Medicine)

Address 701 North Broadway
Sleepy Hollow, NY 10591
US

Phone
Business: +1-914-366-3690 7a-4p
24/7: +1-914-366-6665; +1-914-804-8671 Dr. O
Hospital: +1-914-366-3000

View on Google Maps™

Facility Upstate University Hospital, Syracuse NY (Hyperbaric Medicine Unit (SUNY))

Address 750 East Adams Street
Rm. 1528
Syracuse, NY 13210
US

Phone
Business: +1-315-464-4910 8am-4pm
24/7: +1-315-464-5449 (trans ctr)
Hospital: +1-315-464-5540

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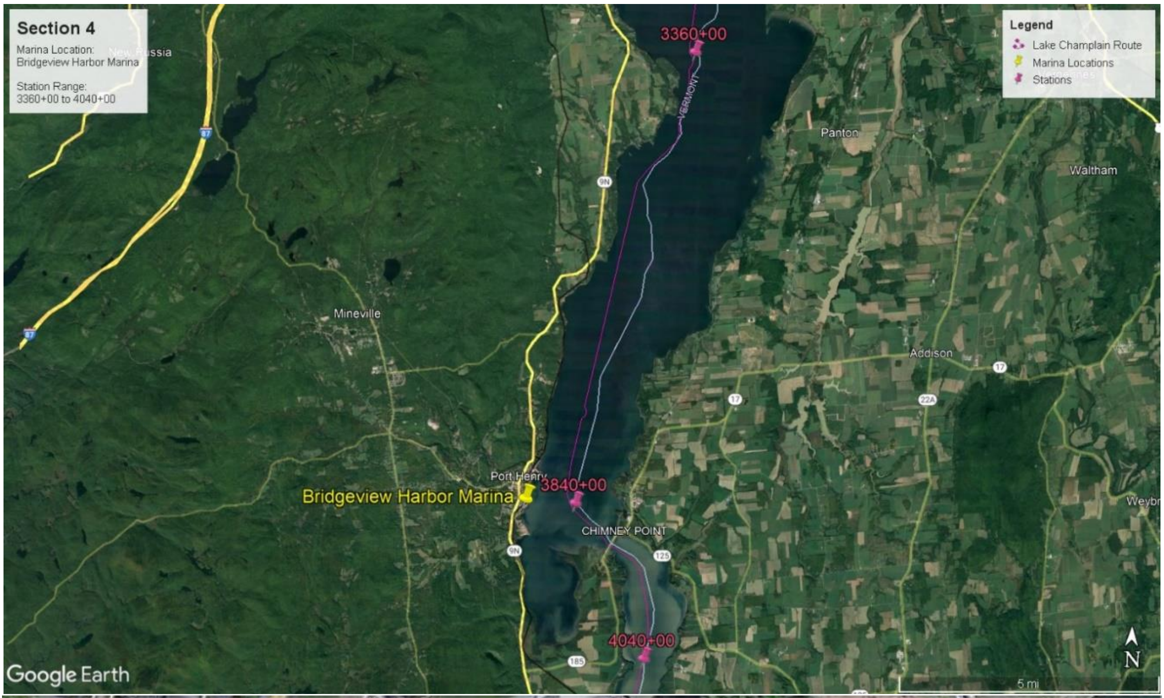
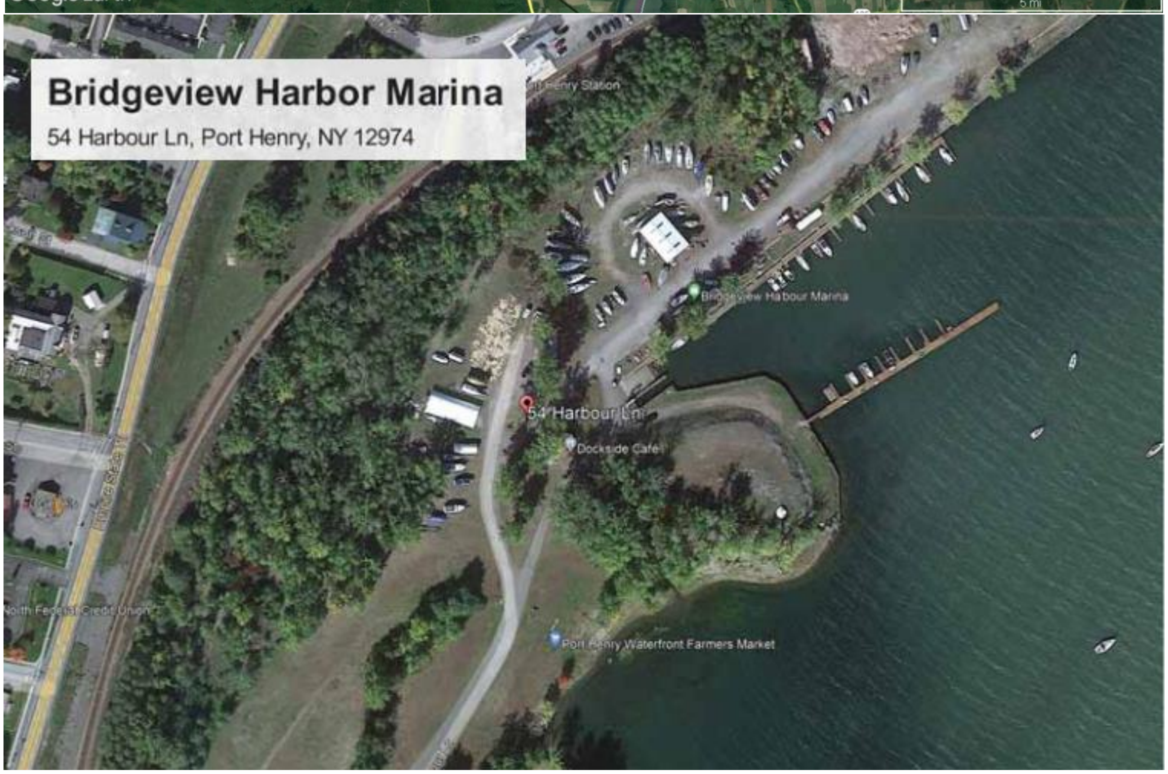
JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)





Northeast Remsco Construction CaldwellMarine International HUXTED TRENCHLESS

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Occupational Doctor – NonEmergency

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2. A review of these emergency requirements will be provided annually.

JOB EMERGENCY ACTION PLAN

JOBSITE DETAILS			
Date: 06/01/2023	Project Owner: CHPE, LLC	Contractor: Caldwell Marine International	
Project Name: CHPE – Monitor Bay Marina			Job No: NKT 1233
Project Address: 17 Monitor Bay #1, Crown Point, NY 12928			
PM: Thomas Ulisse	Cell: 732 620 3470	Supt:	Cell:

EMERGENCY CALLING INFORMATION – 911		(Local numbers are required, even if 911 is used.)
Department	*Name*	*Telephone Number*
POLICE	Ticonderoga Police Dept.	911 (518) 585-3456
FIRE DEPARTMENT	Ticonderoga Fire Dept	911 (518) 547-9982
FIRST AID/ NON-EMERGENCY	Elizabethtown Community Hospital	(518) 585-2831
HOSPITAL / EMERGENCY	Columbia Memorial Health	(518) 828-7601
POISON CONTROL	NY Poison Control	800 222 1222
SPILL RESONSE	US Ecology	800 899 4672
OSHA	** Corporate Safety Director will Initiate Any/All Contact with OSHA**	
DIVE HOSPITAL	See Dive Hospital Posting	
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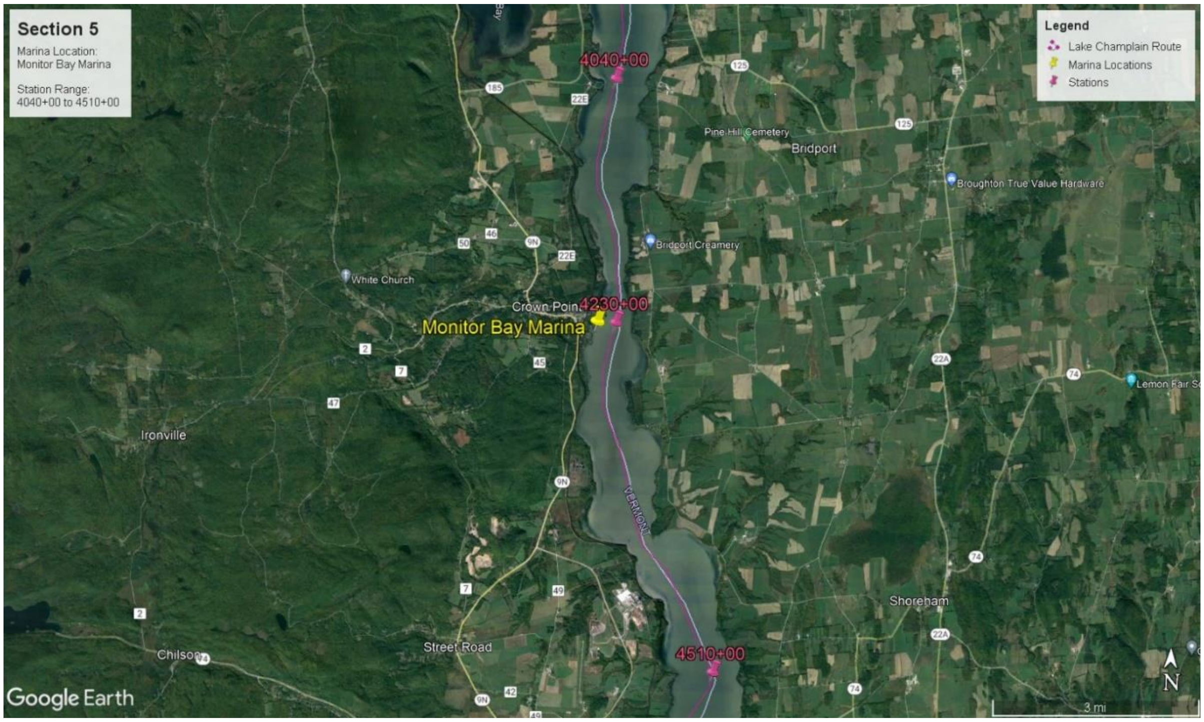

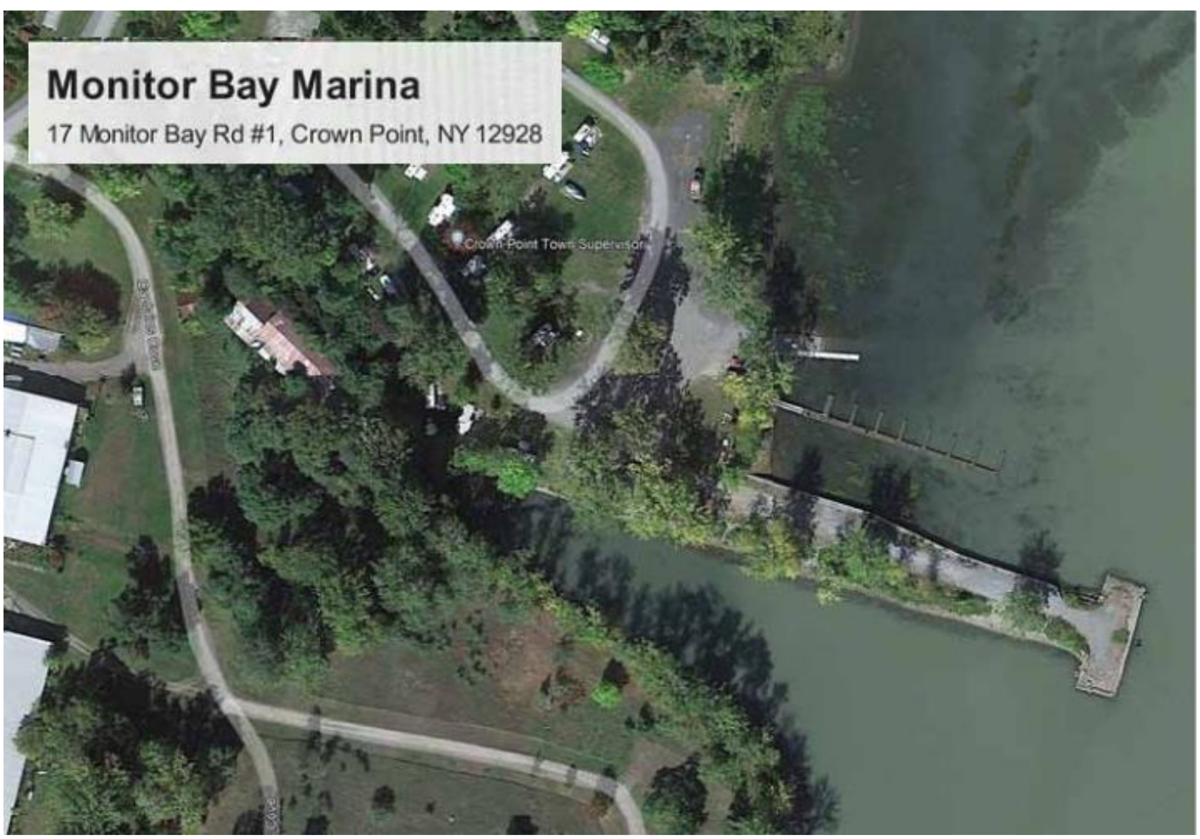

NORTHEAST REMSCO Construction
CaldwellMarine INTERNATIONAL
HUXTED TRENCHLESS

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JOBSITE DETAILS			
Date: 06/01/2023	Project Owner: CHPE, LLC	Contractor: Caldwell Marine International	
Project Name: CHPE – Chipman Point Marina			Job No: NKT 1233
Project Address: 68 Chipman Point Rd., Orwell, VT 05760			
PM: Thomas Ulisse	Cell: 732 620 3470	Supt:	Cell:

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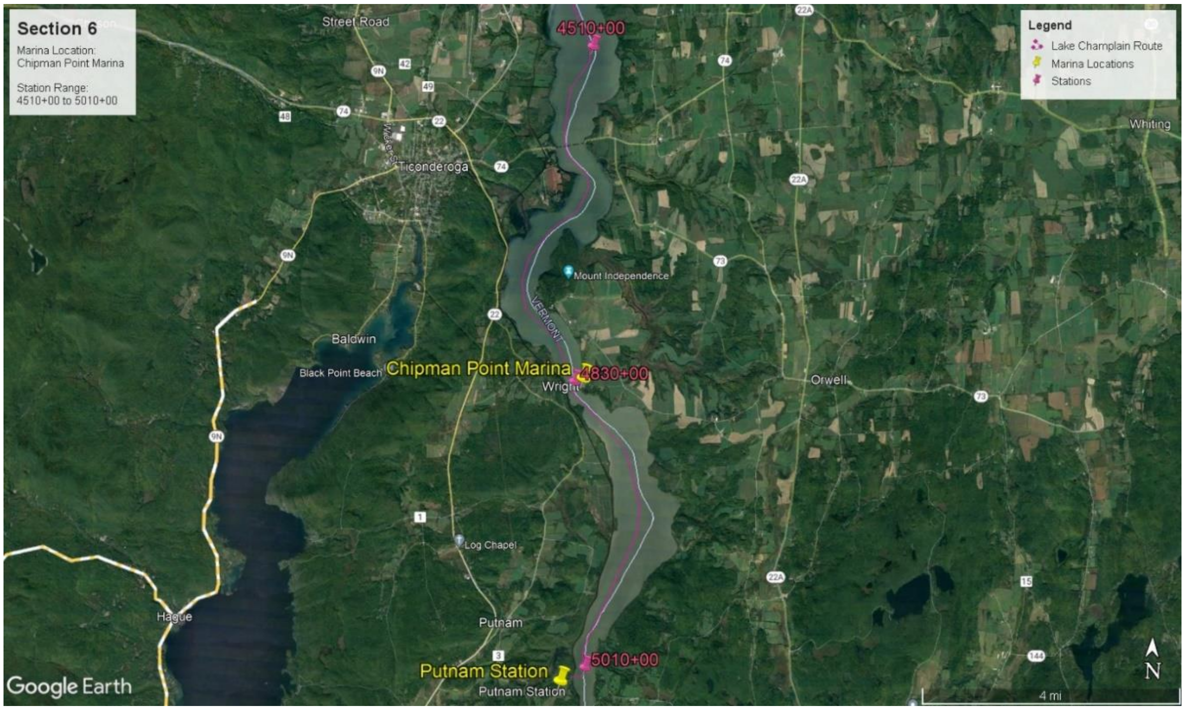

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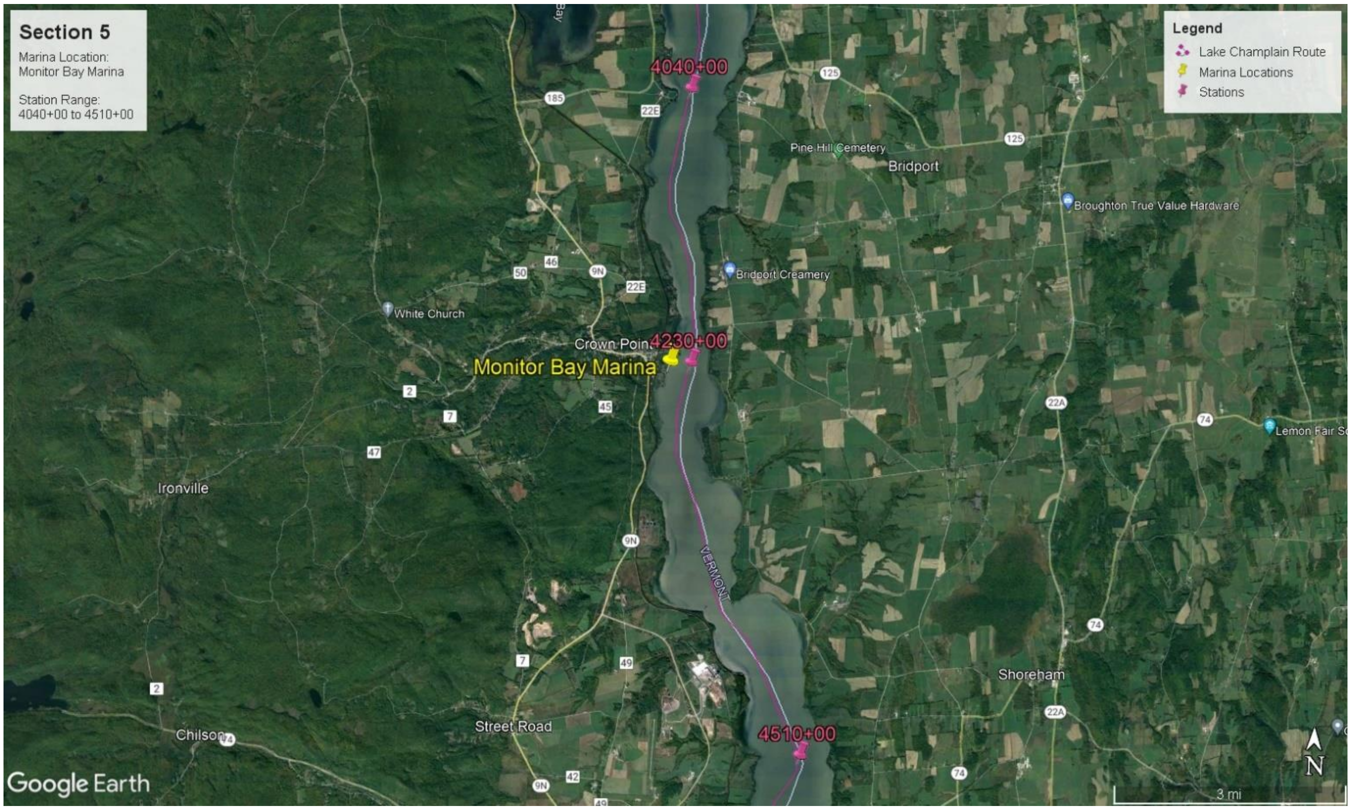
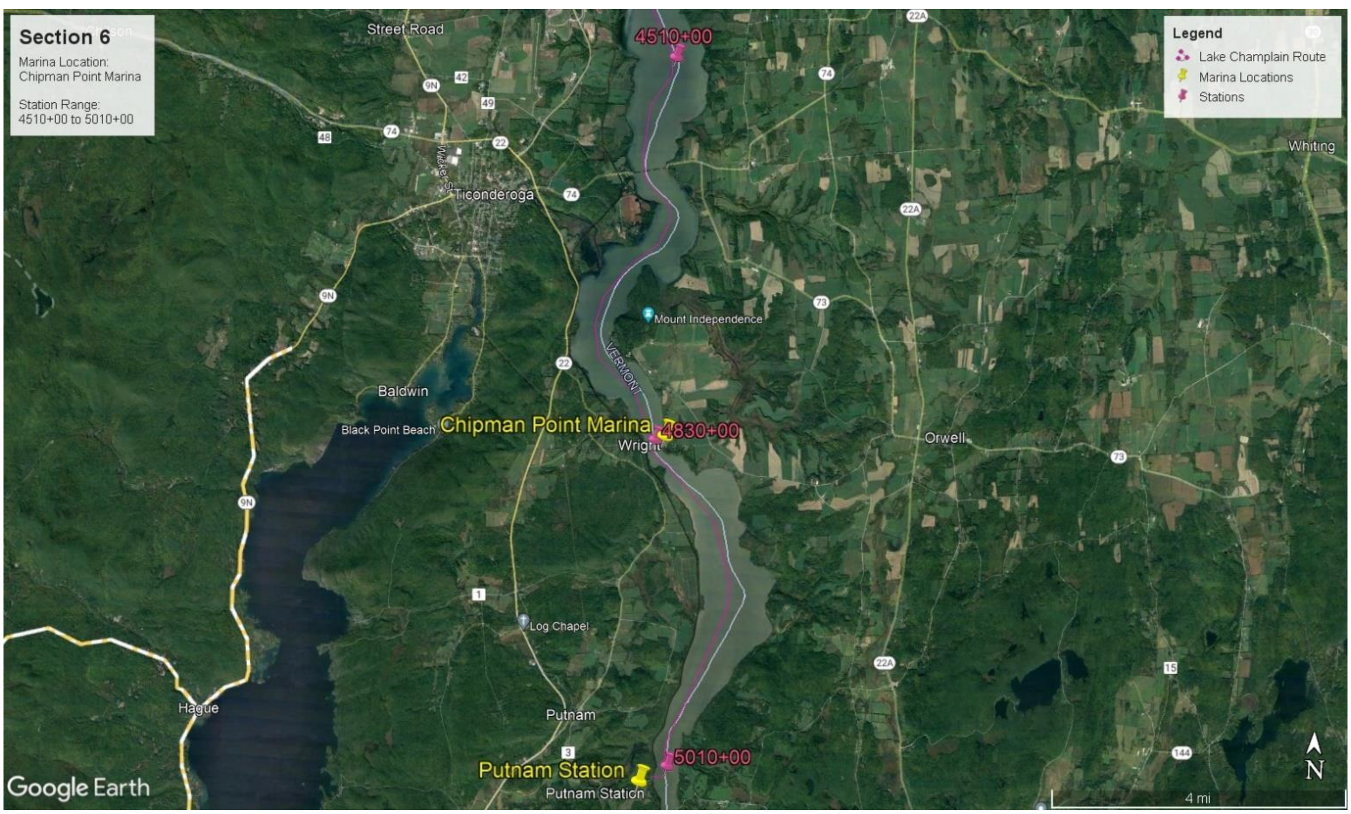


Section 5
Marina Location:
Monitor Bay Marina
Station Range:
4040+00 to 4510+00
Legend
Lake Champlain Route
Marina Locations
Stations
4040+00
4230+00
Monitor Bay Marina
4510+00
Crown Poin
Bridport
Pine Hill Cemetery
Broughton True Value Hardware
Bridport Creamery
White Church
Ironville
VERMONT
Shoreham
Street Road
Chilson
N
3 mi
Google Earth



Section 6
Marina Location:
Chipman Point Marina
Station Range:
4510+00 to 5010+00
Legend
Lake Champlain Route
Marina Locations
Stations
4510+00
4830+00
5010+00
Chipman Point Marina
Putnam Station
Street Road
Ticonderoga
Whiting
Mount Independence
VERMONT
Baldwin
Black Point Beach
Orwell
Log Chapel
Hague
Putnam
N
4 mi
Google Earth

Man Overboard

Project: CHPE

Emergency: Man Overboard

Overview

This Emergency Response Plan (ERP) has been developed specifically to support the Caldwell Marine International, LLC (CMI) marine operations. The purpose of this plan is to provide a precise set of procedures and protocols that will be used by CMI during a Man Overboard Incident.

Organization	Phone Number	Alternate
US Coast Guard	212-668-7000	VHF channel 16
Fire Department	911	
Ambulance	911	
Corporate Safety Director Lucky Abernathy	732-557-6100	908-433-3755 cell

Procedure

IF A PERSON IS WITNESSED FALLING OVER THE SIDE:

- Spotter notifies barge superintendent of the incident immediately by any means so as not to lose sight of victim.
- Spotter designated and had visual contact of person in water and has no other assigned task that would require him to ever lose visual contact.
- If the barge is spud down or the vessel anchored and the victim is able to help themselves back to the vessel assist them in the up and over process.
- If underway turn stern hard over away from the side the person fell over.
- Flotation devices and light markers are thrown overboard.
- Begin a written chronological record of the event.
- Record latitude and longitude.

If the victim does not give the "OK" signal, begin establishing communications with the nearest rescue facility to standby for medical evacuation.

Rescue Crew:

- Complete a head count of all personnel aboard. (Ensure only one person missing.) Rescue boat and boat crew rigged and ready to launch.
- One member of rescue boat crew outfitted as rescue swimmer, rigged with retrieval harness and retrieval line.
- Medical equipment standing by ready to treat hypothermia and/or possible blunt trauma from the fall.
- Utilize rescue swimmer to bring victim to ladder mounted on beam.
- No matter the rescued victim's verbal description of his/her medical condition, perform primary and secondary medical survey.
- Update the rescue facility it they were initially called. If they are already enroute to your position, have them continue to take the person to a medical facility.
- Provide Caldwell Marine International with a detailed chronological situation report ASAP. The formal report must be sent to the companies Health and Safety Officer within 24 hours of the incident, no exceptions.

IF PERSON IS ASSUMED MISSING OVERBOARD:

- Immediately establish contact with, and provide detailed chronological situation reports with the nearest search and rescue agency.
- Begin search as advised by assisting rescue agency.
- Call for any vessels in the vicinity to assist in search if willing. Determine water temperature, water current direction and speed.
- Interview crew under witness, have them prepare and signed witnessed statements attesting to or denying knowledge of following:
    - Last area person was seen.
    - Last time the person was seen.
    - What the person was wearing.
    - Any preexisting medical or mental condition.
    - What task the person was last assigned to.
    - His/her perceived mental state.

Provide Caldwell Marine International with a detailed chronological situation report ASAP. The formal report must be sent to the companies Health and Safety Officer within 24 hours of the incident, no exceptions.

ATTACHMENT 5
Incident Investigation Report

INJURY REPORT – FORM # 1

(Completed by Investigating Supervisor)

Report Only ☐

Complete Within 8 Hours or Before End of Shift
email to: safety@jaginc.co

Location:		**Investigation #**	
		Work Comp#	
Date of Incident:	**Time of Incident:** ☐ AM ☐ PM		
Date Reported:	**Shift:** ☐ 1 ☐ 2 ☐ 3 ☐ OTHER		
Location of Incident:	**Length of Shift:** ☐ 8 ☐ 10 ☐ 12 ☐ OTHER		
Type of Incident: ☐ **Injury** ☐ **Illness** ☐ **Near Miss** ☐ **Other:** ______			
Incident Description:			

PERSON INVOLVED

1.	**Name of Person involved:**	
2.	**Employment Status:**	☐ **Employee** ☐ **Sub-Contractor** ☐ **General Public**
3.	**Date of Hire/Assignment:**	
4.	**Job Title/Craft/Position:**	
5.	**Department:**	
6.	**Manager/Supervisor:**	
7.	**Gender:**	☐ **Male** ☐ **Female**
8.	**How long in Current Position:**	**Yrs.** **Months**
9.	**List the possible witnesses of the incident – Attach witness statement (Form #2):**	
10.	**Photographs taken** ☐ **Yes** ☐ **No**	**(PICTURE MUST BE TAKEN WHENEVER POSSIBLE)**
11.	**Is the employee involved employed anywhere other than JAG Companies ?** ☐ **Yes** ☐ **No** **If yes, where and what does s/he do?**	
12.	**What day of the week did the incident occur?**	☐ M ☐ Tu ☐ W ☐ Th ☐ F ☐ Sa ☐ Su
13.	**What consecutive day of the employee's work week was it?**	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
14.	**Was the employee working overtime at the time of the incident?**	☐ **Yes** ☐ **No**
15.	**Was the employee doing their regularly assigned/scheduled job duties?** ☐ **Yes** ☐ **No** **If "NO", then please explain**	

NOTE: Multiple Injuries – If more than one person is injured in an incident, a separate incident form will need to be completed for each person. Keep all the information for these incidents together and submit as one package.

JAG COMPANIES

INJURY / ILLNESS

1. **What type of injury / illness occurred?**

☐ Abrasion ☐ Amputation ☐ Bruise ☐ Concussion ☐ Dislocation
☐ Fracture ☐ Foreign Body ☐ Laceration ☐ Sprain/Strain ☐ Loss of Consciousness
☐ Other:

2. **To what part (s) of the body?** ☐ Right ☐ Left ☐ Both

☐ Right ☐ Left ☐ Both

3. **What was the initial type of treatment was provided?** ☐ First Aid ☐ Medical Clinic ☐ Hospital
☐ None - Not Needed or Requested at Time of Incident

Name and Location of treating facility: ____________________

4. **Was the injury/illness reported in a timely manner?** ☐ Yes ☐ No

If not, why?

5. **Onset of condition** ☐ Gradual ☐ Sudden

6. **Has the employee experienced a similar injury, pain, or discomfort previously?**

☐ Yes ☐ No ☐ Unknown

If "Yes" explain

7. **Did the incident result in a lost time accident?** ☐ Yes ☐ No ☐ Unknown

If Yes, what was the date of the last day worked?

8. **Has the person to been assigned light duty or job transfer?** ☐ Yes ☐ No ☐ Unknown

9. **When the employee was sent for post incident drug & alcohol test?** ☐ Yes ☐ No

Supervisor (print):	**Signature:**	**Date:**
Time of this Report: ☐ AM ☐ PM		

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
Incident Report– Form # 1	Investigating Supervisor	Within 8 hour or End of shift
Incident Statement –Form # 2	Person Involved in Incident	Within 24 hours
Incident Investigation-Form #3	Witness / Description - Extension for Form 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

Call EH&S Director ASAP with Details of the Incident - Lucky Abernathy at (908) 433-3755

NOTE: Initial report within 8hrs and a complete report with Incident Statement(s) within 24hrs

JAG COMPANIES

INCIDENT STATEMENT – FORM# 2

Complete within 24 email to: Safety@jaginc.co

STATEMENT FORM

Company: ______________________ email to: Safetey@jaginc.co

Statement By:	☐ Person/Employee Involved ☐ Employee Witness ☐ Manager/Supervisor ☐ Witness ☐ Contractor ☐ Temporary ☐ Visitor
Name:	**Date of Incident:** ***Time of Incident:***

STATEMENT

Print Name: **Signature:** **Date:**
Supervisors Review: **Date:**

INCIDENT INVESTIGATION FORM # 3

(Completed by Investigating Supervisor)

Complete within 24 Hours or before end of shift
email to: Safety@jaginc.co

Investigation #	
Work Comp#	

Company: ______________________

Date of Incident:	**Time of Incident:** ☐ AM ☐ PM
Type of Incident:	☐ Injury ☐ Illness ☐ Property Damage ☐ Other: ☐ Fire ☐ Near Miss ☐ Equipment Damage
Incident Description:	

PERSON INVOLVED

1.	**Name of Person(s) involved**	
2.	**Employment Status**	☐ Employee ☐ Temporary ☐ Sub-Contractor ☐ Visitor
4.	**Job Title/Position**	
5.	**Department**	
6.	**Manager/Supervisor**	

ROOT CAUSE ANALYSIS

1. What unsafe acts and or conditions contributed to the incident?

☐ Failure to Lockout/tagout	☐ Not wearing PPE	☐ Defective tool / equipment
☐ Lack of training or knowledge	☐ Wearing unsafe clothing	☐ Willful disregard of safety policy
☐ Improper guarding	☐ Inattentiveness / distraction	☐ Failed to recognize hazard
☐ Poor housekeeping	☐ Over exertion / pushing / pulling	☐ Other:

Other – please explain:

2. What is the root causes(s) of the incident?
(Please list or describe) ______________________

____

____

____

3. Did the person(s) involved violate a Company safety rule/regulation? ☐ **Yes** ☐ **No**

If so, which one and describe? ______________________

____

____

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Name: **DOI:**

EQUIPMENT / MATERIAL ANALYSIS N/A ☐

1. **Was the equipment/machine/tool involved suited for the purpose?** ☐ Yes ☐ No

   If No, please explain

2. **Was the equipment/machine/tool involved in good condition?** ☐ Yes ☐ No

   If No, please explain

3. **Were the safeguards in place?** ☐ Yes ☐ No

   If No, please explain

ENVIRONMENT N/A ☐

1. **Was the area where the incident occurred well lit?** ☐ Yes ☐ No

   If No, please explain

2. **Walking/Working Surface:** ☐ Slippery ☐ Wet ☐ Dry ☐ Level ☐ Not level ☐ Cracked ☐ N/A

   Other:

CORRECTIVE ACTIONS N/A ☐

1.
2.
3.

Supervisor (print)		**Signature**		**Date**	

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
1. Incident Report	Investigating Supervisor	Within 8 hour or end of shift
2. Incident Statement	Person involved in incident	Within 24 hours
3. Incident Statement	Witness or description extension for Form 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

NOTE: Initial report within – 8hrs and a complete report with Incident Statement(s) within 24hr.

JAG COMPANIES

FIRST AID LOG – FORM # 4 Week of / /

Submit to Safety@jaginc.co Monthly

THIS FIRST AID LOG IS TO BE COMPLETED FOR ANY INJURY REPORTED TO A SUPERVISOR OR ANY FIRST-AID TREATEMENT PROVIDED BY THE SUPERVISOR

Employee Name: ______ Date: ______ Time: ______ ☐ AM ☐ PM
Type of Injury: ______ Description of Injury: ______

Treatment Given: ______
Person Treating:

1) Employee Name: ______ Date: ______ Time: ______ ☐ AM ☐ PM
Type of Injury: ______ Description of Injury: ______

Treatment Given: ______
Person Treating:

2) Employee Name: ______ Date: ______ Time: ______ ☐ AM ☐ PM
Type of Injury: ______ Description of Injury: ______

Treatment Given: ______
Person Treating:

3) Employee Name: ______ Date: ______ Time: ______ ☐ AM ☐ PM
Type of Injury: ______ Description of Injury: ______

Treatment Given:
Person Treating:

4) Employee Name: ______ Date: ______ Time: ______ ☐ AM ☐ PM
Type of Injury: ______ Description of Injury: ______

Treatment Given:
Person Treating:

5) Employee Name: Date: Time: ☐ AM ☐ PM
Type of Injury: ______ Description of Injury: ______

Treatment Given:
Person Treating:

JAG COMPANIES

EQUIP/GL INCIDENT REPORT # 5

Complete Within 8 hours or before the End of Shift
email to: Safety@jaginc.co

Report Only	☐
Investigation #	

Company: ______________________ **Vehicle #:**

Date of Incident: **Time of Incident:** ☐ AM ☐ PM

Date Reported: **Shift:** ☐ 1 ☐ 2 ☐ 3 ☐ OTHER

Incident Location: **Length of Shift:** ☐ 8 ☐ 10 ☐ 12 ☐ OTHER

City: **State:**

What day of the week did the incident occur : ☐ Mon ☐ Tue ☐ Wed ☐ Thur ☐ Fri ☐ Sat ☐ Sun

Type of Incident: ☐ Motor Vehicle Accident ☐ Equipment Damage ☐ Property Damage ☐ Theft ☐ Fire ☐ Near Miss ☐ Unsafe Condition ☐ Other:

Incident Description:

Accident / Incident Description

Driver/Operator Name: **How long in Current Position:** Yrs. months

Employment Status: ☐ Employee ☐ Temporary ☐ Contractor ☐ Owner Operator

Any Injuries: ☐ Yes ☐ No * ☐ Fatality
If so, Who:

Was anyone removed from the scene by ambulance? * ☐ Yes ☐ No
If so, Who:

Was any vehicle towed: * ☐ Yes ☐ No **Which vehicle:** ☐ Yours ☐ Other driver ☐ Both

Was a police report made: ☐ Yes ☐ No **Report # :** **Was Driver ticketed:** * ☐ Yes ☐ No

Other Driver's Insurance Information : **Name:** **Insurance:** **Unavailable:** ☐

Other Vehicle Make: **Model:** **Ins. Carrier :** **Policy #**

List the possible witnesses of the incident: 1) 2) 3)

Photographs taken: ☐ **Yes** ☐ **No** **(PICTURES MUST BE TAKEN!!!!)** **If not, why:**

Diagram of Incident :

Provide a drawing of the roadway configuration and all vehicles or objects that were invoilved in the incident.

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Accident / Incident Description - Continued

Incident Occurred during:	☐ Loading ☐ Unloading ☐ In route (driving) ☐ Backing up ☐ Moving Forward ☐ Excessive Speed ☐ Unexpected Movement ☐ Unsafe Operation ☐ Turning ☐ Other :
Vehicle Type:	☐ Forklift ___ Ton ☐ Tractor ☐ Trailer ☐ Straight Truck (26,000 or below) ☐ Auto ☐ Other
Weather Conditions:	☐ Clear ☐ Rain ☐ Snow ☐ Wind ☐ N/A (In-side) ☐ Sun Glare ☐ Other
Road Conditions:	☐ Dry ☐ Wet ☐ Snow covered ☐ Icy ☐ Dark ☐ Other
Damage to:	☐ Tire/wheels ☐ Cab ☐ Body _____ (Location) ☐ R ☐ L ☐ Windshield ☐ N/A ☐ Drive Train ☐ Frame/Suspension ☐ Bumper - ☐ Front ☐ Rear ☐ Other

Note: **If the DOT driver received a ticket or answered yes to two (2) or more of the questions above with an asterisk (*) by it, then the driver must report for a Post-Accident Drug/ Alcohol Testing directly!!!**

When was the Post Incident Drug & Alcohol Test done:

DOT D & A Test: ☐	**NON- DOT D & A Test:** ☐	**If a test was not performed, Why?**
Date:	**Time:** ☐ AM ☐ PM	**Location:** **State:**

Reminders for the Drivers:
- ☐ Completer drivers report of accident
- ☐ Protect the vehicle and cargo
- ☐ Set warning devices and move to A Safe location
- ☐ Discuss the incident with ONLY proper authorities
- ☐ Obtain information i.e. Other vehicle info/witness names and numbers etc.
- ☐ Pictures, Pictures, Pictures

Driver/Operator (print):	**Signature:**	**Date:**
Supervisor (print):	**Signature:**	**Date:**

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
Equipment Incident Report– Form # 5	Investigating Supervisor	Within 8 hour or End of shift
Incident Report – Form # 1	Supervisor (If Employee Injury Involved)	Within 8 hour or End of shift
Incident Statement –Form # 2	Person involved in incident	Within 24 hours
Incident Investigation-Form #3	Witness / Description extension for Parts 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

NOTE: Initial report within 8hrs/end of shift and a complete report with Incident Statement(s) etc. within 24hrs.

JAG COMPANIES
CASE #:

INCIDENT DESCRIPTION	
Job: 1233: Champlain Hudson Power Express Submarine Cable Ins **Date of Incident:** 6/16/2023 12:00 AM **Date Reported:** 6/16/2023 1:50 PM **Date Recorded:** 6/16/2023 1:52 PM **Status:** Open	**Recorder:** ABERNATHY, LUCKY D **Recorder Email:** **Recorder Phone Number:**
Incident Description: Example of Environmental Incident Report	

CASE CONTACTS	
Person in Charge: ABERNATHY, LUCKY D **Person in Charge Email:** **Person in Charge Phone Number:**	**Person Most Familiar with Incident:** **Person Most Familiar Email:** **Person Most Familiar Phone Number:**

INCIDENT LOCATION	
Location Description: Example **Address 1:** **Address 2:** **City:** **State:** **Zip:** **Country:**	**Latitude:** 0.00000 **Longitude:** 0.00000 **Weather:**

OTHER USEFUL INFORMATION
Estimated Cost: $0.00 **Actual Cost:** $0.00
Case Notes:

Environment

GENERAL INFORMATION
Environmental Type: Spills of Oil, Fuel or Chemicals
Incident Description: Example
Agency to be contacted: Example
Contact #: Example
Contacted: No
Materials Involved: Example
Source of Spill: Example
Quantity Spilled: Example
Area Affected: Example
Spill Entered Waterway: No
Clean Up and Spread Prevention Steps: Example

NOTES
Notes: Example

ATTACHMENTS

ATTACHMENT 6
Corporate Health & Safety Policies and Procedures Manual

(Incorporated by Reference)

ATTACHMENT 7
Confined Space Entry Forms

Caldwell Marine International

CONFINED SPACE ENTRY PERMIT

LOCATION and DESCRIPTION of Confined Space:	
PURPOSE of Entry:	
DEPARTMENT:	
SUPERVISOR:	
Permit Type: □ **Specific Entry** □ **Duration of Job** □ **Annual** □ **Special/Hot Work**	
Hazards: □ O_2 □ **Flammability** □ **Toxic Chemical (specify)-** □ **Other (specify)-**	
KEY PERSONEL (Initialed by Individual)	

Authorized Entrants	Attendant(s)	Rescue Personnel
	1st -	
	2nd -	

ENTRY CHECKLIST

Item	YES	N/A	Item	YES	N/A
Lockout - De-energize/electrical			Lifelines		
Lockout - Mechanical/valves			Fire Extinguisher(s)		
Purge - Flush and Vent			Rescue Personnel Available		
Positive Ventilation			Lighting		
Secure Area, Barriers in Place			Protective Clothing		
Emergency SCBA at Site			Oxygen Meter		
Escape Harness			Combustible Gas Meter		
Tripod Emergency Escape Unit			Chemical Detector		

Special Precautions & Equipment:

Air Monitoring

Test Parameter	Permitted Condition	Perform Test		Initial Results	2	3	4	5
		YES	NO		Time	Time	Time	Time
% Oxygen	19.5 - 23%							
% of LEL	< 10 %							
% of CO	< 25 %							
Hydrogen Sulfide	< 10 %							

[QUALIFIED PERSON] has verified that all the above conditions have been satisfied and authorizes work to proceed as specified:

Name:________________________________**Title:**____________________________**Date:** ______________________

ATTACHMENT 8
Hot Work Permit

HOT WORK PERMIT

Date:____________________ Time: ______________________________

Location: ____

Issued To: ____

Site Safety Officer (if applicable): ____

Supervisor: ____

Do not cut or use open-flame or spark producing equipment until the following precautions have been taken.

Protective Equipment to be used: ____

Fire Watch Assigned: ____

(Initial Each of The Following)

__________ The location where the work is to be done has been personally examined.

__________ Any available fire protection systems are in service.

__________ There are no flammable dusts, vapors, liquids, or unpurged tanks (empty) in the area.

__________ Explosive meter reading <10%. 1st Reading:_______2nd Reading: _______
Additional readings: ____

__________ All combustibles have been moved away from the operation, or otherwise protected with fire curtains or equivalent.

__________ Ample portable fire extinguishing equipment has been provided.

__________ Arrangements have been made to patrol the area for at least 30 minutes after the work has been completed.

__________ The phone number for the local Fire Department is: ________________

NOTE: This form is to be filled out in its entirety by the responsible person performing the “HOT WORK.” It must be approved by the Health and Safety Officer and the client prior to beginning the project.
This permit expires 24 hours after the designated "start time." If work is to continue another permit must be issued.

Company:	Date:
Responsible Person:	Start Time:
Work to be performed:	End Time:
Location (area, room, etc.):	Equipment:
Is it possible to perform this work in the shop? Yes No	Other:

Place a checkmark if the following items have been completed.

Flame or spark-producing equipment to be used has been inspected and found in good repair.	
Sprinklers, where provided, are in commission and will not be taken out of service while this work is being done.	
There are no combustible fibers, dusts, vapors, gases, or liquids in the area. Tanks and equipment previously containing such materials have been purged. The absence of gases or vapors has been verified by a combustible gas detection instrument. If there is a possibility of a leak developing in nearby piping, equipment, or tanks, this area is to be continuously monitored. Call Site Safety if assistance is needed to test area at (specify phone #):______________________________	
Fire alarms will not be taken out of service while work is being performed. If alarm system must be inactivated during work, then client will be contacted prior to taking alarm out of service so that a suitable "Fire Watch" can be coordinated. *Under no circumstances will fire alarms be taken out of service without contacting client.*	
The work will be confined to the area or equipment specified on this permit.	
Surrounding floors have been swept clean and, if combustible, wet down.	
Contractor has ample portable fire extinguishers available and trained personnel to use them.	
All combustibles have been relocated 35 feet from the operation and the remainder protected with metal guards or flame-proofed curtains or covers (not ordinary tarpaulins).	
All floor and wall openings within 35 feet of the operations have been tightly covered.	
Responsible personnel have been assigned to provide a "Fire Watch" for dangerous sparks in the work area, as well as on floors above and below while work is being performed.	
Arrangements have been made to provide a "Fire Watch" to patrol the area, including floors above and below, during any lunch or rest period and for at least one-half hour after the work has been completed.	

I attest that the above precautions have been taken:	
Name of Person Responsible for performing Hot Work:	
Site HSO Approval (name):	
Date:	

ATTACHMENT 9
Safety Inspection Form

Inspected By:____ Date: ______________________

Worksite Information	Yes	No	N/A
Posting of OSHA and other work-site warning posters?			
First aid equipment properly stocked?			
Work site injury records being kept?			
Emergency telephone numbers conspicuously posted?			
Emergency Information (evacuation, muster points, etc.) posted?			
Safety Meetings conducted periodically? When was last meeting?			

Describe violation, location, and corrective actions taken:

____

____

____

Housekeeping and Sanitation	Yes	No	N/A
Are emergency lights fully operational?			
Regular disposal of waste and trash?			
Passageways and walkways clear?			
Waste containers provided and used?			
Sanitary facilities adequate and clean?			
Adequate supply of water?			
Adequate lighting?			
Trash receptacle for drinking cups?			
Are handrails and stair treads in good repair?			
Is smoking restricted to certain locations?			
Are electrical cords and plugs in good condition?			
Is a clearance of 3' maintained around hot water heaters, electric breaker panels, heating units, and fire sprinkler riser?			
Are electric circuit breakers free of obstructions?			
General neatness of working areas:			

Describe violation, location, and corrective actions taken:

____

____

____

Fire Prevention	Yes	No	N/A
Fire instruction to personnel?			
Fire extinguishers identified, accessible, and fully charged?			
“No Smoking” signs posted and enforced where needed?			
Good housekeeping?			
Storage use and handling of flammable liquids properly done?			
Fire hazards checked?			
Is gasoline contained only in UL listed containers?			

Describe violation, location, and corrective actions taken:

____

____

____

Handling and Storage of Materials	Yes	No	N/A
Are materials properly stored and stacked?			
Are passageways clear?			
Shelves in stockrooms in good repair and properly anchored.			
Stacks on firm footing, not too high?			
Are employees lifting loads correctly?			
Are materials protected from weather conditions?			
Flammable liquids not stored in areas used for exits or stairways?			

Describe violation, location, and corrective actions taken:

____

____

____

Hand Tools	Yes	No	N/A
Proper tool being used for each job?			
Neat storage, safe carrying?			
Inspection and maintenance?			
Electric tools are grounded?			

Describe violation, location, and corrective actions taken:

____

____

____

Personal Protective Equipment	Yes	No	N/A
Eye protection?			
Respirators and mask?			
Helmets, hoods, head protection?			
Gloves, aprons, sleeves?			
Hearing protection?			
Safety harnesses and lifelines?			
Shirts are to be worn?			
Back support belts?			

Describe violation, location, and corrective actions taken:

____

____

____

Hazardous Materials	Yes	No	N/A
Is a binder containing SDS for supplies containing hazardous chemicals available to employees before using?			
Are “Safety Data Sheets” being available on request signs posted in conspicuous locations?			
Is the hazardous waste inventory log maintained?			
Are hazardous waste storage areas inspected weekly?			
Is the hazardous material dispositioning log maintained?			
All containers clearly identified?			
Proper storage practices observed?			
Proper storage temperatures and protection?			
Proper type and number of extinguishers nearby?			
Are there any visible dust or fumes that could be of a concern?			

Describe violation, location, and corrective actions taken:

____

____

____

Unsafe acts and/or practices observed:

____

____

____

Site Supervisor____Date: __________

Safety Inspector____Date: __________

ATTACHMENT 10
HSE Monthly Report

HEALTH, SAFETY & ENVIRONMENT – MONTHLY REPORT

HSE RECORD - MONTHLY REPORT			
HSE METRICS	**Last Month**	**Cumulative**	**Notes**
Days since an LTI;			
Number of Senior Leadership Safety Tours;			
Number of site safety inspections;			
Number of positive observations;			
Visits by the regulator;			
Visits by CHPE (TDI and WSP);			
LAGGING INDICATORS			
Number of Employees at Site			
Manhours worked during the month;			
CMI Hours			
Injuries by category			
a. Recordable and lost time injuries			
b. Medical Treatment injuries;			
c. Accidents with Restricted Work Case;			
d. First Aid injuries;			
d. MPD (major permanently disabling injuries);			
Near Miss incidents			
Lost time days			
Number of Fatalities			
Statistical analysis			
a. LTIFR (Lost Time Incident Frequency Rate)			
b. AIFR (All Incident Frequency Rate)			
Detailed incident reports (Doc Ref. #)			
Reports of any environmental incidents			

ATTACHMENT 11
Site Specific Safety Orientation Form

SITE SPECIFIC SAFETY ORIENTATION

Contractor / Subcontractor:	Project Number:
I have attended the site orientation and understand and furthermore I accept the site rules and regulations presented.	
Printed Name:	**Trade:**
Address:	**Telephone Number:**
Emergency Contact Person & Telephone Number:	**Driver's License Number:**

MEDICAL QUESTIONS – This information is medical and is considered confidential.
All questions are voluntarily requested to assist in the event of an emergency.

1. **Do you have any known allergies?** ☐ No ☐ Yes If yes, describe: ______________________
2. **Are you on any medications?** ☐ No ☐ Yes If yes, describe: ______________________
3. **Do you have first aid training?** ☐ No ☐ Yes If yes, exp. date: ______________________

SAFETY RULES AND REGULATIONS	
☐ Review of Federal Regulations & Requirements	☐ Work Permit
☐ Emergency Response / Alarms	☐ Scaffolding / Tag System
☐ First Aid Station / Location / Training	☐ Ladders
☐ Reporting ACC / INC / Injuries / Hazards	☐ Riggers – Responsibilities
☐ Worker Responsibilities	☐ Preventive Maintenance Program
☐ Foreman Responsibilities	☐ Excavations
☐ Management Responsibilities	☐ Barricades
☐ Worker Right to Know	☐ Signage / Flagging
☐ Site Hazards	☐ Welders Responsibilities / Work Protection, etc.
☐ HNIS / MSDS – Training / Locations	☐ Fire Extinguishers / Locations / Inspections
☐ Communication Systems	☐ Torches / Cutting Equipment / Safeguards / Flash Arrestors
☐ Traffic Patterns / Parking / Security	☐ Proper Storage / Transporting Cylinders
☐ Safety Meetings	☐ Inspection of Hoses / Coupling etc.
☐ Smoking / Alcohol / Drugs	☐ Equipment Safeguards
☐ Zero Tolerance Rules	☐ Grinders / Disc Rated
☐ Equipment Inspection / Certification	☐ Electrical Cords / Connectors / Overhead Lines
☐ Equipment Hazards	☐ Hand Tools / Power Tools
☐ Lockout Program	☐ Rowdiness / Horseplay
☐ P.P.E. Eyes / Ears / Head / Hands / Feet	☐ Good Housekeeping / Sanitation
☐ Safety Harness / Lanyards	☐ Spill kits & Spill Response
☐ Confines Space / Training	☐ Other:

Attendee's Signature:	Date:
Instructor's Signature:	**Date:**

ATTACHMENT 12
Lightning Safety Procedures

Overview

The purpose of this document is to provide a guide for personal safety during thunderstorms.
A brief review of common medical problems encountered with a lightning strike and appropriate first aid treatment is also included.

References

OSHA Emergency Action Plans 29CFR 1926.35

Hazards

Direct strike - statistics show that death resulted in over 70 % of cases.
Side flash - e.g. standing near a tree - this can be as serious as a direct strike.
Contact potential - physical contact with struck object has similar consequences to direct strike.
Step voltage - lightning impulse traveling through/on ground and may pass through one limb/part and out another. Injuries include burns and paralysis but these are usually temporary.
Surge propagation - person close to or in contact with an electrical appliance or power/communication line. Serious injury is not common but a number of deaths have resulted from telephone usage.

Key Responsibilities

Managers and Supervisors

- Review project Emergency Action Plan (EAP), as outlined in 29 CFR 1926.35
- Review written lightning safety protocol with all outdoor workers
- Regularly monitor weather conditions and local weather forecasts prior to scheduled activities
- Monitor SkyScan EWS-PRO 2 Portable Lightning Detector and Early Warning Device
- Notify all employees about lightning safety warnings and instruct workers seek safe shelter inside.
- Suspend outdoor work activities when lightning is detected within 3-8 miles
- Inform all workers to take action after hearing thunder, seeing lightning, or perceiving any other warning signs of approaching thunderstorms.
- Do not allow the resumption of outdoor work activities until 30min after the last lightning strike.

Employees

- Follow all directions and instruction of your supervisor
- When instructed, seek safe shelter ASAP
- Do not return to work until instructed to do so by supervisor.
- Employees should safely secure any work tasks being performed at the time of lightning notification and seek safe shelter inside ASAP.

Procedure/Practices

General
Lightning safety awareness should be a priority at every outdoor facility and operation, where education is the single most important means to achieving this goal.

The number one rule is that workers need to always consider their own situational safety, and those who may find themselves exposed to the risk should always recognize and anticipate their exposure to a changing or high-risk situation, and where appropriate move to a lower-risk location.

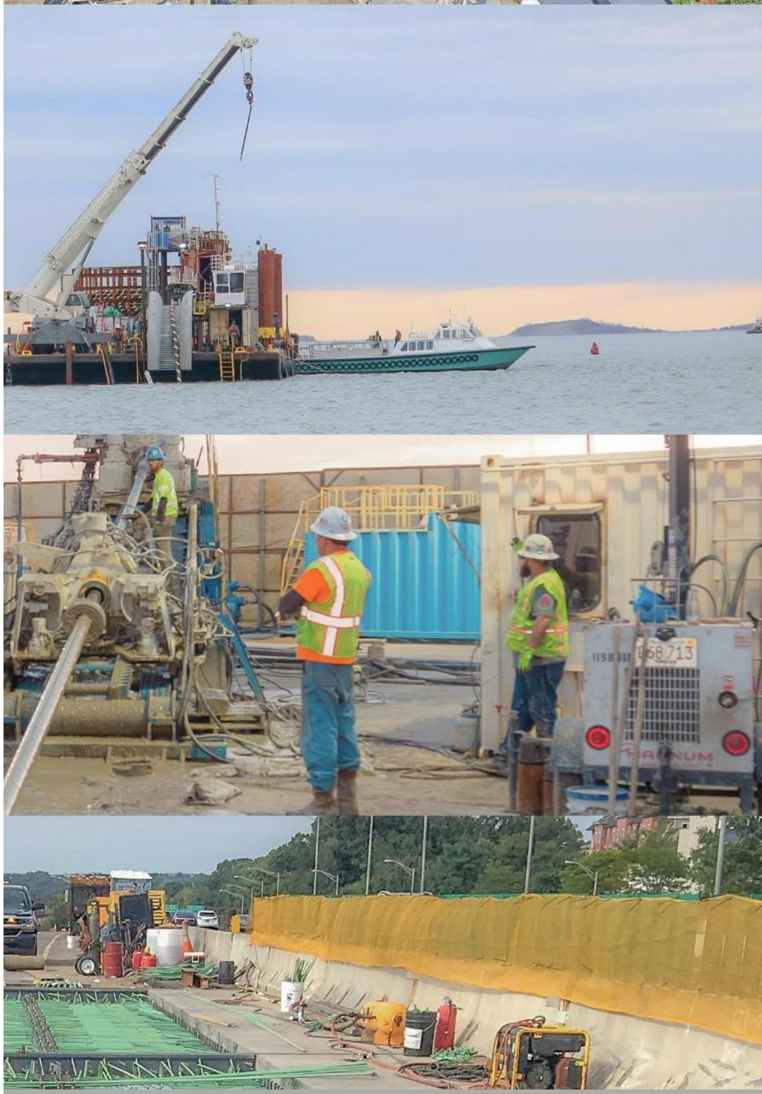
The following steps are suggested:
1. Regularly monitor weather conditions and local weather forecasts prior to scheduled activities.
2. Suspension and resumption of work activities should be planned in advance, in conjunction with this Lightning Risk Policy
3. Understanding of SAFE shelters is essential. SAFE evacuation sites include:
   - Grounder Barge offices/lunchroom/tool containers
   - Fully enclosed metal vehicles with windows up
   - Substantial buildings
   - Low ground
4. UNSAFE SHELTER AREAS include all outdoor metal objects, like power poles, fences and gates, high mast light poles, electrical equipment, mowing and road machinery.
   - AVOID solitary trees.
   - AVOID water.
   - AVOID open fields.
   - AVOID high ground and caves.
5. If you feel your hair standing on end, and/or hear "crackling noises," you are in lightning's electric field. If caught outside during close lightning activity, immediately remove metal objects (including baseball cap, jewelry, belts, car keys etc.), place your feet together, duck your head, and crouch down low with hands on knees.
6. Wait a minimum of 30 minutes from the last observed lightning or thunder before resuming activities. Be extra cautious during this phase as the storm may not be over.
7. People who have been struck by lightning do not carry an electrical charge and are safe to handle. Apply first aid immediately if you are qualified to do so. Get emergency help promptly.
9. Suspend activities, allowing sufficient time to get to shelter. Of course, different distances to safety will determine different times to suspend activities.
10. Be aware of your surroundings and the nearest safe area.

SkyScan EWS-PRO 2 Features:

Accurate digital microprocessor with patented dual antenna receiving system

- Built-in 12 volt rechargeable power source, operating for 7+ days on a single charge
- Loud 95dB alert horn, with adjustable range setting
- Rugged weather-resistant case
- Low battery indicator on the weather detector
- Severe thunderstorm alert that warns of large storm cell approaching
- False signal filtering feature to warn against any possible location interference
- Accurate identification software that eliminates alerts to harmless cloud-to-cloud lightning activity
- Battery management intelligent battery recharging system.
- Case designed with battery recharger storage compartment

ATTACHMENT 13
Pandemic Response Plan



JAG Companies

Pandemic Pathogen Response Plan

VERSION 1.5 | November 1, 2020

Property of JAG Companies, Inc.
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JAG Companies Pandemic Pathogen Response Plan

Note: The following plan provides a general framework that any Northeast Remsco Construction, Caldwell Marine International, Huxted Tunneling, and ECI Drilling International facility/project should follow during a pandemic event. The plan is based on Federal guidelines; however, State/Local Governments, Project Owners, or specific circumstances may require a different standard of response. The Plan, in coordination with the Emergency Response Team, may be altered to support additional requirements requested/required from State/Local Governments or Project Owners or to respond to particular conditions.

1. Purpose & Goal

a. The purpose of implementing the JAG Companies Pandemic Pathogen Response Plan (the "plan") is to:
   i. (1) protect the health of our employees and their families
   ii. (2) to ensure business continuity and maintain mission-critical operations and services during a pandemic event
b. Maintaining essential business functions during a pandemic event is a challenge and the response requires flexibility based on available credible information from government agencies (federal, state, & local) and medical professionals.
c. The plan allows JAG Co. to respond to any pandemic, outbreak, or health related event effectively and efficiently.
d. Leadership is key during a pandemic event. Employees will look to management to provide leadership for JAG Co. We are committed to lead as follows:
   i. *Anticipate*: We will attempt to predict what lies ahead without succumbing to panic.
   ii. *Navigate*: We will course correct as needed in real time.
   iii. *Communicate*: We will continually maintain clear, established lines of communication with our employees.
   iv. *Listen*: We will listen to the experts, our advisors, and our employees, including information we may not want to hear. We will attempt to avoid media hype and crowd hysteria.
   v. *Learn*: We will use what we learn from this experience as a lesson for future events.
   vi. *Lead*: We will improve ourselves and elevate those around us.
e. The plan will be reviewed annually or during the initial phases of a health event as needed. Reviewers will include certain JAG Co. management personnel.

2. Key Terms & Definitions

a. **Close Contact**: Being within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period regardless of whether cloth face covers or masks were in us.
   i. Anyone who has been exposed to COIVD-19 due to "close contact" is required to stay home for 14-days from the day of last exposure.
      1. During the 14 days, that person must maintain a distance of at least 6 fee from others at all times, self-monitor for symptoms, avoid contact with people at higher risk of illness, and follow CDC guidelines if they develop symptoms.
   ii. Brief interactions totaling 15 minutes over the course of 24-hours with:
      1. A person who is known to have COVID-19 (i.e., someone who has been

tested and confirmed to have COVID-19),
2. A person who developed symptoms consistent with COVID-19 two to three days after the interaction, or
3. A person currently experiencing symptoms of COVID-19.

iii. Factors to consider when evaluating close contact:
1. Proximity: closer distance increases exposure risk.
2. Duration: longer interactions increase exposure risk.
3. Symptoms: interactions with a person within two to three days of symptom onset increase your exposure risk.
4. Activity: interactions with persons coughing or shouting increase your exposure risk.
5. Location: interactions in an area that has less ventilation (indoors vs. outdoors) increase your exposure risk.

b. **Hand Hygiene**: Applies to the disinfecting of one's hands. This is usually done with soap and water, hand sanitizer, or hand wipes. It is recommended that you wash your hands for a minimum of 20 seconds with soap & water and 10 seconds with hand sanitizer/wipes.

c. **Human-to-Human Transmission:** Refers to the spread of a pathogen from one human to another by (including but not limited to): direct contact with the blood or body fluids (i.e., *saliva, urine, vomit, semen, and feces*) of an infected person or contact with objects that have been contaminated with the blood or body fluids of an infected person.
   i. The pathogen in the blood & body fluids can enter another person's body through broken skin or unprotected mucous membranes in the eyes, nose, or mouth.
   ii. During outbreaks of pathogen, the disease can spread quickly and human-to-human contact must be avoided and/or eliminated.
   iii. Proper disinfecting and disposal of objects is vital.

d. **Infection Control**: A broad term used to describe a number of measures designed to detect, prevent, and contain the spread of an infectious disease. Some measures include hand washing, respiratory etiquette, use of personal protective equipment (PPE), prophylaxis, isolation, and quarantine.

e. **Infectious Disease**: An infectious disease, or communicable disease, is caused by the entrance of organisms (e.g. viruses, bacteria, fungi) into the body that grow and multiply to cause illness. Infectious diseases can be transmitted by direct contact with an infected individual, their discharges (e.g. breath, cough, sneeze), or with an item touched by them.

f. **Isolation**: When sick people are asked to remain in one place (e.g. home, hospital), away from the public, until they are no longer infectious.

g. **Pandemic**: A disease epidemic that has spread across a large region, for instance multiple continents, or worldwide.

h. **Pathogen**: A bacterium, virus, or other microorganism that can cause disease.

i. **Personal Protective Equipment (PPE)**: PPE is specialized clothing or equipment worn to protect someone against a hazard including an infectious disease. It can range from a mask or a pair of gloves to a combination of gear that might cover some or all of the body.

j. **Prevention**: An action taken to reduce or eliminate the opportunities for transmission of the disease from one individual to another. We must all do our part to prevent the spread of the disease by following the procedures outlined in this process.

k. **Quarantine**: A quarantine is when people who have been in close proximity to an infected person, but appear healthy, are asked to remain in one place, away from the general public, until it can be determined that they have not been infected.

l. **Respiratory Etiquette**: Respiratory etiquette, or good coughing and sneezing manners, is one way of minimizing the spread of pathogens which are passed from human-to-human in the tiny droplets of moisture that come out of the nose or mouth when coughing, sneezing, or talking. Healthy and sick people should cover their nose and mouth when sneezing, coughing, or blowing their nose and then put the used tissue in the trash to prevent the spread of germs.

m. **Social (Physical) Distancing**: An infection control strategy that includes methods of reducing the frequency and the closeness of contact between people to limit the spread of infectious diseases. Generally, social distancing refers to the avoidance of gatherings with many people.
   i. In the event **Social (Physical) Distancing** is not practical nor feasible during work activities, the employee will be supplied and required to wear the appropriate respiratory PPE.

n. **Work from Home (WFH)**: WFH is a consideration available for certain eligible employees as identified by the Emergency Response Team ("ERT") to work temporarily from home or a remote location. The WFH process will be followed by all identified employees:
   i. The ERT will identify employees that can or will work from home.
   ii. The ERT will notify the employee's manager and the manager will assign a virtual meeting group and meeting group leader.
   iii. Normal operating hours apply.
      1. A 30-minute lunch break will be accounted for during working hours.
   iv. OIT will coordinate and set-up the necessary technology for identified employees.
      1. OIT is available to provide all necessary support.

3. Responsibilities

a. <u>Employer</u>: All JAG Companies' operating companies.
   i. Create, distribute and implement a **"Self-Assessment Checklist."**
      1. The checklist does not supersede any daily assessment protocols that may already be in place as provided by the project owner.
      2. The checklist will be provided to employees as well as prominently displayed at all Company facilities (offices, jobsites, shops, etc.).
      3. If you reply **<u>YES</u>** to any of the checklist questions, **<u>STAY HOME</u>** and immediately contact your supervisor.
   ii. Educate workers about general precautions and regularly communicate plans to limit the spread of the pathogen.
   iii. Reinforce good hygiene practices and take steps to make it easy for workers to frequently wash their hands.
      1. Install hand-sanitizing stations throughout workplaces.
   iv. Implement policies that maintain physical distance between workers.
      1. Post social distancing signs as a reminder.
      2. Instruct employees to avoid direct physical contact.
   v. Identify, clean and sanitize high-risk transmission areas regularly.
   vi. Provide appropriate personal protective equipment (PPE)
   vii. Require sick workers to stay home and send sick workers home.

b. Employees: For the sake of clarity, we are ALL employees.

   i. Employees must complete a self-assessment as outlined in the **"Self-Assessment Checklist"** prior to the start of EVERY shift.

      1. The checklist does not supersede any daily assessment protocols that may already be in place as provided by the project owner.
      2. The checklist will be provided to employees as well as prominently displayed at all Company facilities (offices, jobsites, shops, etc.).
      3. If you reply **YES** to any of the checklist questions, **STAY HOME** and immediately contact your supervisor.
      4. Check your body temperature and know the symptoms that may indicate an infection, specifically COVID-19. Check for the following:
         - Fever or feeling feverish
         - General soreness
         - Fatigue
         - Headache
         - Sore Throat
         - Cough
         - Change or Loss of Appetite
         - Repeated shaking with chills
         - Shortness of breath
         - Muscle pain
         - Loss of taste
         - Loss of smell
         - Diarrhea.

   ii. Employees that are or feel ill must **NOT** report to work

      1. Employee should contact their manager to discuss next steps.
      2. Any employee that reports to work with any "sick symptoms" will be sent home immediately.
      3. The employee may not return to work without clearance or a return to work note from a medical professional or approval from ERT.

   iii. Maintain good workplace hygiene, including hand washing practices and cough/sneeze etiquette.

      1. **100%** use of a "**face cover**" on **ALL** company projects, regardless of geographic location.
      2. The Safety Team is available to discuss and suggest the appropriate face covering for your project activities: cloth covering/mask, surgical mask, KN95, N95, face shield, etc.

   iv. Maintain a distance of at least six feet from other workers and limit large group interactions. Follow these same practices on and off the job as well.

      1. In the event the minimum distance of six feet is not practical nor feasible during work activities, the employee will be supplied and required to wear the appropriate respiratory equipment.

   v. Cooperate with response measures instituted by employer and those recommended by health officials at the federal, state and local level.

   vi. Do not share other workers' phones, PPE or other work tools and equipment.

   vii. Receive recommended appropriate immunization or vaccination.

c. Office/Site Managers: Managers are responsible for implementing the protocol for employees that are symptomatic and employees returning to work after being out sick.

i. If any employee exhibits symptoms that are indicative of the pandemic, office/site management must be notified immediately. The communication should be oral or telephone first, followed by an email.
    1. Isolate the employee to the best of your ability.
    2. Provide a mask to the employee and instruct them to put the mask on immediately. Masks and other PPE will be available onsite.
    3. The Corporate Safety Director ("CSD") will speak directly with the employee to avoid any misinformation or having pertinent information "lost in translation." The CSD will manage the communications with the employee and protect the identity of the employee to best of their ability.
    4. Instruct the employee to leave work. Ask the employee to avoid public transportation if possible.
    5. Advise the employee to seek medical attention.
    6. Have the employee's workstation, work area, vehicle, tools, etc. cleaned and disinfected immediately by a cleaning service.
    7. If the diagnosis from a medical professional is that the symptoms are unrelated to the pandemic, then the employee may to return to work following review by the ERT.
    8. If the diagnosis from a medical professional is that the employee has the illness causing the pandemic, then the employee must follow the Diagnosed Individual Protocol outlined in *Section 5d* below.
    9. Check on the employee during their absence from work and encourage a return to work once they feel better and are cleared by medical professional.

ii. **Temperature Screening**
    1. To protect your co-workers and families, the company will require temperature screening for all employees returning to their workplace after being sick or quarantined.
    2. Body temperatures will be taken in a manner that is consistent with infection control and social distancing policies (six-foot separation between individuals in line) and provides privacy for those individuals being screened.
    3. Screening information will be considered confidential and protected accordingly, even while acting on that information to protect the health and safety of others in the workplace.
    4. For the purpose of the Plan, a fever is defined as subjective fever (feeling feverish) or a measured temperature of 100.4 F (38 C) or higher.
    5. An employee with a body temperature of 100.4 F (38 C) or higher may be denied from returning to their workplace after being sick or quarantined.
        - Employees who screen positive for a fever will be rechecked a second time after 15 minutes.

iii. Any thermometer or other equipment used in the temperature screening process that touches an employee or is touched by an employee should be properly disinfected between uses.

d. <u>Emergency Response Team</u> ("ERT"): An ERT will be responsible for investigating all pandemic events & emergency events and evaluating the impact such event will have on JAG Co. The ERT will be responsible for providing guidance in responding to the event. The ERT will consist of some or all of the following JAG Co. employees (*the ERT may also include other JAG Co. employees*):

i. Lucky Abernathy, Corporate Safety Director JAG Companies
ii. Roly Acosta, President/CEO JAG Companies
iii. Marcelo Afonso, CFO JAG Companies
iv. Dustin Brasher, VP/GM ECI Drilling International
v. Anna Camooso, HR Manager JAG Companies
vi. Greg Goett, Counsel JAG Companies
vii. John Gutierrez, VP/Equipment Manager JAG Companies
viii. Ray Post, VP/GM Huxted Tunneling
ix. Rob Ross, VP/GM Northeast Remsco Construction
x. Jim Yuille, VP/GM Caldwell Marine International

4. Communication

a. Good communication during a pandemic event is critical to the success of our response. The company will utilize various channels of communication to keep our employees informed including telephone calls, emails, text messages, emergency text message service, letters, handouts, website, social media accounts, etc.
b. The communicator may vary, but the message will have "one voice" for consistency, clear instructions & directions, and to avoid confusion.
c. Regular communication provides:
    i. Notification of any changes in our Tiered Response Plan (*detailed in this plan*).
    ii. Clarification to any Executive Orders from Federal, State, or Local governments.
    iii. Updates on the status of the pandemic from credible sources including the Center for Disease Control ("CDC"), the World Health Organization ("WHO"), & the Occupational Safety & Health Administration ("OSHA").
    iv. Changes to our Response Plan.
    v. Prompt notification of all employees of any known exposure to COVID-19 at the worksite.

5. Pandemic Pathogen Protocol

a. International Travelers: Any employees or project personnel, including subcontractors & vendors, returning from a CDC Level 2 or 3 country must disclose their travels to their manager or project management prior to returning to work. The traveler must remain out of work for the CDC (or equivalent government agency) designated quarantine period (beginning from the date returned to the United States) even if they are not directed to quarantine by government officials. https://wwwnc.cdc.gov/travel/notices/
    i. An employee might be permitted to follow WFH process if job duties allow.
b. Domestic Travelers: Any employees or project personnel, including subcontractors & vendors, returning from domestic travel must disclose their travels to their manager or project management prior to returning to work. Notification is required regardless of travel method (i.e., air, rail, ship, road, etc.) The ERT will provide guidance that may include a CDC (or equivalent government agency) designated quarantine period (beginning from the date returned to the United States) even if they are not directed to

quarantine by government officials.

    i. An employee might be permitted to follow WFH process if job duties allow.

c. <u>Individuals directed to Quarantine by Federal, State & Local Authorities</u>: Employees, subcontractors or vendors who are directed to quarantine by federal, state or local authorities must remain out of work for the duration of the quarantine period.

    i. An employee might be permitted to follow WFH process if job duties allow.

d. <u>Diagnosed Individuals</u>: Employees, subcontractors or vendors who have been diagnosed with a pandemic pathogen must remain out of work for the CDC (or equivalent government agency) designated quarantine period starting from the date of the positive diagnosis. The individual cannot return to work unless they have been cleared by a medical professional and the ERT.

    i. An employee might be permitted to follow WFH process if job duties allow.

e. <u>Others</u>: Individuals who feel they are at risk for contracting a pandemic pathogen must provide a written statement to their manager explaining the reason for their concerns. Concerns might include shared residence with a diagnosed person, close contact with a diagnosed person, exposure to the pathogen in their personal life, etc. The ERT will review the statement and provide guidance that may include some period of quarantine.

    i. An employee might be permitted to follow WFH process if job duties allow.

f. These are intended as general guidelines; JAG Co. may modify or make exceptions following review and approval by the ERT.

6. COVID-19 Risk Assessment

a. The Company will conduct periodic assessments of risk levels following OSHA and CDC guidance to keep employees safe on a continuous basis.

b. OSHA classifies occupational risk to COVID-19 infections as:

    i. ***Lower Exposure Risk***: Activities that do not require contact between people know to be, or suspected of being, infective with COVID-19 nor frequent contact with (within 6 feet of) the general public.

    ii. ***Medium Exposure Risk***: Activities that require frequent and/or close contact with (within 6 feet of) people who may be infected with COVID-19, but who are not known or suspected to be infected with COVID-19.

    iii. ***High Exposure Risk***: Activities with high potential for exposure to known or suspected sources of COVID-19.

    iv. ***Very High Exposure Risk***: Activities with high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures.

7. JAG Companies Face Cover PPE Protocol

a. During a pandemic, company protocol is **<u>100%</u>** use of a "**face cover**" on **<u>ALL</u>** company property (office, project, shops, etc).

b. **General Information**

    i. A face covering is a personal protective device that is worn on the face or head and covers at least the nose and mouth. A face covering is used to reduce the wearer's risk of inhaling hazardous airborne particles (including infectious agents), gases or vapors.

    ii. Information indicates that covering your nose and mouth can slow the spread of a pathogen, including COVID-19.

iii. Lowering the covering from your nose and mouth while talking defeats the purpose of wearing the face covering since you can spread virus while you talk.

iv. Employees may be unable to wear every available face covering due to certain medical conditions.

    1. Employees should consult with the Safety Department prior to utilizing a face covering that they are unfamiliar with or uncertain of wearing.

v. An employee experiencing difficulty breathing while wearing a face covering should social distance immediate and discontinue use. The employee must report the issue to their supervisor as soon as possible.

c. **Cloth Face Covers**

i. A cloth face cover is a material that covers the nose and mouth.

ii. It can be secured to the head with ties or straps or simply wrapped around the lower face. It can be made of a variety of materials, such as cotton, silk, or linen.

iii. A cloth face covering may be factory-made or sewn by hand or can be improvised from household items such as scarfs, T-shirts, sweatshirts, or towels.

iv. Employees may provide their own cloth face covering or request a company issued cloth face cover.

v. It is recommended that you wash your cloth face covering frequently, ideally after each use, or at least daily.

vi. Use a bag or bin to store cloth face coverings until they can be laundered with detergent and hot water and dried on a hot cycle.

vii. If you must re-wear your cloth face covering before washing, wash your hands immediately after putting it back on and avoid touching your face.

viii. Do NOT share cloth face coverings nor any other PPE.

ix. Discard cloth face coverings that:

    1. No longer cover the nose and mouth
    2. Have stretched out or damaged ties or straps
    3. Cannot stay on the face
    4. Have holes or tears in the fabric

d. **Surgical Masks**

i. A surgical mask is a loose-fitting, disposable device that creates a physical barrier between the mouth and nose of the wearer and potential contaminants in the immediate environment.

ii. Surgical masks are made in different thicknesses and with different ability to protect you from contact with liquids. These properties may also affect how easily you can breathe through the facemask.

iii. If worn properly, a surgical mask is meant to help block large-particle droplets, splashes, sprays, or splatter that may contain germs (viruses and bacteria), keeping it from reaching your mouth and nose. Surgical masks may also help reduce exposure of your saliva and respiratory secretions to others.

iv. Employees should minimize the demand for surgical masks respirators by undertaking preventative actions on the job site. That is our first line of defense.

v. Surgical masks will be provided to employees when required.

vi. Do NOT share surgical masks nor any other PPE.

vii. Surgical masks are not intended to be used more than once. If your mask is damaged or soiled, or if breathing through the mask becomes difficult, you should remove the face mask, discard it safely, and replace it with a new one.

viii. To safely discard your mask, place it in a secure waste receptacle. Wash your hands after handling the used mask.

e. **N95 Respirator Masks** (KN95 Masks are a suitable alternative under certain emergency circumstances)

i. A N95 is a type of respirator which removes particles from the air that are breathed through it. These respirators filter out at least 95% of very small (0.3 micron) particles. N95's are capable of filtering out all types of particles, including bacteria and viruses.

ii. Achieving an adequate seal to the face is essential. When properly fitted and worn, minimal leakage occurs around edges of the respirator when the user inhales. This means almost all of the air is directed through the filter media.

iii. The CDC does not recommend that the general public wear N95 respirators to protect themselves from respiratory diseases, including coronavirus. Everyday preventative action prevents the spread of respiratory viruses.

iv. To ensure N95 respirators are available when needed, employees should minimize the demand for N95 respirators by undertaking preventative actions on the job site. That is our first line of defense.

v. N95 respirators will be provided to employees when required. An employee will be issued one (1) N95 respirator per week (or as needed) when required.

vi. Do NOT share N95 respirators nor any other PPE.

vii. During times of supply shortages, the CDC allows for the re-use of N95 respirators assuming it is not clogged with particulates.

viii. The respirator should be carefully stored between uses:

1. In a receptacle that allows for some breathability: a paper bag, a plastic container with holes in the top, a closable plastic bag with holes in it.
2. Label respirators with the user's name before use to prevent reuse by another individual

ix. The wearer should wash his or her hands before & after handling the respirator.

x. Respirator users should not attempt to disinfect N95 respirators. It may create a health hazard for the user and it may render the respirator ineffective in providing respiratory protection.

xi. As the N95 mask gets clogged, it becomes more difficult to breathe. When this occurs, throw it out and request a new one.

xii. Discard the mask if it is wet, dirty, deformed, or if the filter is torn.

xiii. To safely discard your mask, place it in a secure waste receptacle.

8. Tiered Response Plan

a. The JAG CO. Tiered Response Plan outlines our temporary approach to a pandemic event to keep our employees & their families safe and maintain mission-critical operations and business continuity.

Office Response Plan

The following shall be applied to each JAG office location as may be required:

TIER ZERO ("0")

- Office open with minimal restrictions.
- Follow the CDC Five:
    - Hands: Wash Them Often
    - Elbow: Cough Into It
    - Face: Don't Touch It
    - Feet: Stay More Than 6ft Apart
    - Feel: Sick? Stay Home

TIER ONE ("1")

- Office open with some restrictions.
- Certain eligible employees might be offered the opportunity to work temporarily from home or remote location ("home").
    - Job description must allow for productive work from home.
    - Manager approval required
    - Follow "Work from Home" Process.
- Request that all meetings be conducted via teleconference or virtual platform.
- Limit personal interactions with co-workers.
- Limit visitors to the office (vendors, subcontractors, spouse, children, etc.)
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Restrict occupancy in common areas such as break or lunch areas.
- Eliminate water coolers and other shared resources (high-touch areas).
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- Nonessential business related travel suspended.
- Use of a face covering outside of your personal workspace and where 6' of distance cannot be maintained with other employees.

TIER TWO ("2")

- Office open with further restrictions.
- Office restricted to essential personnel and activities as well as employees where telecommunicating poses a hardship.
    - The ERT will identify essential personnel & activities as required.
- All eligible non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - ERT approval required.
    - Follow "Work from Home" Process.
- All meetings must be conducted via teleconference or virtual platform.
- Limit interactions with co-workers.
- No visitors to the office.
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Restrict occupancy in common areas such as break/lunch areas to accommodate 6' social distance.
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- All business travel is suspended.
- Use of a face covering outside of your personal workspace and where 6' of distance cannot be maintained with other employees.

TIER THREE (“3”)

- Office Closed.
- All eligible essential & non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - Follow “Work from Home” Process.
- All meetings must be conducted via teleconference or virtual platform.

Field/Shop/Non-Office Locations Response Plan

The following shall be applied to each JAG Companies operating location as may be required:

TIER ZERO (“0”)

- Location is operational with minimal restrictions.
- Follow the CDC Five:
    - Hands: Wash Them Often
    - Elbow: Cough Into It
    - Face: Don’t Touch It
    - Feet: Stay More Than 6ft Apart
    - Feel: Sick? Stay Home

TIER ONE (“1”)

- Location is operational with some restrictions.
- Certain eligible employees might be offered the opportunity to work temporarily from home or remote location (“home”).
    - Job description must allow for productive work from home.
    - ERT approval required
    - Follow “Work from Home” Process.
- Request that all meetings be conducted via teleconference or virtual platform.
- Limit personal interactions with co-workers.
- Limit visitors to essential project personnel (owner, engineer, vendors, suppliers, subcontractors, etc.)
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Eliminate water coolers and other shared resources (high-touch areas).
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- Hold separate “Tool Box Talks” or other job meetings with the various crews.
- Eat lunch separately to the extent possible.
- Reduce choke points (i.e., project entrances, portable toilet facilities, etc.).
- Use of a face covering outside of your personal workspace and where 6’ of distance cannot be maintained with other employees.

TIER TWO (“2”)

- Location is operational with further restrictions.
- Location restricted to essential personnel and activities.
    - The ERT will identify essential personnel & activities as required.

- All eligible non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - ERT approval required.
    - Follow “Work from Home” Process.
- All meetings must be conducted via teleconference or virtual platform.
- No visitors to the location except for essential personnel.
- Limit interactions with co-workers. Eat lunch separately.
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- Hold separate “Tool Box Talks” or other job meetings with the various crews.
- Use of a face covering outside of your personal workspace and where 6’ of distance cannot be maintained with other employees.

TIER THREE (“3”)

- Location is Closed.
- All eligible essential & non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - Follow “Work from Home” Process.
- All meetings must be conducted via teleconference or virtual platform.

ATTACHMENT 14
Dive Procedures and Safe Practices Manual

DIVING PROCEDURES
& SAFE PRACTICES
MANUAL

REVISION TABLE			
REV. #	DESCRIPTION	DATE	APPROVED
00	Creation	06/20/08	AB AG
01	Revised after review	10/17/17	LA DC
02	Revised after review	12/17/21	LA EP DC
03	Revised after review	05/18/22	LA EP DC
04	Revised after review	06/17/22	LA EP
05	Revised after ADCI audit	03/28/23	LA EP JC
06	Revised after ADCI audit	04/25/23	LA EP JC
07	Revised formatting after review	05/05/23	LA EP JC

This manual references the current ADCI International Consensus Standards for Commercial Diving and Underwater Operations – 6.4 Edition & the US Navy Diver's Handbook – Revision 7

a JAG Company

Table of Contents

1. General Information

1.1 Introduction

The procedures and requirements outlined in this manual are founded on the regulations that have been established by the U. S. Coast Guard, the Association of Diving Contractors International (ADCI), and the Occupational Safety and Health Administration (OSHA), and the US Navy Diver's Handbook – Revision 7.

When diving operations occur that are not covered in this manual, local regulations must be determined. Should differences between local regulations and this manual occur the more conservative guidance shall be used. If a direct conflict exists between this manual and local regulations, Caldwell Marine International (CMI) management must be consulted for guidance.

This manual applies to all types of diving operations conducted by Caldwell Marine International divers and contractors. It provides guidance and detailed procedures to be followed when conducting air diving, both surface supplied and SCUBA. As changes to regulations governing commercial diving occur this manual will be updated.

1.2 Diving Personnel Responsibilities

Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner. All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent) and in the use of a manual bag-type resuscitator. Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology and fully understand emergency procedures.

1.2.1 Diving Supervisor

The Diving Supervisor is the on-scene-representative of Caldwell Marine International management and is directly responsible for the safe conduct of all phases of diving operations. The diving supervisor shall be designated in writing and given to the Person- in-Charge prior to any diving operation. THE NUMBER ONE PRIORITY OF THE DIVING SUPERVISOR IS THE SAFETY OF THE DIVE TEAM UNDER THEIR AUTHORITY. The Diving Supervisor has the final word concerning diving operations, shall exercise caution when dealing with matters not covered by company policy, and must understand and comply with all government regulations and company policies that apply to the diving operation.

The responsibilities of the Diving Supervisor include:

- The Supervisor shall be in immediate control of the diving operation and available to implement emergency procedures.
- The Supervisor is not permitted to dive unless there is another qualified supervisor designated in writing and is available to take over the diving operation.
- The Diving Supervisor shall coordinate with the Person-in-Charge, Craft Masters, Customer Representative, all persons responsible for anything that may affect the safety of the divers and the efficient completion of the diving operations.
- Personally verify that all personnel in the dive team are qualified and physically able to perform tasks assigned. He must assess the physical condition of the divers prior to each dive to determine if any physical impairment is present which would be harmful

to their health and safety ether in the water or in a chamber.
- The Diving Supervisor will perform Job Hazard Analysis (JHA) for each task undertaken before any underwater task is begun. The purpose of the JHA is to provide a written document identifying hazards associated with each step of a job and develop solutions that will either reduce, eliminate, or guard against hazards. On the JHA, sentences should be short and simple. The ADCI sample JHA form in Section 11.8: Reference Materials can be copied and used as is or modified to suit individual company needs.

1. Sequence of Basic Job Steps
   - Break the job into observable steps. Do not be too general or overly detailed.
   - If the job is complex, break it into several tasks and prepare a JHA for each task. Begin with an active verb, e.g., disconnect, check, invert, assemble, isolate, start, stop, etc.
   - Number each step.

2. Potential Hazards
   - Identify possible hazards associated with each step and list that hazard opposite the job step.
   - Consider potential accident causes (strain, sprain, slip, fall, cut, crush, etc.).
   - Consider environmental and health hazards (vapors, gasses, heat, noise, toxicity, etc.).

3. Recommend Safe Procedures and Protection
   - Develop solutions for each potential hazard and list the solution opposite the hazard.
   - Detail controls, e.g., ventilate, isolate, allow to cool, secure, guard, train, etc.
   - List personal protective equipment (PPE) required, e.g., gloves, eye protection, respirators, fall protection, etc.

4. Assign Responsibility
   - Assign a specific person the responsibility of implementing the safety procedures or protection required.

5. Personnel Involved
   - Identify the persons preparing, reviewing, and approving the JHA.
   - Distribute the JHA to all personnel involved in the job or task and ensure that each person is familiar with the contents of the JHA.

6. Revising the JHA
   - The JHA should be reviewed and updated whenever new equipment, products or procedures are introduced into the work site. This is especially true if an accident has occurred on a task upon which a JHA has been performed.

TEAM BRIEFING

1. Before commencing with any underwater operation, the dive team members shall be briefed on:
   - The tasks to be undertaken.
   - Safety procedures for the diving mode.
   - Any unusual hazards or environmental conditions likely to affect the safety of the underwater operation.
   - Any modifications to operating procedures necessitated by the specific underwater operation.
2. Before each dive, the diver shall be instructed to report and record any physical conditions, problems or adverse physiological effects that may render the diver unfit to dive.
3. The supervisor will establish a dive plan ensuring that enough trained personnel, supplies, and proper equipment are available for the safe and timely completion of the diving operation.
4. The Diving supervisor shall personally verify the emergency assistance checklist to ensure a two-way communication system is available to reach emergency assistance if required.
5. The Diving supervisor shall ensure that diving operations are conducted from a safe dive platform.
6. The Supervisor shall verify that the Safety Procedures Checklist, Equipment Procedures Checklist, and the Recompression Chamber Checklist, if chamber is on location, have been performed properly and ensure that all diving equipment designated for use is suitable for the planned operation and is in good working order.
7. Ensure that all manuals, instructions, decompression, and recompression tables and regulatory publications are available at the dive location. Provide the Customer Representative a copy of the dive manual and a dive plan outlining the diving operation.

TERMINATION OF DIVE

1. The working interval of a dive shall be terminated when:
   - Directed by the dive supervisor and/or the person in charge.
   - The diver requests termination.
   - The diver fails to respond correctly to communications or signals from a dive team member.
   - Communications are lost and cannot be quickly re-established with the diver, the tender/diver and/or the diving supervisor.
   - In live boating operations, the person controlling the vessel requests termination.
   - The diver begins to use the diver-carried reserve breathing gas or the dive-location reserve breathing gas
2. The Diving Supervisor will immediately activate emergency procedures at the first sign of a problem with the dive. As soon as the situation stabilizes, he will inform the Person-in-Charge, and Customer Representative.
3. Report all accidents or incidents required by law to the company. Ensure that all reports required are promptly filled out sent to the proper authorities.

1.2.2 Diver

Assigned by the Diving Supervisor, the diver should be at least 18 years old, and medically certified "fit to dive". The diver shall be qualified to dive the equipment in use and be in possession of an up-to-date diver's logbook. The Diver must have a current certification in First Aid and CPR. At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O_2 provider certification or be DMTs.

- Understand and comply with company policies and this document.
- Always follow safe diving practice.
- Ensure diver-worn equipment is properly maintained, complete, and ready for use. As required, assist in the maintenance and repair of all diving equipment.
- Immediately obey all commands or instructions form the diving supervisor to return the surface or first decompression stop.
- Act as standby diver when directed to do so.
- Act as a chamber operator as required.
- Report any recent medical treatment or illness to the diving supervisor.
- Report all symptoms after a dive to the diving supervisor immediately and as accurately as possible.
- Report all equipment problems to the diving supervisor.
- Know and observe the rules for flying after diving or traveling to altitudes higher than the dive site.
- Remain in the vicinity of the recompression chamber if required.
- Be ready to assume the responsibilities of the Diving Supervisor where one is not required.

1.2.3 Standby Diver

The Standby Diver is that individual possessing the required training and experience to enter the water at the diving station to render assistance to a stricken diver.

- The Standby's helmet or mask will be fitted to the standby umbilical in a wrench tight status. The flow to the helmet or mask will be verified, and a communications check will be conducted to ensure three-way communications between the standby diver, topside, and the stricken diver.
- The Standby will remain in the immediate vicinity of the diving control station, receives the same briefings and instructions as the working diver, monitors the progress of the dive, and be fully prepared to respond if called upon for assistance i.e.. Standby diver is at the dive station with his diving helmet, harness, bail-out bottle and weight belt and available to render immediate assistance when called upon. The standby diver shall also be equipped with an octopus rig.

1.2.4 Tender

The tender is assigned by the diving supervisor to continuously tend a diver. He must have a basic understanding of diving acquired through a special school or equivalent experience He shall not be assigned any other task while the diver is under the water. The Tender must have a current certification in First Aid and CPR. The Tender must:

- Set up and operate all equipment as directed by the lead tender, Diving supervisor. Assist in topside work connected with the diving operations or other topside work as required or directed.

- Stay alert to what is going on with the dive. Be aware of the diver's location and the divers' depth. Once the diver is in the water, the tender constantly tends the lines to eliminate excess slack or tension. The tender exchanges line-pull signals with the diver, keeps the Diving Supervisor informed of the line-pull signals and amount of diving hose/tending line over the side and remains alert for any signs of an emergency.
- Immediately report any conditions, which may be hazardous or unsafe.
- If qualified, operate the recompression chamber when directed by the diving supervisor.
- If qualified to act as an inside tender he must be medically certified, "fit to dive."
- If acting as an inside tender, he must be familiar with and alert for any symptoms of oxygen toxicity.

1.3 Medical Requirements

1.3.1 General

For persons engaged as divers or otherwise subjected to hyperbaric conditions, the initial exam and periodic medical re-examination will be recorded using the ADCI diving medical examination form. Non-diver dive supervisors must also be medically cleared to serve as a dive supervisor. Note: Copy of ADCI physical examination form inserted in Addendum 8.

All persons engaged as divers or otherwise subjected to hyperbaric conditions are required to get an annual exam. More frequent or extensive examination(s), including a complete medical re-examination, should be required if there have been any incidents (illness, accidents, etc.) during the course of that year that may have caused a change in the individual's medical condition. The diver is required to notify the diving medical examiner of any changes in his/her medical condition including any change in medications:

- An initial medical examination
- Periodic re-examination recommended annually but as minimum on an annual basis

Note: A re-examination is required after a diving related injury or illness to determine fitness to return to diving duty. For the purposes of these medical requirements all examinations are to be performed only by licensed physicians qualified to perform commercial diver medical examinations. Must have licensed physician signature to be legible and/or stamped, with their medical designation clearly indicated. Non-physicians are not recognized by the ADCI as being qualified to perform commercial diver medical examinations

1.3.2 Physical Examination

The initial examination and subsequent periodic re-examination include the following:

- Work History
- The test required in section 2. Table 1 (ADCI consensus 6.4) as appropriate
- Any test deemed necessary to establish the presence of any disqualifying conditions
- Any test the physician needs to prepare the written report.
- Any tests deemed necessary to establish the presence of any of the disqualifying conditions listed in this section.
- Any additional tests the physician deems necessary.

If within one year the individual has had a comprehensive medical examination comparable to the initial diving physical and no disqualifying conditions are present, the examination can be use in place of the initial examination.

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

Any person engaged as a diver, or otherwise exposed to hyperbaric conditions, will have a medical evaluation following any non-diving injury or illness that requires any prescription medication, any surgical procedure or any hospitalization.

The person should not be permitted to return to work as a diver, or otherwise be subjected to hyperbaric conditions, until he or she is released by a physician recognized by the ADCI to do so.

The examining physician should determine the scope of the examination in light of the nature of the injury or illness

1.3.4 Physician's Written Report
With respect to the initial examination or any re-examination, the diver must obtain a written report from the examining physician that contains the following information:

- Results of the examination and tests given on accordance with this section.
- The physician's opinion as to the fitness of the person to perform as a diver based on his medical history and the results of the test required in section 2. Table 1 (ADCI consensus 6.4) in particular to the following:
- Stress to the pulmonary, muscular, cardiac and skeletal systems.
- Interference with effective external communication of the gas-containing organs of the body.
- Condition if the central and peripheral nervous system.
- Any other factor that indicates material impairment of the employee's health.
- The physician's opinion as to whether there exist any disqualifying conditions.
- Any recommended limitations placed on the persons activities as a diver or exposure to hyperbaric conditions.
- A statement by the examining physician the individual has been informed of the results of the physical any and conditions that require further examination or treatment.

1.3.5 Disqualifying Conditions
A person having any of the following conditions, as determined by a qualified physician shall be disqualified from engaging in diving or other hyperbaric activities:

- History of seizure disorders other than childhood febrile convulsions.
- Cystic or cavity disease of the lungs, significant obstructive or restrictive lung disease, or recurrent pneumothorax.
- Chronic inability to equalize sinus and middle ear cavities.
- Significant central peripheral nervous system disease.
- Significant cardiac abnormalities.
- Chronic alcoholism, drug abuse, or history of psychosis.
- Significant hemoglobinopathies.
- Significant malignancies.
- Grossly impaired hearing.
- Pregnancy.
- Chronic obstruction of the Eustachian tubes.
- Chronic gastrointestinal disease.
- Hernia
- Severe head injury, cranial surgery.
- Severe visual defects.
- Excessive obesity.
- Diabetes.
- Gross abnormality of the renal tract.
- Severe Stammering.
- Any acute condition while undergoing treatment for that condition

Below are the current Disqualifying Conditions Listed on the ADCI current edition:

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

The above current list does not mean that all other conditions are acceptable such as excessive obesity. For example, previously listed diabetes. Current guidelines suggest that DM with a stable HBA1c and no medications is not disqualifying.

1.3.6 Withdrawal from Hyperbaric Conditions

Withdrawal from hyperbaric conditions shall be determined by a physician examination whether a person's health will be at risk by continued hyperbaric exposure.

1.3.7 Medical Record Keeping

An accurate medical record for each person subject to the medical specifications of this section should be maintained. The record should include the employees current dive physical and be maintained for at least 5 years after the last hyperbaric exposure.

Medical Test for Diving

Test	**Initial**	**Annual Per ADCI current table 2.3.4 table 1**	**Comments**
History and Physical	X	X	Include predisposition to unconsciousness, vomiting cardiac arrest, impairment of oxygen transport, serious blood loss, or anything that in the opinion of the examining physician will interfere with effective underwater work.
Chest X-Ray	X	X	PA (Projection: 14" x 17" min.)
Bone and Joint X-Ray Survey	X		Required initially and as medically indicated.
EKG: Stress			Required only as medically indicated.
Pulmonary Function	X	X	Required initially and as medically indicated
Audiogram	X	X	Threshold audiogram by pure tone audiometry; bone conduction audiogram as medically indicated.
Visual Acuity	X	X	Required initially and as medically indicated.
Color Blindness	X		Required initially
Hematocrit, Hemoglobin, WBC Count	X	X	
EEG			Required only as medically indicated
Routine Urinalysis	X	X	
EKG Standard (12l)	X		Required initially to establish baseline, annually after age 35, and as medically indicated
Comprehensive Metabolic profile.	X	X	Optional including cholesterol and triglycerides required for drivers over 40
Lipid Panel	X	X	Required annually after age 35
Framingham Risk Score	X	X	Required annually after age of 35

1.4 Record Keeping

1.4.1 Diving Logs

During each diving operation, an operation log shall be maintained covering the entire operation. The Diving Supervisor will ensure that the master operations log is properly updated.

Operations logbook will be maintained at the dive control center. This logbook will be a chronological record of all events that directly affect the diving operation. The diving supervisor will sign all entries.

Each employer shall establish and maintain a record of each diver's hyperbaric exposure. This record shall contain the following:

- Name and address of the company.
- Location, time and date of diving operations.
- Names of the dive supervisor, diver and tender/diver.
- Depth of dive.
- Bottom time.
- Approximate water temperature and thermal protection used.
- Environmental conditions (approximate sea state, underwater visibility and underwater currents).
- Decompression tables and schedule used.
- Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation.
- Breathing mixture used and composition.
- Type of work performed.
- Type of diving equipment worn.
- Any unusual conditions.
- For each dive for whom decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:
    - Description of decompression sickness symptoms, including depth and time of onset.
    - Description and results of treatments.
- Diver's condition upon surfacing.
- Diver's signature

1.4.2 Maintenance Logs

Caldwell Marine International shall insure that the equipment identified below will be maintained, inspected/tested, and tagged at the appropriate intervals and documented:

- The date and results of each check of the medical kits.
- The date and results of each test of the air compressor.
- The date and results of each check of breathing mixtures.
- The date and results of each check of each breathing supply system.
- The date, equipment cleaned, general cleaning procedure, and names of persons cleaning the diving equipment for oxygen service.
- The date and results of each test of the breathing supply hoses and system.
- The date and results of each inspection of the breathing gas supply system.
- The date and results of each test of depth gages and timekeeping de-vices.

- The date and results of each test and inspection of each PVHO.
- The date and results of each inspection of the diving equipment.
- The date and results of each test and inspection of pressure piping.
- The date and results of each test and inspection of volume tanks and cylinders.
- See Addendum 2

1.5 Red Tag Policy

Any equipment that is not in compliance with established standards for CMI, USCG, ADCI, or OSHA shall be red tagged and quarantined until all repairs or test have been made. If a piece of equipment is not fully operational and tested it is not compliant and must be Red Tagged.

1.6 Limits/Prohibitions

This section will establish limits for the use of the various types of diving equipment and breathing gases for Caldwell Marine International divers and contractors. These limits are in accordance with accepted safe diving practices. THEY ARE CONSIDERED FIRM DO NOT EXCEED THEM WITHOUT EXPRESS PERMISSION FROM Caldwell Marine International MANAGEMENT. The limits established in this section are to govern all diving operations regardless of the geographical location, unless they conflict with regulations established by the local government. In this case the limits that are more conservative shall be used, and the area of difference will be brought to the attention of Caldwell Marine International management.

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

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

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

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

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

If diving operations are conducted in a physically confining space, refer to Penetration Diving in Section 3.15.

Diver worn/carried emergency gas supply (bailout) must have a minimum calculated four-minute supply at the anticipated depth. Refer to Section 6.11.2 (ADCI consensus 6.4): Diver Worn or Carried Emergency Gas Supply. Volume tanks are only required for air dives or chamber operations utilizing an LP compressor. Operations utilizing only HP/ bottled air supplies do not require a volume tank.

1.6.1 General Limits
The limits presented in Table 1-1 are to govern all diving operations conducted by Caldwell Marine International divers and contractors.

Table 1-1 - Caldwell Marine International Diving Limits		
Depth: Feet	Meters	Type of Diving Activity
0 fsw	0 m	CMI requires a bail out bottle at all times regardless of depth. (USCG) (ADCI SECTION 6.3.6)
60 fsw	18.2 m	Recompression chamber required at the dive site for any dives deeper than this depth or any dives requiring decompression.
130 fsw	39.6	Stage or open bell required for dives deeper than this depth or for any for any dives requiring decompression (USCG)
170 fsw	51.8	Normal working limit for surface supplied air diving. Dives deeper than this depth will not be conducted without the permission of Caldwell Marine International management.
190 fsw	57.9 m	Air dives deeper than this depth will NOT BE ALLOWED!

1.6.2 Drug and Alcohol Policy
As stated in the conditions of employment by Caldwell Marine International:

- A pre-employment drug screening program shall be in place.
- A routine, random and “for cause” drug screening program shall be in place.

2. Operational Planning

2.1 General Planning Considerations

Planning of a diving operation shall include a Job Hazard Analysis. A successful diving project is the direct outcome of careful, thorough planning. The nature of each operation determines the scope of the planning effort, but certain general considerations apply to every operation. SECTIONS 4, 5, 6 OF THE ADCI CONSENSUS 6.4 MUST BE CONSIDERED AND IMPLEMENTED.

- Bottom Time: Bottom time is always at a premium. Developing measures to conserve bottom time or increase diver effectiveness is critical for success.
- Preplanning: An operation that is delayed due to unanticipated problems may fail. Preplanning the use of the time available to accomplish specific objectives is a prerequisite to success.
- Equipment: Selecting the correct equipment for the job is critical to success.
- Environmental Conditions: Diving operational planners must plan for safely mitigating extreme environmental conditions. Personnel and support facility safety shall be given the highest priority.
- Diver Protection: It is critical to protect divers from shipping hazards, temperature extremes, and dangerous pollution during all operations.
- Emergency Assistance: It is critical to coordinate emergency assistance from outside sources before the operation begins.
- Weather: Because diving operations are weather dependent, dive planning should factor in delays due to weather.

2.2 Define Project Objective

A clear and concise statement of the project objective shall be established. This includes an in-depth breakdown of all tasks required to complete the job, the location and the time frame in which it is to be accomplished. All parties involved in the project, diving and non-diving should work together to define the scope of work. Once the diving objectives have been outlined planning can begin.

2.3 Information Gathering

The size of the operation, the diving site location, bottom conditions, and the prevailing environmental conditions influence the extent and type of information that must be gathered when planning an operation. Some operations are of a recurring nature; so much of the required information is readily available. However, even for a standard operation, procedures may have been modified or special environmental conditions may exist, requiring a change in the plan or special tools. Potential changes in task requirements affecting work procedures should not be overlooked during planning. Areas, which should be considered when planning an operation, include government regulations affecting diving, resources, both logistical and emergency that are available locally to support the operation.

2.3.1 Surface Conditions

Surface conditions in the operating area affect both the divers and the topside team members. Surface conditions are influenced by location, time of year, wind, waves, tides, current, cloud cover, temperature, visibility, and the presence of other ships. Completing the Environmental

Assessment Worksheet can help ensure that environmental factors are not overlooked during planning. Weather reports and long-range weather forecasts shall be studied to determine if conditions will be acceptable for diving. Weather reports shall be continually monitored while an operation is in progress.

NOTE: Diving should be discontinued if sudden squalls, electrical storms, heavy seas, unusual tide or any other condition exists that, in the opinion of the Diving Supervisor, jeopardizes the safety of the divers or topside personnel.

2.3.2 Sea State

A significant factor is the sea state. Wave action can affect everything from the stability of the moor to the vulnerability of the crew to seasickness or injury. Unless properly moored, a ship or boat drifts or swings around an anchor, fouling lines and dragging divers. Wave action will cause the vessel to pitch and roll, resulting in a potentially hazardous surge on lines and hoses to the diver and equipment such as a jet sled or bell, on or near the bottom. Divers are not particularly affected by the action of surface waves unless operating in surf or shallow waters, or if the waves are exceptionally large. Surface waves may become a serious problem when the diver enters or leaves the water and during decompression stops near the surface.

2.3.3 Tender Safety

Effective dive planning shall provide for extreme temperatures that may be encountered on the surface. Normally, such conditions are a greater problem for tending personnel than for a diver. Any reduction in the effectiveness of the topside personnel may endanger the safety of a diver. Tending personnel shall guard against:

- Sunburn
- Windburn
- Hypothermia
- Frostbite
- Dehydration
- Heat exhaustion

2.3.4 Surface Visibility

Variations in surface visibility are important. Reduced visibility may seriously hinder or force postponement of diving operations. For operations to be conducted in a known fog belt, the diving schedule should allow for delays because of low visibility. Diver and support crew safety is the prime consideration when determining whether surface visibility is adequate. Proper flags signaling devices shall be use during the day and at the proper lighting shall be used to warn other vessels in the area.

2.3.5 Depth

Depth is a major factor in selecting both diving personnel and apparatus and influences the decompression profile for any dive. Depth must be carefully measured and plotted over the general area of the operation to get an accurate depth profile of the dive site. Operations in deep waters may also call for special support equipment such as underwater lights, cameras, ROV, etc.

2.3.6 River or Major Ocean Currents
The direction and velocity of normal river, ocean, and tidal currents will vary with time of the year, phase of the tide, configuration of the bottom, water depth, and weather. Tide and current tables show the conditions at the surface only and should be used with caution when planning diving operations. The direction and velocity of the current beneath the surface may be quite different than that observed on the surface.

2.3.7 Underwater Visibility
Underwater visibility varies with depth and turbidity. Visibility is poorest in harbor areas because of river silt, sewage, and industrial wastes flowing into the harbor. Agitation of the bottom caused by strong currents and the passage of large ships can also affect visibility. Divers are frequently required to dive at night or in an enclosed space where visibility very limited. Generally good visibility can be considered a luxury and should be accounted for.

2.3.8 Type of Bottom
The type of bottom may have a significant effect upon a diver's ability to move and work efficiently and safely. Advance knowledge of bottom conditions is important in scheduling work, selecting dive technique and equipment, and anticipating possible hazards. The type of bottom is often noted on the chart for the area, but conditions can change within just a few feet.

2.4 Logistics
The initial task to be planned for is getting all equipment, supplies and personnel on site at the proper time. Once on the scene and operating the problem becomes one of maintaining an adequate supply required materials to meet anticipated requirements.

- Consultation with the Person-in-Charge of the platform from which operations are to be conducted is necessary. He must fully understand all the demands that will be placed on his vessel, so he has time to make the preparations required to ensure that his craft is ready on time. Arrangements must also be made for the placement of diving and support equipment on board in a manner that will not affect the stability and operability of the craft.
- Complying with regulations established by the government whose waters diving operations are being conducted is essential. It is not uncommon for a government to require written permission, submit copies of intended diving procedures, to have procedures that are more conservative than this manual. Governments may require environmental impact statements. The cost of not complying with governmental regulations can be enormous.
- Arrangements for personnel must not be overlooked. This not only includes arranging for enough qualified personnel at all levels, but also arranging backups if personnel scheduled for a job are unable to make it and making sure that personnel know when and where they are supposed to be, and any special equipment they are to bring.

2.5 Chart and Checklists
The charts and checklists are provided to assist the project planner complete the Job Hazard Analysis (See Addendum #3)

3. Safety

3.1 General

This section is intended to cover general safety rules and regulations relating to operations and equipment not dealt with in other sections. Caldwell Marine International divers and contractors should become intimately familiar with this section. SAFETY IS A FULL-TIME JOB. The more conscientious each employee becomes regarding safety, the safer and cost effective each job becomes.

- No standards will ever exist which can substitute for common sense, sound judgment, and a continuing concern for operation risk management.
- The procedures contained in this manual represent the minimum acceptable diving safety procedures to be employed in commercial diving operations.
- It is recommended that deviation from these procedures should only be undertaken when, in the opinion of the diving supervisor that an emergency situation exists and these procedures would do harm.
- Decompression procedures established in the US Navy Diving Manual Revision 7 Will be used as a guideline and it will be the responsibility of all diving personnel to know and understand them to establish a safe and healthful working environment
- fir the diver.

3.2 Emergency Services

At all times while diving operations are being carried out, emergency services must be available and be able to proceed by the fastest means of transport to the location of the diving operations in the event of a life-threatening emergency.

1. Each contractor/school shall develop and maintain a list of the available sources of emergency aid, equipment and professional assistance with call signs, phone numbers or other means and instructions for establishing contact with them for locations where operations are conducted. The hours of operation of the nearest hyperbaric facility, along with its chamber capability, i.e. 6 ATA or 165'.
2. Each contractor/school shall make the contact list available at the company's principal place of business, at the field operations office and to those who may have a need for it to fulfill the company's emergency response plan.
3. The list shall include information necessary to obtain the following types of emergency aid as appropriate for the type of diving or underwater activity conducted:
   - Appropriate decompression chamber to accommodate TT6.
   - Hospital or medical treatment facility.
   - Air or ground transportation.
   - On-call physician that is knowledgeable of the type of diving operation conducted to treat for potential diving-related illnesses.
   - Coast Guard or other national Rescue Coordination Centers.
4. Two-way communications shall be available and accessible at any diving, hyperbaric or other underwater work site in order to engage emergency services as required

3.3 Diving Operations

- Watercraft of any kind shall not come alongside a vessel from which diving operation are being conducted while a diver is in the water. The only exception to this rule is when the diver is working out of a stage or diving bell and the diving supervisor has giving his permission.

- Precaution shall be taken to ensure that the divers umbilical does not become fowled in the propellers of the diving support vessel.
- Prior to lifting heavy objects from the bottom, the diver should leave the water.
- Appropriate signals, accordance with Figure 3 –1, shall be displayed when conducting diving operations (See Addendum #1)
- Every precaution must be taken to prevent the diver's umbilical from becoming fouled on hazards on the bottom.
- All efforts must be taken to isolate or shutdown any equipment/systems at the work site that present a potential hazard to the diver.
- Diver will not cut any lines until their purpose is known and permission is given from topside.
- The depth of the water, condition of the diver shall determine the length of the dive.
- No diver who shows apparent sings of intoxication, its after-effects (hangover), or is under the influence of drugs will be allowed on any dive station.
- Skylarking, horseplay, or carelessness will not be allowed on any diving station.
- All adjoining work activities shall be informed prior the commencement of diving operations.
- When a diver enters a pipeline, wreck, structure, tunnel, or any other restricted underwater area, another diver shall be available at the point of entry to tend the diver who has entered the enclosed space.
- All tools passed to the diver or recovered from the diver shall be turned off.
- If the diving supervisor does not feel that the divers fully understand all the safety aspects of the task, the diver shall not be used for the job.
- Divers should not dive with colds, sinus, or lung congestion.
- The diver shall make sure that he fully understands the task he is being asked to perform.
- Any diver who is taking medicine for any reason will inform the diving supervisor of the type of medicine and what for. All medicine must be cleared by a diving medical doctor prior to diving.

3.4 Responsibilities of the Diving Supervisor

The Diver Supervisor is on the frontline of this companies' construction operation. He is responsible for the safe practices of all diving personnel and non-diving personnel working in his diving station. SAFETY IS NEVER TO BE JEOPARDIZED TO ACHIEVE A TASK. To realize this important responsibility the following items are considered the minimum standards:

- Enforce safety procedures and company policy
- Inform employees of safe practices
- See that all practical recommendations are carried out. If there is a conflict with set procedures bring it to the attention of management for the benefit of all employees.
- Ensure all accidents are fully investigated and all reports are submitted in a timely manner, and that corrective measures are put in place to protect against the accident happing again.
- Stay up to date with new diving techniques and assist in teaching the new methods to fellow employees.

- Stay current in US Navy techniques for treating Arterial Gas Embolism and Decompression Sickness.
- Maintain an open exchange of information between management and employees.
- Maintain accurate records.
- Establish dive plans with the safety of the dive team first in mind.

3.5 Diving Personnel Responsibilities

As an employee of Caldwell Marine International, you are our most valued asset.

- Develop and utilize correct and safe working practices at all times.
- Use the proper tool for the task at hand.
- If you notice damage on equipment for example, a crack weld or stuck valve bring it up to your supervisor so it can be fixed, more importantly so the equipment does not get put into service during a diving operation and fail while in use by a diver in the water or under pressure in a chamber.
- The proper PPE is always worn
- Report all injuries immediately and completely.
- Participate in daily JAG review and safety meetings.
- Correct hazards under your jurisdiction and report those outside your responsibility to your supervisor.
- Practice good housekeeping in your work areas
- Only use tools that are cleaned for Oxygen use on an Oxygen system.

3.6 Deck and General Safety

All personnel, including deck crew:

- Stand clear of all lines, hoses, diving equipment, and high-pressure flasks and diver supply hoses.
- Exercise care while loading materials around diving gear and diving equipment. If you should accidentally damage any diving gear or equipment, bring it to the attention of the diving supervisor so a proper inspection can be accomplished.
- Do not move any diving equipment without permission of the diving supervisor and unless a member of the dive team is present.
- Do not touch any diving equipment especially do not change any valve configurations, line voltage that is connected as a primary or backup sourced for the diver, without permission of the diving supervisor.

3.7 Deck Crew Directly Assisting the Divers

- Be alert and follow instructions carefully.
- Take order only from the diving supervisor.
- Do not wander off from your assigned station unless properly relieved by the diving supervisor.
- Know and be able to identify the meaning of diver line signals.
    - 1 Line Pull - All Stop
    - 2 Line Pulls - Provide Slack on the Divers Hose
    - 3 Line Pulls - Pick-up Slack on Divers Hose
    - 4 Line Pulls - Pick-up Slack – Diver Surfacing
    - Repeated Line Pulls - Emergency, Bring the Diver Up ASAP

3.8 Crane Operators

- When it becomes necessary to move any diving equipment around have a dive team member assist in positioning.
- Should you accidentally bump into the diving equipment while moving a load notify the diving supervisor.
- When assisting in diving operations maintain two-way radio communication with the diving supervisor. Under no circumstances accept any instructions or signals from anyone other than the diving supervisor.
- Understand the task being performed and all hand signals and radio communication expected to be used with the diving supervisor.

3.9 Uses and Storage of Gas Cylinders

VOLUME TANKS/AIR RECEIVERS

Volume tanks used in diving systems shall:

1. Be designed, fabricated, inspected, tested and certified in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section VIII, Div. I, "Unfired Pressure Vessels," and/or other statutory or classification society requirements.
2. Be equipped with a pressure gauge.
3. Be equipped with a check valve on the inlet side.
4. Be pressure-rated to the maximum system pressure on which it is installed.
5. Be equipped with a relief valve as required by code of manufacturer and tested at least annually.
6. Be equipped with condensate drain valve, located at its lowest point.
7. Be equipped with slow-opening valves when used with design pressures exceeding 500 psi.
8. Be cleaned for oxygen service and have slow-opening valves when used in systems containing greater than 50 percent oxygen.
9. Be inspected internally and externally at least annually for damage or corrosion.
10. Be pneumatically tested to MAWP annually, utilizing the breathing mixture normally used.
11. Be hydro tested to 1.3 MAWP (ASME 2007 UG 99) every fifth year or after any repair, modification or alteration to the pressure boundary and marked with the test date.
12. Have a unique identity with results of all tests being recorded in the equipment log.

GAS STORAGE CYLINDERS AND TUBES

High-pressure gas cylinders or tubes shall:

1. Be manufactured to recognized code or standard.
2. Be equipped with an overpressure relief device.
3. Be visually examined externally at least annually for damage and corrosion.
4. If rack-mounted into banks of cylinders or tubes, have valves and regulators protected from damage caused by impact or from falling objects (International Consensus Standards For Commercial Diving And Underwater Operations 124)

5. Be hydrostatically tested every fifth year to the requirements of the code of the manufacturer by an authorized test facility and stamped with the date of test.
6. Be inspected internally at least annually for damage or corrosion if used underwater by a qualified technician.
7. Be labeled as to contents. Fire-hazard warning signs should be erected in the vicinity of stored oxygen.
8. Be stored in a well-ventilated area, protected from overheating and secured from falling.
9. A record shall be kept in a designated place of the contents and pressure of each cylinder, quad or bank. These records should be updated daily when the system is in use.

EGS (BAILOUT) BOTTLES

High pressure bottles used for and EGS (bailout) shall:

1. Be manufactured to recognized codes or standards.
2. Be equipped with an overpressure relief device.
3. Be inspected internally and externally at least annually for damage or corrosion by a qualified technician.
4. Be hydrostatically tested every fifth year to the requirements of the code of the manufacturer by an authorized test facility and stamped with the date of test.
5. Have a unique identity with results of all tests being recorded in the equipment log. It is recommended that a maximum rate of 600 psig per minute be adhered to for the safe filling of EGS (bailout) bottles and that personnel refrain from over-pressurization or fast filling. Proper PPE should be worn by all personnel when charging cylinders. Proper labeling of contents (bottom mix) should be visible on the bottle. It is further recommended that complete discharge of the bottom mix be conducted after the dive if the bottle is charged with a mixture other than air.

NEVER-

- Use cylinders as rollers or supports even when they are empty.
- Use valve protection caps for lifting cylinders.
- Use a hammer or wrench to open cylinder valves.
- Drop or allow any cylinder to fall especially oxygen.
- Tamper with fuse plugs.

ALWAYS-

- Open cylinder valves slowly to allow the pressure in the system to come up gradually.
- Keep cylinders far enough away from hot areas so that sparks, slag or flames will not reach them.
- Store cylinders, both full and empty, so they cannot be knocked over.
- Soap test new connections.
- Shut valves when finished with them even for a short time.
- Use the proper “T” wrench to key to open valves on cylinders such acetylene.
- Replace the cylinder valve cap when the regulator is removed.
- Tie cylinders down.
- Store cylinders in a ventilated area.
- Mark empty cylinders.

3.10 Oxygen Safety Precautions

Oxygen is the most hazardous gas generally handled during diving operations. Oxygen lowers the ignition temperature of flammable substances and accelerates combustion. Hydrocarbons (oil grease etc..) can spontaneously combust in high Oxygen environments. The following rules apply when working with pure or high Oxygen percentages.

- Equipment used with oxygen must be designed for such use.
- Always use a clean oxygen regulator to get oxygen form a cylinder.
- Never lubricate or allow oil or grease to come in contact with oxygen connections, or other oxygen equipment.
- Oxygen systems with pressures greater than 125 psig must have slow opening shut-off valves.
- All lubricants, gaskets, plastics, diaphragms, O-ring materials etc., use in oxygen systems must be O2 compatible.
- All oxygen system must be assembled free of organic materials and loose particles. All valves, gauges, piping, used in oxygen systems must be Certified "Cleaned for Oxygen Service."
- The Recompression Chamber environment will be maintained at 19 to 25 presents. Chamber occupants will not be allowed flammable material in with them.
- Clothes, blankets, bedding, and other materials used in recompression chamber must be made of fire-retardant materials.
- Never use oxygen for compressed air or as a source of pressure.
- The minimum psig in an O2 cylinder 25 psi.

3.11 Operation and Use of Equipment Underwater

Whether it is a screwdriver, specially designed tool, or welding torch, the diver will be thoroughly familiar with and experienced in use of whatever underwater tool is being used at the time.

- Never use a tool is not in good working condition.
- Do not overburden the work site.
- Arrange to have all required gear and tools readily available.
- Power tools shall be off when sent to a diver and when brought to the surface.
- If a hydraulic or pneumatic is available to perform the task required never use a electrically powered tool as a substitute.
- Never lower or drop tools or materials on divers or subsea assets. Always perform any drops next to the diver or assets.

3.12 Underwater Cutting and Welding

Underwater cutting and welding operations involve several hazards, including lethal electrical currents, oxygen and hydrogen rich gases that will explode in the presence of a spark and electrode tip, with temperatures more than 10,000°F.

It is impossible to anticipate all possible situations that may arise in underwater cutting or welding operations. Consequently, it cannot be assumed that safe operating conditions will exist simply by blindly following the guidelines set forth in this manual. Nonetheless, with a thorough knowledge of cutting and welding fundamentals combined with the use of common sense and sound judgment, the procedures described in this manual can be performed in maximum safety.

3.12.1 Explosive Gases

A. Gases produced by underwater cutting are rich in oxygen and hydrogen and will explode if trapped and ignited. Gases from underwater cutting will collect in closed compartments, open tubular structural members, open piping systems, shaped structural members and under such members as "H" beams.
   - Prior to cutting, it is mandatory that provision be made to evacuate existing gases and eliminate the possibility of further gas entrapment. If the presence of trapped explosive gas mixtures is uncertain, it may be necessary to drill holes in suitable locations to allow the gases to escape. This will flood the compartment with seawater. An alternative would be to purge the compartment with a mixture of gases, which will not support combustion.
   - Underwater cutting and welding processes generate explosive gases.
   - When cutting with power on or welding, hydrogen and oxygen are dissociated from the water and will travel separately as bubbles. These bubbles can collect in a trapped or confined space overhead. As the hydrogen and oxygen gases combine, they will ignite, causing a popping sound.
   - Oxygen cutting is about 60 percent efficient, resulting in approximately 40 percent pure oxygen being released into the environment. This gas can become entrapped above the work area, and when combined with a fuel such as hydrocarbons, can easily be ignited by a hydrogen bubble or a spark trapped in the bubble. Any pop is a sign of explosive gases collecting above the underwater work area and is the point when cutting or welding must stop, and the cause investigated.
   - Prior to the start of any underwater cutting or welding, as built drawings and physical configuration of the work area must be studied to determine all these areas and voids that could contain or trap explosive gases. These areas and voids must be vented or made inert in accordance to prevent possible explosions.
   - Care should also be taken when cutting or welding on enclosures that are on or above riverbeds, especially in mud, because trapped methane gas in the proper concentrations can explode.

B. Any one or a combination of the following may produce explosive gases:
   - Petroleum products such as gasoline, fuel oil or greases.
   - Paint mixing mediums, such as linseed oil or thinners.
   - Epoxies, adhesives, and solvents.
   - Ammunition or bulk explosives.
   - Decaying vegetable or animal matter; and
   - Unburned gases from cutting torches.
   - Every precaution must be taken to prevent an underwater explosion. To minimize the possibility of explosions from trapped gasses, the following procedures are recommended:
     - Start cutting at the highest point and work downward.
     - When cutting thick material, i.e., propeller shafting, cut from the outside and work around the circumference. By withdrawing the electrode every few seconds to allow water to enter the cut, exceedingly high temperatures cannot build up inside the metal.
     - Brushing or stroking action in the direction of the intended cut should be used.
     - Gases may be vented to the surface with a vent tube (flexible hose) secured in

place from the high point where gases would collect to a position above the waterline.

3.12.2 Electricity Underwater

A. Electricity Underwater

Electricity and water are incompatible by nature and the use of electrically powered equipment underwater presents a potential shock danger to both the diver and the tender. When using electrically powered equipment such as cutting, welding or underwater lighting, the diver and tender must be protected from electric shock. All personnel engaged in underwater cutting and welding should be thoroughly trained in CPR and first aid so they can render immediate assistance in the event of an accident. There are many conditions that contribute to making underwater work difficult. These include adverse currents, unstable footing, poor visibility, and low temperatures. A constant source of danger comes from the falling or rolling of cut-away pieces. This is especially true in salvage wrecking. These, combined with the dangers involved in operating an electric arc capable of producing fatal shock, severe burns, and explosive gas pockets, create a situation where the diver must be extremely alert.

The following precautions must be observed:

- Careful examination should be made before starting the cut to learn how the cut-away pieces will fall and whether there are any projections, wires or other objects which may foul lines or cause a piece to swing around in an unexpected manner.
- Be extremely careful when cutting tightly bound wire rope e.g., wire wrapped in a ship's propeller. When severed, the wire can backlash with spring-like force.
- Before cutting, ensure that umbilical and diving equipment will not be in the path of slag from the cutting operation.
- Avoid cutting overhead, if possible, since the falling molten material will seriously damage the diving helmet, dress and umbilical.
- Never put down or carry an electrode holder while the power is on.
- Never change an electrode while the power is on.
- The diver must never allow any body part or equipment to come in contact with the grounded work when the safety switch is closed.
- Care should be taken with diver-carried large loose metallic items (i.e., wrenches and backpacks) to ensure no contact is made with a live electrode or the work.

B. Power Supply

The power supply used for underwater cutting or welding shall consist of only approved electric welding machines and shall be tested for proper working order prior to use. Use only DC welding power. Competent, experienced personnel in accordance with approved plans shall install electric welding equipment. This requirement is especially applicable to the installation of primary power lines and outlets intended to supply power to the electric welding machines. The equipment shall only be operated in accordance with the manufacturers recommended operating procedures and the safety precautions outlined in this manual. The following precautions are to be observed during set up and operation of arc cutting or welding equipment:

- Ensure that the welding machine frame and supporting structure are grounded before starting operations.

- Ensure that neither terminal of the welding machine is or becomes short-circuited to the machine frame before starting operations.
- Ensure that all electrical connections are securely made before starting operations.
- Stand on dry wood, rubber matting or similar insulating material and not on grounded metal.
- Wear dry rubber or rubberized-canvas gloves that are in good condition when handling energized holders, torches, cables, or welding machines.
- Keep the welding machine commutators clean to prevent excessive flashing.
- Keep the welding machine clean and operable, free of oil and grease and (in electrical parts) free of metallic particles that can cause short circuits.

C. Electrode Holders and Cutting Torches

The following are electrode holder and cutting torch precautions that should be observed:

- Use only torches and electrode holders that have been specifically designed for underwater applications. They must have the capacity to handle the maximum rated current required by the electrode being used.
- Inspect the apparatus and ensure that all current-carrying parts are fully insulated with nonconducting material. This material should safely insulate against the maximum voltage encountered to ground. Remember, new does not necessarily mean ready for use. Extra insulation may be required, which will provide further diver protection and extend the life of the electrode holder.
- Standard holders designed for surface use shall not be used except in exceptional situations.
- Inspect the electrode holders for worn or damaged parts and insulating material and repair or replace any parts as necessary. Flashback arrestors and monel screens must always be in proper working order.
- Do not lower the welding or cutting torch before the ground clamp is securely attached near the work area.
- Before lowering or raising the electrode holder or ground clamp, ensure that the current is off, and the knife switch is open.
- Never attempt to change or tighten an electrode with the current on.
- Never hold the holder so the electrode points toward the body. This can be likened to pointing a loaded pistol at oneself.
- Special care should be taken to avoid touching the metal parts of the diving equipment with the electrode or any uninsulated parts of the electrode holder.

D. Power Cable and Connector Safety

The following are power cable and connector safety precautions that should be observed:

- All parts of the cables that are intended to be submerged shall be fully insulated and watertight. This cannot be overstated.
- Inspect cables and cable connections for damaged insulation before starting operations. Defects in the cable must be repaired or the cable replaced before starting operations.
- All connections shall be made tight and thoroughly insulated by wrapping in rubber tape, applying a layer of scotch cote, then wrapping with electrical tape. This will

prevent current loss at the connections. Cables that produce bubbles during operation should be replaced. The bubbles indicate that current is being lost through the porous insulation.

- Use only welding cables that are a minimum of 2/0 extra flexible. An exception is the electrode holder lead, which can be 1/0. The 1/0 lead is more flexible and will aid the diver in maneuvering the electrode holder. The cable must conform to the applicable requirements of Military Specification MIL-C-915. Cables must be capable of handling the maximum current requirements of the intended work.
- Do not use excessive lengths of cable with large sections stored on deck. When working in deep water, a strain relief should be provided across the connections to support cable weight.
- When connecting lengths of cable, use connectors that have a current carrying capacity that is equivalent to the cable being used.
- Ensure that the 1/0 stinger lead between the electrode holder and the welding lead is defect-free. The cable connection coupling the stinger lead to the 2/0 welding lead should be thoroughly insulated with a layer of scotch cote, wrapped in rubber tape, insulated with an additional layer of scotch cote, then finally wrapped with electrical tape or heat-shrink tubing. This will afford added protection for the diver.

WARNING: The position of the ground in relation to the diver must be such that at no time does the diver or equipment become positioned between the ground and the electrode. The diver must avoid becoming part of the electrical circuit.

- Secure the ground clamp as close to the worksite as possible, preferably in the forward line of vision. The diver must face the ground when welding or cutting. A good rule-of-thumb to remember is: NEVER TURN YOUR BACK TO THE GROUND WHEN THE POWER IS ON.
- Keep additional power cables such as underwater light cables and welding leads separated.
- Cables should be strung overhead if they are to be run for long distances. If this is not practicable and they must be laid on deck, they must be protected and arranged to prevent interference with safe passage of personnel.
- When portable lighting is used, it should be clamped or fully secured in position and not handheld. The portable lighting power cords must be kept clear of the welding leads and work area. Additionally, a ground-fault detector/interrupter (GFD/I) must be incorporated in the circuit.
- Cables in storage should be kept dry and free of grease and oil, which cause premature breakdown of the insulation.

CAUTION: When AC power is required for underwater lighting or operation of hand tools, the AC equipment must be protected by ground-fault detection (GFD) and/or ground-fault interruption (GFI) devices.

E. Safety Switch

A positive-acting, infusible current interrupt switch, rated at 400 amperes must be in the welding circuit. This switch protects the diver by breaking the electric circuit, thereby stopping the current supply to the electrode holder. The safety switch, more often referred to as a knife switch, is the most important safety item included in the underwater cutting or welding equipment inventory. The diver is fully isolated from electric current when the knife switch is open. The tender (phone talker) should only be instructed to close the switch when the electrode is poised for cutting or welding. It is extremely important to mount the switch correctly. The switch must be positively acting, rigidly mounted and located so that it cannot be accidentally knocked or vibrated closed. Should the switch fall, the circuit would be broken. Both double-pole and single-pole safety switches are authorized, however a double-pole is the most often used because both the working and ground lead are opened or closed simultaneously. To ensure safety switch effectiveness, the following guidelines must be followed:

- When using a single-pole knife switch, it should be located in the welding-lead side of the electric circuit and should be able to handle the maximum welding current. The safety switch must be mounted vertically on a non-conducting (wooden, plastic, etc.) stand. The switch has an open circuit potential of approximately 80 volts across the poles. To prevent accidents, the safety switch should be fitted with a non-conducting slotted cover.
- When reverse polarity is required, the safety switch must be placed in the cutting or welding lead side of the circuit.
- Never operate a knife switch in a combustible atmosphere.
- The knife switch must be in proper working order. Additionally, the switch contact surfaces should be periodically checked for verdigris accumulation.
- The current shall be always off (knife switch open), except when poised for or actually cutting or welding.
- When a single-pole knife switch is used, special care must be taken to ensure that the safety switch is not shunted out between the switch and welding machine.
- Wet, bruised or worn cables can be shorted by rubbing against the welding machine frame, hatch combings or by lying on a steel deck. This creates a potential source of danger. Inspect the cable thoroughly and wrap any questionable spots in the insulation with rubber tape, followed by an additional layer of electrical tape or heat shrink.
- Periodic inspection should be made to ensure that the insulation is not damaged.
- The safety switch shall be in such a position that enables the phone talker or designated tender to operate or oversee the operation of the switch during the entire time the diver is in the water. The switch shall not be closed unless specifically directed by the diver to do so. The phone talker shall confirm each change to the diver via the intercommunications system.

F. Fire and Explosion Prevention

The major causes of fire and explosion are listed as follows:

- Combustibles reached by the arc,
- Flying sparks,
- Hot slag,
- Misuse of compressed gases and cylinders and
- Short circuits.
- It is necessary for the diving supervisor be aware of topside work being conducted in

the vicinity of the diving station. Do not allow welding or cutting in an area where there are combustibles. Sparks and slag can fly up to 35 feet. Keep equipment clean and operable, free of oil and grease and free of metallic particles (in electrical parts) that can cause short circuits.
- Hydrocarbons ignite almost spontaneously in the presence of oxygen. Never allow oxygen-carrying components to come in contact with oil or grease.

3.13 Hand Tools
- Hand tools are often misused simply because the user has never been shown how to use the tool the proper way.
- Wrenches should be inspected frequently to eliminate worn or sprung jaws, broken cages, springs, and bent or cracked handles.
- Frequently inspect driving faces of hammers, chisels, drift pins, bars, and similar tools to eliminate mushroomed heads, broken faces, cracked handles and other defects.
- Handles should be sound and securely wedged or fastened to the tools. Painting or taping of handles are prohibited for these practices may cover defects or cracks.
- Keep hand tools clean and in good working order.

3.14 Explosives
Prevention of explosive accidents depends on careful planning and faithful observance of proper blasting practices. The slightest abuse or misdirection of explosives may either kill or cause serious injury to yourself or others. Two general statements may be made about safety and the uses of explosives:

(1) a blaster most important responsibility is safety; and
(2) the safety of every blasting operation depends on its people.

The most important ingredients in a safety program are the quality of its people and the quality of their training. If explosives are to be used on a project a complete Explosive Safety Plan will be completed by the planner covering all aspects of safety and State, Federal, or Governmental regulations. The planner will ensure that the blasting crew is well trained in the blasting technique to be used, and that all safety precautions that can be taken are taken to protect personnel and equipment.

3.15 Confined Space Entry/Tunnel Penetration
Divers are often required to work in an enclosed or confined space. Enclosed space diving shall be supported by a surface-supplied air system.
NOTE: Physically Confining Space is any space which would restrict the diver's ability to rotate head to toe, 180 degrees in any plane and/or when the diver has no direct access to the surface or bell for recovery of the diver from the water.

Enclosed Space Hazards:
- The interior of sunken ships, barges, pipelines, and cofferdams is hazardous due to limited access, poor visibility, and slippery surfaces.
- Enclosed spaces may be dry or flooded, and dry spaces may contain a contaminated atmosphere.

NOTE: When a diver is working in an enclosed or confined space an additional diver shall be stationed at the underwater point of diver ingress and immediately available to come to the assistance of the diver. In these conditions the dive team must include an additional Tender/Diver, ultimately, the number of tending divers deployed depends on the situation and the good judgment of the Diving Supervisor on the site.

Enclosed Space Safety Precautions:

- Because of the hazards involved in enclosed space operations, divers must rigorously adhere to the following warnings.

WARNING: During enclosed space diving, all divers shall be outfitted with a surface supplied rig that includes a diver-to-diver and diver-to-topside communications system and a Bailout Bottle for the diver inside the space.

WARNING: For a dry penetration the divers shall not remove their diving equipment until the atmosphere tests confirm that the atmosphere is safe to breath the air will be tested constantly and the diver must be always ready to don his diving rig.

WARNING: If the diving equipment should fail, the diver shall immediately switch to the Bailout Bottle and abort the dive. The air requirement for the Bail out Bottle shall be determined during the planning stages of the dive.

Diver-worn or carried emergency gas supply (bailout) shall have a minimum calculated four-minute supply at the anticipated depth and calculated minimum for egress from enclosure:

1. Have a cylinder(s) meeting the requirements in Section 6.11.2(ADCI consensus 6.4)
2. Have a depth-compensating regulator on the cylinder capable of delivering the proper pressure and flow to the diver's helmet or mask in accordance with the helmet or mask manufacturer's recommendations.
3. Have a means of attachment to the hat or mask, which prevents accidental disengagement.
4. The diver-carried EGS or mask/helmet shall have a positive means of isolating it from the primary gas supply.
5. When diving a gas mixture other than air, sample/test to verify contents.
6. Bottles must be clearly marked with content, date, pressure and the name of the individual performing this verification

Working Around Corners:

- When working around corners where the umbilical is likely to become fouled or line-pull signals may be dissipated, a second diver (tending diver) may be sent down to tend the lines of the first diver at the obstruction and to pass along any line-pull signals.
- Line-pull signals are used when audio communications are lost and are passed on the first diver's lines; the tending diver uses his own lines only for signals directly pertaining to his own situation.

Pre-Entry Planning:

- A site specific HASP is required before entry into a confined space.
- The plan will cover all aspects of the planned operation; entry and egress form the confined space, health hazards physical chemical biological, emergency response plan. Additionally, the HASP will include any permits required by local, state, and federal governments.

Training of Personnel:

- A diving certification is not considered a certification to enter a confined space.
- The entire crew will be trained in confined space entry and rescue.

4. Equipment Requirements
To ensure the safety and wellbeing of the diver, the equipment used in diving operations must be designed to adequately perform the service required, properly maintained in accordance with Governmental regulations, and manufacturers specifications. This section will provide details of the requirements which equipment must meet prior to being used in diving operations conducted by Caldwell Marine International divers.

4.1 General System Requirements
To be considered complete, and safe for diving operations a diving system must include the following equipment:
- The equipment must be maintained and certified as per governmental regulations
- The equipment must be capable of supplying the correct gas mixer at the proper standard cubic feet (SCF) and pressure as required for depth.
- A Recompression Chamber is required for any dives deeper than 60 feet or for any dives requiring decompression, or when live-boating at any depth.
- Voice communications between top side and all divers is required.
- An accurate depth-measuring device is required.
- First aid equipment
- Wet suit, dry suit or hot water suit system which will maintain the diver's body temperature
- A system, which will allow the diver to enter and safely exit the water, is required.

4.2 Diving Supervisor Responsibilities
Prior to the beginning of any diving operation, the diving Supervisor shall ensure that:
- That all equipment except for mobile equipment required for the job is in place, ready for immediate use and secured firmly in place for the duration of the project.
- That the deck recompression chamber is readily accessible to divers returning from underwater operations.

At a minimum every 24 hours the diving Supervisor shall check:
- That all diving systems and equipment being used are in good working order.
- That all diving equipment has been leak tested.
- That all diving systems valve line up configurations have not been tampered with by non-diving personnel.

4.3 Diver Worn Equipment
For the proposes of this manual, diver worn equipment shall include all equipment required for the safety and the wellbeing of the diver, which is worn by or attached to the diver while he is in the water. When required by Caldwell Marine International, divers will use equipment specified and provided by Caldwell Marine International. No exceptions will be made without the permission of Caldwell Marine International management, except in the event of an emergency.

4.3.1 Helmets
The diver's helmet is the most important piece of equipment. Improperly maintained helmets put the diver at an extreme risk. Helmets/masks used by Caldwell Marine International divers will:
- Have a non-return check valve located at the attachment point of the umbilical to the

helmet.

- Must have an exhaust valve.
- Have reliable two-way communications system
- Must supply the diver with a vent rate of 4.5 (acfm) at any depth the helmet is operated at.
- Dive Superintendent will check helmet certifications and do a visual inspection.

4.3.2 Pre-Dive Checks

Immediately prior to each use, a helmet/mask will receive the following checks:

- JSA/JHA Pre dive meeting
- Equipment Checks
- Visual inspection for obvious signs of damage to the frame, faceplate, breathing system, neck dam, etc.
- Proper operation of the gas system including all regulators and valves.
- A vacuum test performed on the non-return valve.
- A communication check.

4.3.3 Thermal Protection

It is the responsibility of the diver to provide himself with and maintain a wet suit or dry suit, which will provide thermal protection.

Suit Selection:

Custom wet suits designed for cold-water diving, variable volume dry suits, and hot water suits have all been used effectively for diving in extremely cold water. Each has advantages and disadvantages that must be considered when planning a particular dive mission. All suits must be inspected before use to ensure they are in good condition with no seam separations or fabric cuts.

4.3.4 Wet Suits

Custom wet suits have the advantages of wide availability, simplicity, and less danger of catastrophic failure than dry suits. Although the wet suit is not the equipment of choice, if used the following should be considered:

- The wet suit should be maintained in the best possible condition to reduce water flushing in and out of the suit.
- Wearing heavy insulating socks under the boots in a wet suit will help keep feet warm.

CAUTION: In very cold water, the wet suit is only a marginally effective thermal protective measure, and its use exposes the diver to hypothermia and restricts available bottom time. The use of alternative thermal protective equipment should be considered in these circumstances.

4.3.5 Variable Volume Dry Suits

Variable volume dry suits provide superior thermal protection to the surface-supplied diver in the water and on the surface. They are constructed so the entry zipper or seal and all wrist and neck seals are waterproof, keeping the interior dry. They can be inflated orally or from a low-pressure air source via an inlet valve. Air can be exhausted from the suit via a second valve, allowing excellent buoyancy control. The level of thermal protection can be varied through careful selection of the type and thickness of long underwear. However, too much underwear is bulky and can cause overheating, sweating, and subsequent chilling of the standby diver.

Dry suit disadvantages are increased swimmer fatigue due to suit bulk, possible malfunction of inlet and exhaust valves, and the need for additional weights for neutral buoyancy. Furthermore, if the diver is horizontal or deployed with the head below the rest of the body, air can migrate into the suit lower extremities, causing over inflation and loss of fins and buoyancy control. A parting seam or zipper could result in a dramatic loss of buoyancy control and thermal shock. Nevertheless, because of its superior thermal protection, the dry suit is an essential component of extremely cold-water diving.

4.3.6 Extreme Exposure Suits/Hot Water Suits

Hot water suits provide excellent thermal protection. If their use can be supported logistically, they are an excellent choice whenever bottom times are lengthy. They are impractical for use by standby divers exposed on the surface.

A hot water system failure can be catastrophic for a diver in very cold water since the hot water is a life support system under such conditions. Hot water temperature must be carefully monitored to ensure that the water is delivered at the proper temperature. Should dive conditions/durations require the use of a hot water suit system it will be provide by the company.

4.3.7 Pre-Dive Checks and Maintenance

The following are checks that should be conducted prior to each use:

- Inspect the zipper slides.
- Check foam for gouges, rips, or parting of the seams.
- Checks boots and gloves for damages.
- After each dive clean rinse, and dry the suit, boots, and gloves with fresh clean water.
- Store in a dry location avoid folding for long periods.

4.3.8 Safety Harness/Bailout Bottle

All divers must wear a safety harness. A working diver shall be equipped with a full body diving harness that:

a. Is designed to:
    i. Provide a method to securely attach the umbilical to the diver.
    ii. Lift an unconscious or injured diver and his or her equipment from the water in an emergency.
    iii. Be utilized for underwater use.
b. Has an overall breaking strength of no less than 2,000 pounds.
c. Is equipped with a positive buckling device (i.e., designed to prevent strap pull-through and accidental release by the diver). It shall not be possible to release the harness by a single action.
d. Is equipped with at least one attachment point for the umbilical that is rated to at least the same breaking strength as the lifeline or strength member in the umbilical bundle. If the harness has multiple attachment points of different strengths, those suitable for umbilical attachments are to be clearly identified.
e. Is equipped with adjustable, permanently attached leg straps.

f. Is fitted with at least one lifting (recovery) ring, accessible when the diver is fully dressed, suitable for recovery of the diver from the water in an emergency using a hoisting device or other suitable means.
g. Is designed to maintain the diver in a heads-up position during recovery (using the lift ring/rings) from the water in an emergency.
h. Allows for easy disconnect of the main umbilical and weights, without removal of the main bail-out harness. This may be achieved by use of a separate/independent outer harness or jacket for the bailout system and diver's weights, or similar systems.
i. Is to be visually inspected prior to use for any signs of deterioration or damage. Any harness whose material condition is in doubt shall not be used until a determination is made by the diving supervisor.
j. Is to be regularly maintained in accordance with the manufacturer's recommendations.
k. Is certified by the manufacturer the diver up and over the side in an emergency.

Bailouts:
Diver-worn or carried emergency gas supply (bailout) shall have a minimum calculated four-minute supply at the anticipated depth.

EGS systems shall:
1. Have a cylinder(s) meeting the requirements for (ADCI, USN, CMI).
2. Have a depth-compensating regulator on the cylinder capable of delivering the proper pressure and flow to the diver's helmet or mask in accordance with the helmet or mask manufacturer's recommendations.
3. Have a means of attachment to the hat or mask, which prevents accidental disengagement.
4. The diver-carried EGS or mask/helmet shall have a positive means of isolating it from the primary gas supply.
5. When diving a gas mixture other than air, sample/test to verify contents.
6. Bottles must be clearly marked with content, date, pressure and the name of the individual performing this verifications.

EMERGENCY GAS SUPPLY DURATION FORMULA
DA = VA/CD DA = Duration in Minutes
VA = Available Volume
CD = Consumption Rate at Depth Consumption rate at depth = Volume minute X depth in bars or atmospheres Gauge pressure minus (depth in pressure + regulator delivery pressure) = usable gas pressure

BAILOUT CALCULATIONS FOR 50 Cu. Ft. CYLINDERS									
Depth fsw	**Depth psi**	**ATA**	**Rate cu.ft / min**	**Cylinder psi**	**Cylinder volume cu.ft**	**Delivery Pressure depth in psi + 150 psi reg press.**	**Usable Gas pressure**	**Usable Gas cu.ft / bottle**	**Duration Minutes at Depth**
300	133.50	10.09	1.5	3000	50	283.50	2716.50	45.28	2.99
275	122.38	9.33	1.5	3000	50	272.38	2727.63	45.46	3.25
250	111.25	8.58	1.5	3000	50	261.25	2738.75	45.65	3.55
225	100.13	7.82	1.5	3000	50	250.13	2749.88	45.83	3.91
200	89.00	7.06	1.5	3000	50	239.00	2761.00	46.02	4.34
175	77.88	6.30	1.5	3000	50	227.88	2772.13	46.20	4.89
150	66.75	5.55	1.5	3000	50	216.75	2783.25	46.39	5.58
125	55.63	4.79	1.5	3000	50	205.63	2794.38	56.57	6.48
100	44.50	4.03	1.5	3000	50	194.50	2805.50	46.76	7.73
75	33.38	3.27	1.5	3000	50	183.38	2816.63	46.94	9.56
50	22.25	2.52	1.5	3000	50	172.25	2827.75	47.13	12.49
25	11.13	1.76	1.5	3000	50	161.13	2838.88	47.31	17.95

4.3.9 Knife

Several types of knives are available:

- Diving knives should have corrosion-resistant blades and a handle of plastic, hard rubber, or wood.
- Handles made of wood should be waterproofed with paint, wax, or linseed oil.
- Handles of cork or bone should be avoided, as these materials deteriorate rapidly when subjected to constant saltwater immersion. Cork may also float the knife away from the diver.
- Knives may have single-or-double- edged blades with chisel or pointed tips. The most useful knife has one sharp edge and one saw-toothed edge.
- All knives must be kept sharp.
- The knife must be carried in a suitable scabbard and worn on the diver's, harness, hip, thigh, or calf.
- The knife must be readily accessible, must not interfere with body movement, and must be positioned so that it will not become fouled while swimming or working.
- The scabbard should hold the knife with a positive but easily released lock.
- The knife and scabbard must not be secured to the weight belt. If the weights are released in an emergency, the knife may be also dropped unintentionally.

4.3.10 Umbilical

The primary link to the divers is the umbilical. It carries breathing gas to the diver, a means of communications, and a method of measuring the diver depth. Also, if the time duration and water temperature are a factor the umbilical carries hot water to the diver for thermal protection.

Diver umbilical and dive hose assemblies shall:

1. Meet the requirements of paragraph (CMI, ADCI, USCG, USN).
2. Be marked from the diver/bell end in 10-foot intervals up to 100 feet and marked in 50-foot intervals thereafter.
3. Be subjected to an annual pressure test to one-and-one-half times the design working pressure of the system. The test pressure should be maintained without loss of pressure (when corrected for temperature) for 10 minutes. Note: To ensure uniformity throughout the commercial diving industry, ADCI Standard 006 recommends the following color coding be used by all participants:

DIVERS UMBILICAL MARKINGS	
10 feet (3.05 meters)	**1 white band**
20 feet (6.10 meters)	**2 bands**
30 feet (9.15 meters)	**3 white bands**
40 feet (12.2 meters)	**4 white bands**
50 feet (15.25 meters)	**1 yellow band**
60 feet (18.29 meters)	**1 yellow band/1 white band**
70 feet (21.34 meters)	**1 yellow band/2 white bands**
80 feet (24.39 meters)	**1 yellow band/3 white bands**
90 feet (27.44 meters)	**1 yellow band/4 white bands**
100 feet (30.49 meters)	**1 red band**
150 feet (45.73 meters)	**1 red band/1 yellow band**
200 feet (60.98 meters)	**2 red bands**
250 feet (76.22 meters)	**2 red band/1 yellow band**
300 feet (91.46 meters)	**3 red bands**

Beyond 300 feet (91.46 meters), continue to place yellow bands after 50 feet (15.25 meters) and red bands after 100 feet (30.49 meters).

4. Be marked with a unique identity and be subjected to a planned maintenance program.
5. Consist of a breathing gas hose, communications cable, a means of determining the diver's depth, and a strength member (the strength member may be the entire hose assembly, if so designed).

6. Have a minimum break strength of the hose assembly, including terminating hardware (e.g., “D” ring or attaching points), of 1,000 pounds.
7. Pneumo hose shall be annually pressure-tested for leakage. The umbilical assembly used for the standby diver must be of sufficient length to reach the primary diver at his or her furthest possible excursion from the dive station.

4.4 Gas Hose Requirements

1. Oxygen hoses shall meet the requirements of Section 6.5.2 and be suitable for intended use.
2. LP hose assemblies (less than 500 psi) used in systems containing greater than 50 percent oxygen are to be cleaned for oxygen service.
3. Hoses used for oxygen (over 50 percent) service shall be identified by a consistent code or tagged “FOR OXYGEN USE ONLY”.
4. Lubricants used to assemble fittings on hoses for oxygen service shall be compatible with oxygen.

(HP) Breathing Gas Hose Assemblies shall:

1. Have a minimum burst pressure equal to four times the maximum allowable working pressure (MAWP) and be suitable/rated by the manufacturer for work intended.
2. Have connectors with pressure capability equal to or greater than the designed working pressure of the system on which they are installed.
3. Have fittings of corrosion-resistant material that cannot be accidentally disengaged.
4. Be kink-resistant or arranged to prevent kinking.
5. Be visually examined and pressure tested after each boundary repair.
6. Be suitable for breathing gas service.
7. Each hose assembly will be subjected to an annual pressure test to the maximum allowable working pressure (MAWP) of the system. The test pressure should be maintained (when corrected for temperature) for 10 minutes

4.5 Breathing Gas Systems

Regardless of the source, the air must meet certain established standards of purity, must be supplied in an adequate volume for breathing, and must have a rate of flow that properly ventilates the helmet or mask. The air must also be provided at sufficient pressure to overcome the bottom water pressure and the pressure losses due to flow through the diving hose, fittings, and valves.

The air supply requirements depend upon specific factors of each dive such as depth, duration, level of work, number of divers being supported, and type of diving system being used.

4.5.1 Requirements for Air Supply

All surface-supplied diving systems must include a primary and a secondary air supply:

- The primary supply must be able to support the airflow and pressure requirements for the diving equipment designated.

- The capacity of the primary supply must meet the consumption rate of the designated number of divers for the full duration of the dive (bottom time plus decompression time).
- The maximum depth of the dive, the number of divers, and the equipment to be used must be considered when sizing the supply.
- The secondary supply must be sized to be able to support recovery of all divers using the equipment and dive profile of the primary supply if the primary supply sustains a casualty at the worst-case time (for example, immediately prior to completion of planned bottom time of maximum dive depth, when decompression obligation is greatest).
- Primary and secondary supplies may be either high-pressure (HP) bank-supplied or compressor- supplied.

4.5.2 Air Supply Flow Requirements

The required flow from an air supply depends upon the type of diving apparatus being used.

- The open-circuit air supply system must have a flow capacity (in acfm) that provides sufficient ventilation at depth to maintain acceptable carbon dioxide levels in the mask or helmet.
- Carbon dioxide levels must be kept within safe limits during normal work, heavy work, and emergencies.
- The flow requirements for respiration in a demand system are based upon the average rate of airflow demanded by the divers under normal working conditions.
- The maximum instantaneous (peak) rate of flow under severe work conditions is not a continuous requirement, but rather the highest rate of airflow attained during the inhalation part of the breathing cycle. The diver's requirement varies with the respiratory demands of the diver's work level.

4.5.3 Supply Pressure Requirements

To supply the diver with an adequate flow of air, the air source must deliver air at sufficient pressure to overcome the bottom seawater pressure and the pressure drop that is introduced as the air flows through the hoses and valves of the system.

4.5.4 Water Vapor Control

A properly operated air supply system should never permit the air supplied to the diver to reach its dew point. Controlling the amount of water vapor (humidity) in the supplied air is normally accomplished by one or both of the following methods:

- Compression/Expansion. As high-pressure air expands across a pressure valve, the partial pressure of the water vapor in the air is decreased. Since the expansion takes place at essentially a constant temperature (isothermal), the partial pressure of water vapor required to saturate the air remains unchanged. Therefore, the relative humidity of the air is reduced.
- Cooling the air prior to expanding it raises its relative humidity, permitting some of the water to condense. The condensed liquid may then be drained from the system.

4.5.5 Air Compressors

Low pressure air compressors used in diving operations conducted by Caldwell Marine International personnel must have:

- A certified volume tank that meets required specifications (ADCI Ref. 6.13.1)
- A check valve on the inlet side.
- A pressure gauge.
- A drain valves
- An intake, which is located away from areas containing exhaust, fumes from internal combustion engines or other harmful contaminates.
- An efficient filtration system.
- Slow opening relief valves when the system operating pressure exceeds 500 psi.

4.5.6 Gas Purity Standards

Gas used in diving operations conducted by Caldwell Marine International divers will meet the following standards for purity:

AIR PURITY REQUIREMENTS

1. All compressors, transfer pumps or booster pumps used for breathing air service will be subjected to an air quality test every six months. (Including all sources of third party supplied air). Compressors with a discharge pressure of 500 psi or less shall meet the standards of the current ANSI CGA required for Grade D air, or equivalent. Compressors with a discharge pressure that exceeds 500 psi shall meet the requirements of the current ANSI CGA for Grade E air, or equivalent.
2. Air purity tests shall be taken at the discharge point that would normally supply the breathing gas system, the diver's hose or cylinder fill point.
3. Documentation of the latest test(s) shall be kept on file and available upon request.
4. Compressors used for breathing gas transfer other than atmospheric air shall be checked every six months to ensure they do not induce contaminants into the gas being processed

4.5.7 Gas Cylinder Color Codes

Color coding systems are not standards and can vary significantly. To determine what gas is contained in a cylinder the making on the cylinder must be used not the color the cylinder.

4.6 Deck Chambers

Recompression chambers are used for the treatment of decompression sickness, and for surface decompression procedures. Diving operations to depths greater than 60fsw, live-boating operations, and any dives requiring decompression, must have a DDC be available at the site.

PVHO DESIGN AND CONSTRUCTION REQUIREMENTS

All PVHOs shall meet the following minimum requirements:

1. PVHOs and their associated systems shall be built in accordance with the most current version of ASME PVHO-1 and/or in conformance with the requirements of a classing society competent in PVHO diving systems.

2. Have a pressure relief device as per the most current version of ASME PVHO-1 or the code/standard of construction. Normally this is no more than 10 percent above MAWP (maximum allowable working pressure) of the PVHO.
3. Any doors, hatches or quick-acting closures associated with a TUP (transfer under pressure) system shall be equipped with an interlock system to prevent accidental opening under pressure. This would include medical locks, equipment locks, and bell TUPquick closures.
4. Have a control panel with a dedicated pressure gauge indicating depth for each pressurized compartment. The gauges shall:
    - Be maintained with a calibration of each depth gauge within six months.
    - Be arranged to allow comparison with another gauge while in operation.

4.6.1 Basic Requirements

Surface Diving Decompression Chambers

When selecting a surface diving decompression chamber, careful consideration must be given to its MAWP capabilities relative to the planned deepest depth of the diving operation.

4.6.2 Labeling

All lines should be identified and labeled to indicate function, content and direction of flow.

4.6.3 Pressure Gauges

Chambers must be fitted with appropriate pressure gauges. These gauges, marked to read in feet of seawater (fsw), must be calibrated every 6 months to ensure accuracy.

4.6.4 State of Readiness

Since a recompression chamber is emergency equipment, it must be kept in a state of readiness. The chamber shall be well maintained and equipped with all necessary accessory equipment. A chamber is not to be used as a storage compartment. The chamber and the air and oxygen supply systems shall be checked prior to each use with the Predive Checklist provided at the end of this section. All diving personnel shall be trained in the operation of the recompression chamber equipment and should be able to perform any task required during treatment.

4.6.5 Post-Dive Checklist

To ensure equipment receives proper post dive maintenance and is returned to operational readiness, perform the equipment checks listed in the Recompression Chamber Post Dive Checklist provided at the end of this section.

4.6.6 Diving Craft and Platforms

Regardless of the technique being supported, craft used for diving operations shall:

- Be seaworthy
- Include required lifesaving and other safety gear
- Have a reliable engine (unless it is a moored platform or barge)
- Provide ample room for the divers to dress
- Provide adequate shelter and working area for the support crew
- Be able to carry safely all equipment required for the operation
- Have a well-trained crew

Other support equipment—including barges, tugs, floating cranes, or vessels may be needed, depending on the type of operation. The need for additional equipment should be anticipated as far in advance as possible.

4.7 Miscellaneous Equipment

4.7.1 Diving Ladders

Diving ladders should be constructed of corrosion resistant material or preserved to prevent corrosion. It should be able to support the weight of two divers. It must extend at least 1meter below the surface. The ladder must be fixed firmly in place and have two handrails extending above the deck of the support craft.

4.7.2 Diving Stages

Diving stages should be constructed of corrosion resistant material or preserved so as to prevent corrosion. It should be able to support the weight of two divers. It must have an open grating platform. A diving stage must be certified for man use.

4.7.3 First Aid Equipment

Each diving operation must have at the dive location and ready for immediate use:

- The Med kits are the responsibility of the diving supervisors when he has custody of the kits of them, but Company safety department will stock maintain the kits.

A medical kit approved by a physician that contains basic and advanced medical supplies necessary for the treatment of illness, minor first aid and trauma related injuries resulting from hyperbaric exposure and non-diving related illness and injuries. The Med kit will be inventoried before and after each job and at six- month intervals:

- Copies of a current emergency first aid handbook
- A bag-type manual resuscitator with mask and tubing.
- A two-way communications system for emergencies.
- A capability to assist an injured diver into the deck recompression chamber.

4.8 Equipment Test Requirements

This section is provided to outline the test requirements for diving systems and equipment used by Caldwell Marine International divers.

4.8.1 Chamber Maintenance

Surface diving decompression chambers shall:

1. Be dual-lock and multiplace (except emergency rescue chambers or chambers designed to mate with another P.V.H.O., if regulatory codes allow).
2. Have sufficient internal dimensions to accommodate a person lying in a horizontal position with another person attending (except designated diving bells, transfer locks and emergency rescue chambers).
3. Permit ingress and egress of personnel and equipment while the occupants remain pressurized.
4. Have a means of operating all installed man-way locking devices, except disabled shipping dogs, from both sides of a closed hatch.

5. Have illumination of the interior sufficient to allow operation of any controls and allow for visual observation, diagnosis and/or medical treatment.
6. Have viewports that allow the interior to be observed from the exterior.
7. Have a minimum pressure capability of 6 ATA (165 fsw [50 msw]; and a minimum pressure capability of the maximum depth of the dive plus 1 ATA.
8. Be capable of a minimum pressurization rate of 60 fsw (18.3 msw) within 1 minute. The inner lock may be blown down in advance to achieve this pressurization rate. There must be adequate air capacity on site to achieve deeper treatment depths.
9. Be capable of a decompression rate of 30 fsw (9.2 msw) per minute to 33 fsw [10.06 msw].
10. Have a means to maintain an atmosphere below a level of 25 percent oxygen by volume.
11. Have a means of maintaining an atmosphere not to exceed 1 percent surface equivalent carbon dioxide by volume.
12. Have mufflers/silencers on blowdown and exhaust outlets.
13. Have suction guards on exhaust line openings inside each compartment.
14. Have piping arranged to ensure adequate circulation.
15. Have all installed flexible hoses meet the requirements of ADCI Section 6.5: Hoses.
16. Have all penetrations clearly marked as to service.
17. Have piping in accordance with ANSI B31.1 and/or the most current version of ASME PVHO-1 or the classification society to which it was built.
18. Have the relief valve pressure settings tested annually and the test recorded in equipment log.
19. Pressure test the chamber and associated piping annually to MAWP, as stamped on the chamber name plate, and record in the equipment log.
20. Have an installed breathing system with a minimum of one mask per occupant per lock, plus one spare mask assembly per lock.
21. Have the capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work.
22. Have a non-return valve or quick disconnect with built-in check valve on through-hull penetrators supplying any built-in breathing system [BIBS].
23. Have a primary and secondary two-way voice communication system between the occupants and the operator.
24. Be equipped with a readily available means for extinguishing fire.
25. When fitted, have electrical systems designed and installed fit for purpose for the environment in which they will operate.
26. Chamber and BIBS exhaust should not vent into an enclosed space.
27. The chamber and its general area and controls should be adequately illuminated for operations at night. An enclosed space can mean a small shack, tented area, container, or inside of a vessel.
28. If external lights are used to illuminate the chamber internally, they shall not be placed in a manner to subject viewports to heat buildup and damage.
29. If the chamber is located away from the dive control station, there must be a means of communications between the two locations.
30. All chambers shall have an emergency breathing media immediately available to the BIBS in addition to the treatment gas.

GENERAL PRECAUTIONS FOR ACRYLIC VIEWPORTS

These are general precautions for the cleaning, operational inspection, installation and maintenance of acrylic viewports used in pressure vessels for human occupancy. For additional information, it is recommended that ASME PVHO-2 be referenced. This document covers design, inspection, and maintenance for acrylic viewports.

CLEANING

When cleaning is required, viewports should be carefully cleaned, and surfaces must not be scratched. An acceptable cleaning agent is mild soap and water. Do not use solvents of any type (alcohol, acetone, etc.) for any purpose on the window, gaskets or O-rings.

CAUTION: Only hand-cleaning is allowed. The use of power-driven tools is not permitted. After cleaning, inspect the window for blemishes such as cracks, chips, dings, scratches, crazing, blisters or discoloration. (Crazing is the development of a network of fine spiderweb-type cracks on the surface of the window; it can be caused by either stress or exposure to solvents.)

IN-SERVICE INSPECTION

Operational inspections should be conducted prior to each chamber pressurization. Visually inspect the accessible exterior, interior and bearing surfaces for the presence of blemishes in the form of crazing, cracks, scratches, blisters and discoloration. A common flashlight will assist in locating blemishes such as chips, cracks, or crazing and in determining the condition of bearing surfaces. Blemishes on the low-pressure face can serve as initiators of cracks and subsequent failure in flat disk and conical frustum viewports. For diving bells and submersible diver lock-out compartment viewports, both faces should be considered low-pressure faces. The depth of the blemish can be measured with a depth micrometer with a pointed rod (Brown and Sharpe, or equivalent or an optical comparator). Consideration should be given to the concentration of scratches, cracks or crazing occurring in the center of the viewing area, as this may be an indication of stress.

INSTALLATION

Viewports should be properly cleaned and carefully installed to ensure proper fit and safe operation. All viewport surfaces should be free of defects. All metal contact surfaces must be smooth and clean. Surface should be free of all defects and foreign matter. An oxygen compatible lubricant, which is compatible with acrylic, should be used. Retaining bolts should also be cleaned, inspected and lubricated. O-ring and gasket sealing surfaces must be completely free of any foreign material, such as cleaning agents and solvents, rust, sand, grit, paint chips, etc. All paint that will come in contact with the viewport should be fully cured.

MARKINGS

Viewport identification markings must be preserved on each viewport during cleaning and handling. Corresponding viewport documentation should be maintained with the PVHO documentation package.

NOTE: Further information can be found in ANSI ASME/PVHO-1

DAMAGE BY ACCIDENT

Major structural damage may be caused by an accident or mishandling. This may include things like:

Pressure Hull:

- Dents
- Gouges
- Damaged penetrator (stripped threads)
- Mating flange
- Lift lug or tie-down eye (bent, broken or hole elongation)
- Support base (frame deformation)

Doors:

- Damaged sealing surface
- Bent/broken hinge
- Damaged dogging mechanism

Viewport:

- Crazing
- Cracked/chipped
- Weld spatter
- Paint thinner damage
- Overheated/blistered (permanent deformation)

DAMAGE BY CORROSION

More important than damage done by an accident, and often unseen until more extensive, is the damage done by corrosion. Most damage by corrosion can be avoided with a diligent preventative maintenance program, however, even with the best preventative maintenance programs, damage can still occur.

Typical corrosion damage may include:

- Pit corrosion (shell and heads)
- Crevice corrosion
- Penetrators
- Viewport sealing surfaces
- Door faces
- Sealing surfaces
- O-ring grooves
- Support legs/saddles

CORROSION ALLOWANCE

Pressure vessels are typically built with a corrosion allowance in the calculated required metal thickness. This information is usually found on the pressure vessel certificate. Examination of corrosion-affected areas should be done in a manner necessary to determine if the corrosion has gone beyond the calculated allowable amount and may require remedial action.

REPAIR OF A PVHO

The owner should be aware of the requirements of the regulatory authority and of interested third parties, as their requirements will have a direct bearing on the repair specification. PVHO repair must be approached properly, regardless of how well the work is done or the quality of the material used. Without a conscious effort to comply with existing rules and regulations, it is possible to have an expensive repair that does not meet the requirements and is unacceptable.

It is important that a defined method is used when approaching the repair of a PVHO. Recommended steps for approaching any repair are as follows:

- I. Appraisal
- II. Plan
- III. Execution
- IV. Testing
- V. Documentation

I. APPRAISAL

1. The initial step is to appraise the damage. This means more than a casual look at the vessel and agreeing that it has been damaged. All damage should be investigated to determine the cause and what measures can be taken to prevent a reoccurrence.
2. Measure or otherwise quantify the damage so you can answer questions about the extent of the visible damage. Be aware that there may be areas of hidden damage. Make a sketch or map of the damaged area; photos may be helpful. Make a written report, describing the nature and extent of the damage. Be accurate and include as much detail as possible. Be honest in your appraisal; remember that the goal is to save the PVHO vessel and to put it safely back into service.
3. Damage to the pressure boundary of the vessel will require that any repairs be done in accordance with the code of manufacture. Likewise, damage to the attached piping shall be repaired to the code to which it was built. Only components meeting the applicable code requirements should be used for repairs or replacements.
4. Gather all of the existing documentation on the vessel. This information will be needed by engineering, code repair shop, authorized code inspector, insurance adjuster, classing society surveyor, etc.
5. Depending on the type and extent of damage, it may be necessary to perform in a nondestructive examination (NDE) to determine the extent of damage. It may be necessary to grit-blast the vessel to bare metal to determine the exact scope of work.
6. Prepare a written report and budget for the repairs. NOTE: If the decision as to the disposition of the repair is yours to make, don’t skip this step. It will become your tool to control the repair project.

II. PLAN

1. Make a technical plan for the repair. The plan should clearly establish the scope of work for the fabricator, as well as the scope of responsibility. This plan, if correctly drawn up, can function as the specification for the work and as part of a purchase order.
2. The plan should clearly state the codes, standards, rules, regulations and quality of workmanship that will govern the work. Don’t forget the paperwork requirements. Be very specific about the paperwork and paper deliverables for which the fabricator or

repair shop is responsible.

3. Prepare the drawings and/or calculations as necessary to affect the planned repair. An engineer, either in-house or outside, may need to be engaged to verify all details have been addressed. You should then obtain agreement from the regulator (jurisdiction) or classing society that:
    a. the proposed repairs and techniques are within the code.
    b. the proposed materials meet the code requirements
    c. the repair plan will be approved. Most repairs will require an initial survey to look at the vessel and assess your repair plan.

III. EXECUTION

1. Having obtained the concurrence of the required parties, and armed with your repair plan, budget, drawings and specifications, you are now ready to talk with a qualified fabricator or repair shop.
2. The least problematic choice is the original vessel fabricator. This is not always possible, but the likelihood is that the original fabricator will have the records that will make the repair and documentation go more smoothly. Unfortunately, many of the fabricators that have built PVHOs in the last 15 years are either out of business or may not have retained the records on your vessel. The ASME requires records to be retained for only five years. It is a good idea to require, as part of your purchase agreement with any fabricator or repair facility, that you receive a copy of all paperwork. If the vessel was registered with the National Board of Pressure Vessel Inspectors, you can get copies of the certificate by contacting the National Board.
3. The next best choice would be a fabricator that is currently building and certifying PVHO vessels. The fabricator should be authorized to apply the ASME "U" stamp and/or the "R" stamp from the National Board. The scope and criteria to differentiate between minor and major repairs is provided in the National Board Code ANSI- NB23. Alternatively, for PVHOs constructed to other codes, the repair shop should be certified to do repairs to the code to which the PVHO vessel was built.

IV. TESTING

1. Prior to, during and after repairs, various types of testing may be employed. Test results should be retained as part of the equipment record.
2. All non-destructive examinations should be done in accordance with ASME Section-V: Non Destructive Examination, by personnel competent in the type of test employed.
3. Pressure tests should be done in accordance with a written procedure and appropriate safety precautions.

V. DOCUMENTATION

1. All repairs and alterations are to be recorded in the equipment log. This should be accompanied by references to certificates and identification markings. Pressure testing should likewise be documented and recorded in the log. Any alteration or modification should be reflected in all drawing revisions.
2. All certificates, drawings, calculations, and reports should be retained for the service life of the equipment. A professional approach to the repair of PVHOs will yield professional

results, thereby preserving a valuable asset and ensuring the safety of the occupants and operators. It is impossible to guarantee that accidents will not happen. However, the probability can be significantly reduced by a good preventative maintenance program and consistent safe practices.

REFERENCES:

- ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and 2
- ASME Section V : Non Destructive Examination
- ANSI — ASME/PVHO-1 and 2
- ANSI B31.1: Code for Pressure Piping, Power Piping
- Association of Diving Contractors International Consensus Standards for Commercial Diving Operations
- 29 CFR Part 1910: OSHA Rules for Commercial Diving
- 46 CFR Part 1917: USCG Rules for Commercial Diving Operations
- IMO (International Maritime Organization) Code of Safety for Diving Systems, a.536 (13)
- IACS (International Association of Classing Societies) - ABS (American Bureau of Shipping) - DNV (Det Norske Veritas) - Lloyds Registry - National Board of Boiler & Pressure Vessel Inspectors ANSI-NB23

4.8.2 Gas Hose Test

- Each breathing gas supply hose will be tested initially and every 12 months thereafter, to 1.5 times the maximum working pressure.
- Each breathing gas supply hose will be internally cleaned of hydrocarbons and particulates initially and every 18 months thereafter.
- Divers' umbilical will have a coupling pullout test initially and every 12 months.

RECOMPRESSION CHAMBER PREDIVE CHECKLIST	
Equipment	**Initials**
Chamber	
Cleared of all extraneous equipment	
Clear of noxious odors	
Doors and seals undamaged, seals lubricated	
Remove floor Plates	
Visually inspect chamber interior for oily or volatile deposits of any kind	
Replace floor plates	
Inspect view ports for cracks clouding or pitting	
Shut outer hatch and pressurize chamber to 75 psi	
Inspect all hull penetrations and snoop for leaks	
Pressure gauges calibrated/compared	
Release pressure open outer hatch	
Air Supply System	
Primary and secondary air supply adequate	
One-valve supply: Valve closed	
Equalization valve closed, if applicable	
Supply regulator set at 250 psig or other appropriate pressure	
Fittings tight, filters clean, compressors fueled	
Exhaust System	
Valve closed and calibrated for ventilation	
Oxygen Supply System	
Cylinders full, marked as BREATHING OXYGEN, cylinder valves open	
Replacement cylinders on hand	
Built in breathing system (BIBS) masks installed inspected for damage and tested. Clean all BIBS mask with Non-Ionic soap	
Supply regulator set in accordance with OPs	
Fittings tight, gauges calibrated	
Oxygen manifold valves closed	
BIBS dump functioning	

RECOMPRESSION CHAMBER PREDIVE CHECKLIST	
Equipment	**Initials**
Electrical System	
Lights	
Oxygen analyzer calibrated	
Direct Current (DC) power supply	
Communication System	
Primary system tested	
Secondary system tested	
Fire Prevention System	
Fire-retardant clothing worn by all chamber occupants	
Fire-resistant mattresses and blankets in chamber	
Means of extinguishing a fire	
Miscellaneous	
Urinal	
Primary medical kit	
Ear protection, sound attenuators/aural protectors (1 set per person) Must have a 1/16” hole drilled to allow for equalization.	
Stopwatches for recompression treatment time, decompression time, personnel leaving chamber time, and cumulative time.	
U.S. Navy Diving Manual Revision 6	
Ventilation bill	
Chamber log	
Operating Procedures (OPs) and Emergency Procedures (EPs)	
Bedpan (to be locked in as required)	

RECOMPRESSION CHAMBER POSTDIVE CHECKLIST	
Equipment	**Initials**
Air Supply	
All valves closed	
Compressors fueled and maintained per technical manual/PMS requirements	
View Ports and Doors	
Viewports checked for damage; replaced as necessary	
Door seals checked, replaced as necessary	
Door seals lightly lubricated with approved lubricant	
Door dogs and dogging mechanism checked for proper operation and shaft seals for tight-ness	
Chamber	
Inside wiped clean with Nonionic Detergent (NID) and warm fresh water	
All but necessary support items removed from chamber	
Blankets cleaned and replaced	
All flammable material in chamber encased in fire-resistant containers	
Primary medical kit restocked as required	
Chamber aired out	
Outer door closed	
Deck plates lifted, area below Deck plates cleaned, Deck plates reinstalled	
Support Items	
U.S. Navy Diving Manual, Operating Procedures (OPs), Emergency Procedures (EPs), ventilation bill and pencil available at control desk	
Secondary medical kit restocked as required and stowed	
Clothing cleaned and stowed	
All entries made in chamber logbook	
Chamber logbook stowed	
Oxygen Supply	
BIBS mask removed, cleaned per current PMS procedures, reinstalled	
All valves closed	
System bled	
Breathing oxygen cylinders fully pressurized	
Spare cylinders available	
System free of contamination	
Exhaust System	
Exhaust: valves closed	

PRESSURE TEST FOR RECOMPRESSION CHAMBERS:

NOTE: All Caldwell Marine International recompression chambers are restricted to a maximum working pressure of 100 psig (225 fsw), regardless of design pressure rating.

A pressure test shall be conducted on every recompression chamber:

- When initially installed
- When moved and reinstalled
- After repairs/overhaul
- At two-year intervals at a given location

Performance of the test and the test results are recorded on a Chamber Air Pressure and Leak Test form (attached).

The test is conducted as follows:

1. Pressurize the innermost lock to 135 psi (MAWP). Leak test all shell penetration fittings, view-ports, dog seals, door dogs (where applicable), valve connections, pipe joints, and shell weldments with the use of soapy water or an evaluation solution.
2. Mark all leaks. Depressurize the lock and adjust, repair, or replace components as necessary to eliminate leaks.
   a. View-Port Leaks. Remove the view-port gasket (replace if necessary), wipe clean.

CAUTION: Acrylic viewports should not be lubricated or come in contact with any lubricant. Acrylic viewports should not come in contact with any volatile detergent or leak detector (non- ionic detergent is to be used for leak test). When reinstalling viewport, take up retaining ringbolts until the gasket just compresses evenly about the viewport. Do not over compress the gasket. Tighten according to manufacturer's torque specifications.

   b. Weldment Leaks. Contact appropriate technical authority for guidance on corrective action.

3. Repeat steps 1 and 2 until all the leaks have been eliminated.
4. Pressurize outer-lock to 135 psi (or stamped MAWP) and repeat Step 2.

WARNING: Do not exceed maximum pressure rating for the pressure vessel (MAWP 135 psi).

5. Depressurize the lock to 165 fsw (73.4 psig). Hold for 1 hour. If pressure drops below 145 fsw (65 psig), locate and mark leaks. Depressurize chamber and repair leaks in accordance with Step 2 above and repeat this procedure until final pressure is at least145fsw (65 psig).
6. Repeat Steps 1 through 5 leaving the inner door open and outer door closed. Leak test only those portions of the chamber not previously tested.

RECOMPRESSION CHAMBER
AIR PRESSURE AND LEAK TEST

Facility test is conducted ______________________________

NAME PLATE DATA

Manufacturer ____

Date of Manufacture ____

Contract/Drawing No. ____

Maximum Working Pressure ____

Date of Last Pressure Test ____

Test Conducted by ____

1. Conduct visual inspection of chamber to determine if ready for test

Chamber Satisfactory ______ Initials of Test Conductor

Discrepancies from visual inspection of chamber:

____

____

2. Close inner door lock. With outer lock door open pressure inner lock to 100 fsw (45psig) and verify that the following components do not leak:

Inner lock leak checks Initials of Test Conductor.

A. Shell penetrations and fittings ______ Satisfactory
B. View Ports ______ Satisfactory
C. Door Seals ______ Satisfactory
D. Door Dog Shaft Seals ______ Satisfactory
E. Valve Connections and Stems ______ Satisfactory
F. Pipe Joints ______ Satisfactory
G. Shell Welds ______ Satisfactory

3. Increase inner lock pressure to 225 fsw (100 psig) and hold for 5 minutes.

Record Test Pressure ______ Satisfactory (Note: Disregard small leaks at this pressure).

RECOMPRESSION CHAMBER
AIR PRESSURE AND LEAK TEST

4. Depressurize lock slowly to 165 fsw (73.4 psig). Secure all supply and exhaust valves and hold for one hour.

Start Time __________________________ Pressure 165 fsw

End Time __________________________ Pressure _________ fsw

If pressure drops below 145 fsw (65 psig) locate and mark leaks. Depressurize, repair, and retest inner lock.
Inner Lock Pressure drop test passed ___________
Satisfactory Initials of Test Conductor.

5. Depressurize inner lock and open inner lock door. Secure in open position. Close outer door and secure.

6. Repeat tests of sections 2, 3, and 4 above when set up in accordance with section Leak test only those portions of the chamber not tested in sections 2, 3, and4.

7. Outer Lock Checks Initials of Test Conductor

A. Shell penetrations and fittings	____ Satisfactory
B. View Ports	____ Satisfactory
C. Door Seals	____ Satisfactory
D. Door Dog Shaft Seals	____ Satisfactory
E. Valve Connections and Stems	____ Satisfactory
F. Pipe Joints	____ Satisfactory
G. Shell Welds	____ Satisfactory

8. Maximum Chamber Operating Pressure (100 psig) Test (5 minute hold)

Satisfactory ____________________________ Initials of Test Conductor

9. Inner and Outer Lock Chamber Drop Test
Start Time ____________________________ Pressure 165 fsw
End Time _____________________________ Pressure ________ fsw

10. All above tests have been satisfactorily completed.

__________________ ____________________ ________________________
Test Conductor Date Diving Supervisor Date Maintenance Supervisor Date

5. Surface-Supplied Air Diving

5.1 Limits

- Surface-supplied air diving shall not be conducted at depths deeper than 170 fsw.
- A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 60 fsw. A decompression chamber is required for dives deeper than 60 fsw when live boating.
- A bell shall be used for dives with an in-water decompression time greater than 120 minutes, except when heavy gear is worn, or diving is conducted in physically confining spaces.

5.2 Minimum Personnel

The minimum number of personnel comprising a dive team must take into consideration not only the direct requirements of work to be performed, but also any additional factors either known or suspected that would require more personnel to support the diving operation.

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

1. At a minimum, at least one member of the dive team must have a recognized O_2 provider certification or be a DMT. If that member is a part of the dive rotation, then at least two members of the dive team must have a recognized O2 provider certification or be DMTs. The minimum number of personnel comprising a dive team is never less than three; however, planning must take into consideration not only the direct requirements of the work to be performed, but also additional factors either known or suspected that may lead to complications during the conduct of the intended operation. Merely because a dive team comprised of three persons may be adequate during one operation does not mean the same number of persons will be sufficient to accommodate the requirements of another operation. Diving contractor management and diving supervisors must carefully consider manning levels of the dive team. Although regulations may permit diving with a minimum crew of three persons, that level of manning is strictly under optimal conditions. For example, any time commercial diving operations are intended to take place in a remote location, or where an air gap from the diving station to the water exceeds 15 feet (4.6 m), at least a fourth member of the dive team should be considered. Shallow Operations with Large Crews When a diving operation takes place in less than 100 fsw (30 msw) and the on-shift crew size is eight or more, then a diving supervisor who is not part of the diving rotation must be part of the crew.
2. Minimum Personnel Requirements:
    - One air-diving supervisor
    - One diver
    - One tender/diver who shall be properly equipped and capable of performing the duties of a standby diver

Working with large crews in shallow water less than 130 fsw:

- When working in shifts with 2 eight-man crew’s a non-diving supervisor is required for each shift.
- When working with 2 four-man crews on the same shift at different locations on a single vessel or facility, a non-diving supervisor is required.

- When working with 2 four-man crews on different shifts on a single vessel or facility, a non-diving supervisor is not required

5.3 General Surface Supplied Procedures

The following are minimum requirements for surface supplied air diving operations.

- Each diver shall be continuously tended while in the water.
- A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.
- Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- Diving depth limitations are based on secondary breathing gas availability. A dive-location secondary breathing gas supply shall be provided and be capable of supporting two divers and a standby for the duration of the required decompression during an emergency.
- For dives deeper than 100 fsw or outside the no-decompression limits:
- A separate dive team member shall tend each diver in the water.
- A standby diver shall be available while a diver is in the water.
- A diver-carried reserve breathing gas supply (bailout) shall be provided for each diver when diving at all times regardless of depth, when direct ascent to the surface is not available, except when heavy gear is worn.
- For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits an extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.
- A separate safety harness with a positive buckling device shall be worn. The harness shall prevent any strain from being placed on the diver’s mask or helmet.
- In the event that diving operations require in-closed space diving a diver shall be stationed at the underwater point of entry.
- An operational two-way voice communication system shall be used between:
- Each surface-supplied air diver and a dive team member at the dive location or bell (when provided or required);
- An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.
- Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.
- A depth-time profile shall be maintained for each diver during the dive including decompression.
- A means capable of supporting the diver shall be provided for entering and exiting the water.
- The means provided for exiting the water shall extend below the water surface for a minimum of three feet and be adequate to facilitate rescue of injured personnel.
- Dive team members shall be briefed on the tasks to be undertaken, safety procedures for the diving mode being used and emergency procedures.

5.4 Minimum Equipment

5.4.1 Shallow Air (0 to 80 fsw, 60 fsw when live boating)

- Adequate air source and volume tank to support two (2) divers.
- Dive location emergency air source
- Two (2)-diver umbilical's each consisting of air hose, strength member, communications cable, and pneumofathometer hose.
- 1 Set of the U.S. Navy No-decompression tables, Repetitive dive tables, and air decompression and treatment tables
- 1 Safe Practices/Operations Manual.
- 1 Control station consisting of communication system and depth gauges.
- Safe means of getting a diver of the water.
- 1 Basic First Aid kit with First Aid Manual and Bag type Manual Resuscitator.
- Two Sets of diver's personal diving equipment consisting of helmet or mask, weight belt if appropriate, protective clothing, tools as required, safety harness, diver carried reserve breathing gas supply (bailout), sharp knife.
- Two time keeping devices.
- Logbook and/or dive sheets

5.4.2 Deep Air (in excess of 80 fsw, 60 fsw when live boating)

- Two adequate air sources and volume tanks to support two (2) divers.
- 1 Double-lock recompression chamber.
- 1 Set air decompression and treatment tables.
- Dive location emergency air source.
- 1 Diving stage (all dives deeper than 100 fsw, outside no decompression limits, or with heavy diving gear.
- Two (2)-diver umbilical's each consisting of air hose, strength member, communications cable, and pneumofathometer hose.
- 1 Safe Practices/Operations Manual.
- 1 Control station consisting of communication system and depth gauges.
- Safe means of getting a diver of the water.
- 1 Basic First Aid kit with First Aid Manual and Bag type Manual Resuscitator.
- Two sets of diver's personal diving equipment consisting of helmet or mask, weight belt if appropriate, diver carried reserve breathing gas supply (bail out), protective clothing, tools as required, safety harness, diver carried reserve breathing gas supply (bailout), sharp knife.
- Adequate supply of oxygen for recompression treatments.
- Spare parts as required.
- 2 Time keeping devices.
- Logbook and/or dive sheets

5.5 Post-Dive Procedures

After the completion of any dive, the Dive Supervisor shall:

- Check the physical condition of the diver.
- Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness.
- Advise the diver of the location of a recompression chamber that is ready for use

- Alert the diver to the potential hazards of flying after diving.
- For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the Dive Supervisor shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

5.6 Recompression Capability

- A recompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:
- Surface-supplied air diving to depths deeper than 60 fsw and shallower than 220 fsw.
- Diving outside the no-decompression limits shallower than 220 fsw.
- Live boating deeper than 60 fsw.
- The recompression chamber shall be:
- Dual-lock.
- Multi-place.
- Located within 5 minutes of the dive location.
- The recompression chamber at a minimum shall be equipped with:
    - A pressure gauge for each pressurized compartment designed for human occupancy
    - A built-in-breathing-system with a minimum of one mask per occupant
    - A two-way voice communication system between occupants and a dive team member at the dive location
    - A view port for each lock
    - Illumination capability to light the interior of the chamber
    - Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.
    - A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

5.7 Record of Dive

The following information shall be recorded and maintained for each diving operation. Each employer shall establish and maintain a record of each diver's hyperbaric exposure. This record shall contain the following:

- Name and address of the company.
- Location, time and date of diving operations.
- Names of the dive supervisor, diver and tender/diver.
- Depth of dive.
- Bottom time.
- Approximate water temperature and thermal protection used.
- Environmental conditions (approximate sea state, underwater visibility and underwater currents). • Decompression tables and schedule used.
- Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation.
- Breathing mixture used and composition.
- Type of work performed.

- Type of diving equipment worn.
- Any unusual conditions.
- For each dive for whom decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:
- Description of decompression sickness symptoms, including depth and time of onset. - Description and results of treatments.
- Diver's condition upon surfacing.
- Diver's Signature

5.8 Air Diving Procedures

5.8.1 Introduction

When air is breathed under pressure, nitrogen diffuses into various tissues of the body. This nitrogen uptake by the body occurs at different rates for the various tissues. It continues as long as the partial pressure of the inspired nitrogen in the circulatory and respiratory system is higher than the partial pressure of the gas absorbed in the tissues. Nitrogen absorption increases as the partial pressure of the inspired nitrogen increases, such as with increased depth. Nitrogen absorption also increases as the duration of the exposure increases, until tissues become saturated.

As a diver ascends, the process is reversed. The partial pressure of nitrogen in the tissues comes to exceed that in the circulatory and respiratory systems. During ascent, the nitrogen diffuses from the tissues to the lungs. The rate of ascent must be carefully controlled to prevent the nitrogen pressure from exceeding the ambient pressure by too great of an amount. If the pressure gradient is uncontrolled, bubbles of nitrogen gas can form in tissues and blood, causing decompression sickness.

To reduce the possibility of decompression sickness, special decompression tables and schedules were developed. These schedules take into consideration the amount of nitrogen absorbed by the body at various depths and times. Other considerations are the allowable pressure gradients that can exist without excessive bubble formation and the different gas-elimination rates associated with various body tissues. Because of its operational simplicity, staged decompressions used for air decompression. Staged decompression requires decompression stops in the water at various depths for specific periods of time.

5.8.2 Air Decompression Definition

The following terms are frequently used when conducting diving operations and discussing the decompression tables.

- Descent time is the total elapsed time from when the divers leave the surface to the time, they reach the bottom. Descent time is rounded up to the next whole minute.
- Bottom time is the total elapsed time from when the divers leave the surface to the time, they begin their ascent from the bottom. Bottom time is measured in minutes and is rounded up to the next whole minute.
- A decompression table is a structured set of decompression schedules, or limits, usually organized in order of increasing bottom times and depths.
- A decompression schedule is a specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table. It is normally

indicated as feet/minutes.

- A decompression stop is a specified depth where a diver must remain for a specified length of time (stop time).
- Depth- The following terms are used to indicate the depth of a dive:
  - Maximum depth is the deepest depth attained by the diver plus the pneumofathometer correction factor (Table 5- 1).
  - Stage depth is the pneumofathometer reading taken when the divers are on the stage just prior to leaving the bottom. Stage depth is used to compute the distance and travel time to the first stop, or to the surface if no stops are required.

Pneumofathometer Correction Factors

Pneumofathometer Depth	Correction Factor
0-100 fsw	+1 fsw
101-200	+2 fsw
201-300	+4 fsw
301-400	+7 fsw

- The equivalent single dive bottom time is the time used to select a schedule for a single repetitive dive. This time is expressed in minutes.
- Unlimited/No-Decompression (No “D”) Limit- The maximum time that can be spent at a given depth that safe ascent can be made directly to the surface at a prescribed travel rate with no decompression stops is the unlimited/no-decompression or No “D” limit.
- A repetitive dive is any dive conducted within 12 hours of a previous dive.
- The repetitive group designation is a letter used to indicate the amount of residual nitrogen remaining in a diver’s body following a previous dive.
- Residual nitrogen is the nitrogen gas still dissolved in a diver’s tissues after surfacing.
- Residual nitrogen time is the time that must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver’s tissues from a previous dive. Residual nitrogen time is expressed in minutes.
- A single dive refers to any dive conducted more than 12 hours after a previous dive.
- A single repetitive dive is a dive for which the bottom time used to select the decompression schedule is the sum of the residual nitrogen time and the actual bottom time of the dive.
- The surface interval is the time a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as he starts his next descent.

5.8.3 Selection of Decompression Schedule

The decompression schedules of all the tables are usually given in 10-foot depth increments and 10-minute bottom time increments. Depth and bottom time combinations from dives, however, rarely match the decompression schedules exactly. To ensure that the selected decom-pression schedule is always conservative, always select the schedule depth equal to or next greater than the maximum depth of the dive and always select the schedule bottom time equal to or next longer than the bottom time of the dive.

For example, to use the Standard Air Decompression Table to select the correct schedule for a dive to 97 fsw for 31 minutes, decompression would be selected for 100 fsw and carried out per

the 100 fsw for 40 minutes (100/40) schedule.
CAUTION: Never attempt to interpolate between decompression schedules.

When planning for surface-supplied dives where the diver will be exceptionally cold or the workload is expected to be relatively strenuous, Surface Decompression should be considered. In such case, conduct decompression from the normal schedule in the water and then surface decompress using the chamber stop time(s) from the next longer schedule. When conducting dives using Standard Air Decompression Tables, select the next longer decompression schedule than the one that would normally be selected.
If the divers are exceptionally cold during the dive or if the workload is relatively strenuous, select the next longer decompression schedule than the one that would normally be selected. If the diver's depth cannot be maintained at a decompression stop, the Diving Supervisor may select the next deeper decompression table.
NOTE: Take into consideration the physical condition of the diver when deter-mining what is strenuous.

5.9 Rules During Ascent

After selecting the applicable decompression schedule, it is imperative that it be followed as closely as possible. Unless a Diving Medical Officer recommends a deviation and the Commanding Officer concurs, decompression must be completed according to the schedule selected.

5.9.1 Ascent Rate

Always ascend at a rate of 30 fpm (20 seconds per 10 fsw). Minor variations in the rate of travel between 20 and 40 fsw/minute are acceptable. Any variation in the rate of ascent must be corrected in accordance with the procedures in paragraph 5.9.3. However, a delay of up to one minute in reaching the first decompression stop can be ignored.

5.9.2 Decompression Stop Time

Decompression stop(s) times, as specified in the decompression schedule, begin as soon as the divers reach the stop depth. Upon completion of the specified stop time, the divers ascend to the next stop or to the surface at the proper ascent rate. Ascent time is not included as part of stop time.

<u>Variations in Rate of Ascent Delays in Arriving at the First Stop</u>
Delay greater than 1 minute, deeper than 50 fsw. Add the total delay time (rounded up to the next whole minute) to the bottom time, re-compute a new decompression schedule, and decompress accordingly.
Delay greater than 1 minute, shallower than 50 fsw. If the rate of ascent is less than 30 fpm, add the delay time to the diver's first decompression stop. If the delay is between stops, disregard the delay. The delay time is rounded up to the next whole minute.

<u>Travel Rate Exceeded</u>
On a Standard Air Dive, if the rate of ascent is greater than 30 fpm, STOP THE ASCENT, allow the watches to catch up, and then continue ascent. If the stop is arrived at early, start the stop time after the watches catch up.

5.10 Decompression Tables

5.10.1 The Unlimited/No-Decompression

The table serves three purposes. First, the table identifies that on a dive with the depth 20 fsw and shallower, unlimited bottom time may be achieved. Second, it summarizes all the depth and bottom time combinations for which no decompression is required. Third, it provides the repetitive group designation for each unlimited/no-decompression dive. Even though decompression is not required, there is still an amount of nitrogen remaining in the diver's tissues for up to 12 hours following a dive. If they dive again within a 12- hour period, divers must consider this residual nitrogen when calculating decompression from the repetitive dive. Any dive deeper than 25 fsw that has a bottom time greater than the no-decompression limit given in this table is a decompression dive and must be conducted per the Standard Air Decompression Table.

Each depth listed in the Unlimited/No-Decompression Table has a corresponding no-decompression limit listed in minutes. This limit is the maximum bottom time that divers may spend at that depth without requiring decompression. Use the columns to the right of the no-decompression limits column to obtain the repetitive group designation. This designation must be assigned to a diver after every dive.

5.10.2 U.S. Navy Standard Air Decompression Schedules

This manual combines the Standard Air Decompression Schedules and Exceptional Exposure Air Schedules into one table. To clearly distinguish between the standard (normal) and exceptional exposure decompression schedules, the exceptional exposure schedules have been separated by a bold line.

NOTE: Never conduct planned exceptional exposure dives.

If the bottom time of a dive is less than the first bottom time listed for its depth, decompression is not required. The divers may ascend directly to the surface at a rate of 30 feet per minute (fpm). The repetitive group designation for a no-decompression dive is given in the Unlimited/No-Decompression Table. As noted in the Standard Air Decompression Table, there are no repetitive group designations for exceptional exposure dives. Repetitive dives are not permitted following an exceptional exposure dive.

5.10.3 Repetitive Dives

During the 12-hour period after an air dive, the quantity of residual nitrogen in divers' bodies will gradually be reduced to its normal level. If the divers are to make a second dive within this period (repetitive dive), they must consider their residual nitrogen level when planning for the dive.

Upon completing the first dive, the divers are assigned a repetitive group designation from either the Standard Air Decompression Table or the Unlimited/No-Decompression Table. This designation relates directly to the residual nitrogen level upon surfacing. As nitrogen passes out of the diver's tissues and blood, their repetitive group designation changes. By using the Residual Nitrogen Timetable (Table 9- 7), this designation may be determined at any time during the surface interval.

To determine the decompression schedule for a repetitive dive using either the unlimited/no-decompression, standard air, or surface decompression table:

- Determine the residual nitrogen level just prior to leaving the surface of the repetitive dive (based on the repetitive dive depth), using the Residual Nitrogen Timetable. This level is expressed as residual nitrogen time, in minutes.
- Add this time to the actual bottom time of the repetitive dive to get the Equivalent Single Dive Time (ESDT).
- Conduct decompression from the repetitive dive using the max depth (MD) and the equivalent single dive time to select the appropriate decompression schedule. Avoid equivalent single dives requiring the use of Exceptional Exposure decompression schedules. Always use a systematic Repetitive Dive Worksheet, when determining the decompression schedule for a repetitive dive.

5.10.4 Residual Nitrogen Timetable for Repetitive Air Dives

The quantity of residual nitrogen in a diver's body immediately after a dive is expressed by the repetitive group designation assigned from either the Standard Air Decompression Schedule or the Unlimited/No-Decompression Table. The upper portion of the Residual Nitrogen Timetable is composed of various intervals between 10 minutes and 12 hours. These are expressed in hours and minutes (2:21 = 2 hours, 21 minutes). Each interval has a minimum time (top limit) and a maximum time (bottom limit). Residual nitrogen times corresponding to the depth of the repetitive dive is given in the body of the lower portion of the table. To determine the residual nitrogen time for a repetitive dive:

- Locate the diver's repetitive group designation from the previous dive along the diagonal line above the table.
- Read horizontally to the interval where the diver's surface interval lies. The time spent on the surface must be between or equal to the limits of the selected interval.
- Read vertically down to the new repetitive group designation. This corresponds to the present quantity of residual nitrogen in the diver's body.
- Continue down in this same column to the row representing the depth of the repetitive dive. The time given at the intersection is the residual nitrogen time, in minutes, to be applied to the bottom time of the repetitive dive.

5.10.5 RNT Exception Rule

An exception to this table occurs when the repetitive dive is made to the same or greater depth than that of the previous dive. This is referred to as the RNT Exception Rule. In such cases, the residual nitrogen time may be longer than the bottom time of the previous dive. A diver's body cannot contain more residual nitrogen than it was originally exposed to. To obtain the equivalent single dive time, simply add the bottom time of the previous dive to that of the repetitive dive. (All the residual nitrogen passes out of a diver's body after 12 hours, so a dive conducted after a 12-hr surface interval is not a repetitive dive.)

5.11 In-Water Decompression

For in-water decompression on air, the time at the first decompression stop begins when the diver arrives at the stop and ends when he leaves the stop.

For all subsequent stops, the stop time begins when the diver leaves the previous stop and ends when he leaves the stop. In other words, ascent time between stops is included in the subsequent stop time.

The same rules apply to in-water decompression on air/oxygen with the exception of the first stop on oxygen. The time at the first oxygen stop begins when all divers are confirmed on oxygen and ends when the divers leave the stop.

Caldwell Marine International reserves the right to use the US Navy Dive Decompression Tables Air or O2 for in-water decompression when applicable.

5.12 Surface Decompression

Surface decompression is a technique for fulfilling all or a portion of a diver's decompression obligation in a recompression chamber instead of in the water, significantly reducing the time that a diver must spend in the water. Also, breathing oxygen in the recompression chamber reduces the diver's total decompression time.

Surface decompression offers many advantages that enhance the divers' safety. Shorter exposure time in the water keeps divers from chilling to a dangerous level. Inside the recompression chamber, the divers can be maintained at a constant pressure, unaffected by surface conditions of the sea. Divers shall be observed constantly by either the inside tender or topside personnel and monitored for decompression sickness and oxygen toxicity.

If an oxygen breathing system is installed in the recompression chamber, conduct surface decompression according to the Surface Decompression Table Using Oxygen. If air is the only breathing medium available, use the Surface Decompression Table Using Air.

Residual Nitrogen Timetables have not been developed for Surface Decompression Repetitive Dives. Repetitive surface decompression dives may be accomplished in accordance with 5.12.

5.12.1 Surface Decompression Table Using Oxygen

- Using the Surface Decompression Table Using Oxygen (referred to as Sur D O2) requires an approved double-lock recompression chamber with an oxygen breathing system. With Sur D O2, divers ascend at a constant rate of 30 fpm. The divers are decompressed to the first decompression stop (or to the surface if there are no water stops required) at an ascent rate of 30 fpm. The travel rate between stops and from 30 fsw to the surface is also 30 fpm (:20 per 10 fsw). Minor variations in the rate of travel between 20 and 40 fpm are acceptable. Once the divers are on the surface, the tenders have three and a half (:03:30) minutes to remove the breathing apparatus and diving dress and assist the divers into the recompression chamber.
- Pressurizing the recompression chamber with air to 40 fsw should take approximately
- 30 seconds (descent rate not to exceed 80 fpm). The total elapsed time from when the

divers leave the 30-foot stop (or 30 fsw if no water stops are required) to when they reach the 40-foot recompression chamber stop must not exceed 5 minutes.

- During descent in the recompression chamber, if a diver cannot clear and the chamber is at a depth of at least 20 fsw, stop, then breathe oxygen at 20 fsw for twice the 40 fsw chamber stop time. Ascend to 10 fsw and breathe oxygen again for twice the 40 fsw chamber stop time. Then ascend to the surface. This "safe way out" procedure is not intended to be used in place of normal Sur D O 2 procedures.
- If the prescribed surface interval is exceeded and the divers are asymptomatic, treat them as if they have Type I decompression sickness (Treatment Table 5,). If the divers are symptomatic, they are treated as if they have Type II decompression sickness (Treatment Table 6,), even if they are only displaying Type I symptoms. Symptoms occurring during the chamber stops are treated as recurrences
- Upon arrival at 40 fsw in the recompression chamber, the divers are placed on the
- Built-in Breathing System (BIBS) mask breathing pure oxygen. The mask should not be strapped on unless there is an inside tender with the divers, the divers must hold the mask to their face and ensure a good oxygen seal.

The designated 40-foot stop time commences once the divers are breathing oxygen. The divers breathe oxygen throughout the 40-foot stop, interrupting oxygen breathing after each 30 minutes with a 5-minute period of breathing chamber air (referred to as an "air break"). Count the air breaks as "dead time" and not part of the oxygen stop time. If the air brake interval falls on time to travel, remove oxygen and commence traveling to the surface at 30 fpm. This procedure simplifies time keeping and should be used whenever using the Surface Decompression Table Using Oxygen. Remove the O 2 mask prior to leaving the 40 fsw stop for the surface.

Warning: The interval from leaving 40 fsw in the water to arriving at 50 fsw in the chamber cannot exceed 5 minutes without incurring a penalty. This is new in the US NAVY Dive Manual revision 7.

5.12.2 Loss of Oxygen Supply in the Chamber (40 fsw Chamber Stop)
If the oxygen supply in the chamber is lost at the 40 fsw chamber stop, have the diver breathe chamber air.

- Temporary Loss- Return the diver to oxygen breathing. Consider any time on air as dead time.
- Permanent Loss- Multiply the remaining oxygen time by three to obtain the equivalent chamber decompression time on air. If 50% helium 50% oxygen or 50% nitrogen 50% oxygen is available, multiply the remaining oxygen time by two to obtain the equivalent chamber decompression time on 50/50. Allocate 10% of the equivalent air or 50/50 time to the 40-fsw stop, 20% to the 30 fsw stop, and 70% to the 20 fsw stop. Round the stop times up to the next whole minute. Surface upon completion of the 20 fsw stop.

5.12.3 CNS Oxygen Toxicity (40 fsw Chamber Stop)
At the first sign of CNS toxicity, the patient should be removed from oxygen and allowed to breathe chamber air. Fifteen minutes after all symptoms have completely subsided, resume oxygen breathing at the point of interruption. If symptoms of CNS oxygen toxicity develop again or if the first symptom is a convulsion, take the following action:

1. Remove the mask.
2. After all symptoms have completely subsided, decompress 10 feet at a rate of 1 fsw/min. For a convulsion, begin travel when the patient is fully relaxed and breathing normally.
3. Resume oxygen breathing at the shallower depth at the point of interruption.
4. If another oxygen symptom occurs, complete decompression time on air. Multiply
5. the remaining oxygen time by three to obtain the equivalent chamber decompression time on air. Allocate 30% of the equivalent air to the 30 fsw stop and 70% to the 20 fsw stop. Surface upon completion of the 20 fsw stop.

5.12.4 Repetitive Dives
There are no repetitive diving tables or surface interval tables for surface decompression dives. If another surface decompression dive using oxygen is planned within a 12-hour period, select the appropriate decompression schedule by:

- Adding the bottom times of all dives made in the previous 12 hours to get an adjusted bottom time, and
- Using the maximum depth obtained in the previous 12 hours.
- The equivalent single dive shall not exceed 170/40 for Sur D O 2 or 190/60 for Sur D Air.

5.12.5 Surface Decompression Table Using Air
The Surface Decompression Table Using Air (referred to as Sur D Air) should be used for surface decompression following an air dive when a recompression chamber without an oxygen breathing system is all that is available.

The total ascent times of the Surface Decompression Table Using Air exceed those of the Standard Air Decompression Table; the only advantages surface decompression using air are getting the divers out of the water sooner and maintaining the divers in a controlled, closely observed environment during decompression. When using the Sur D Air table, all ascents are made at 30 fpm. This includes the ascent rate from the last water stop. The time spent on the surface should not exceed 3½ minutes and the rate of descent to the first recompression chamber stop should not exceed 60 fpm. The total elapsed time for these three procedures must not exceed 5 minutes.
If the prescribed surface interval is exceeded and the divers are asymptomatic, they are treated as if they had Type I Decompression Sickness (Treatment Table 5 or 1A). If the divers are symptomatic, they are treated as if they had Type II Decompression Sickness (Treatment Table 6 or 2A), even if they are only displaying Type I symptoms.

5.12.6 Repetitive Dives
If a second surface decompression air dive is planned within a 12-hour period, the same rule applies as for making a second Sur-D O2 dive.

5.13 Exceptional Exposure
Exceptional exposure dives are those dives in which the risk of decompression sickness, oxygen toxicity, and/or exposure to the elements is substantially greater than on normal working dives. Decompression schedules for exceptional exposure dives are contained in the Standard Air Decompression Table. These exceptional exposure schedules are only used in emergencies, such

as diver entrapment. Exceptional exposure dives should not be planned in advance except under the most unusual operational circumstances.

5.13.1 Surface Decompression Procedures for Exceptional Exposure Dives

The long decompressions times associated with exceptional exposure dives impose unusual demands on a diver's endurance. There is also limited assurance that the dive will be completed without decompression sickness. These two risks can be reduced by using surface decompression techniques rather than completing decompression entirely in the water.

- Complete the entire 20 fsw in the water.
- Ascend to the surface at 30 fpm. Minor variations in the rate of travel between 20 and 40 fpm are acceptable.
- Once on the surface, the tenders have three and a half (:03:30) minutes to remove the breathing apparatus and diving dress and assist the divers into the recompression chamber.
- Pressurize the recompression chamber with air to 20 fsw at a travel rate of 60 fpm.
- Upon arrival at 20 fsw in the recompression chamber, the divers are placed on the Built-in Breathing System (BIBS) mask breathing 100% oxygen.
- The 20-foot stop time commences once the divers are breathing oxygen. Repeat the 20 fsw in-water stop time.
- The divers breathe oxygen throughout the 20-foot stop, interrupting oxygen breathing after each 30 minutes with a 5-minute air break. The air breaks count as part of the stop time.
- Ascend to 10 fsw at 30 fpm. Complete the 10 fsw in-water stop time. The divers breathe oxygen throughout the 10-foot stop, interrupting oxygen breathing after each 30 minutes with a 5-minute air break. The air breaks count as part of the stop time.
- Ascent to the surface at 30 fpm.

5.13.2 Oxygen System Failure (Chamber Stop)

If the oxygen system fails during a chamber stop, complete the remaining decompression time on air.

5.14 Diving At High Altitudes

Because of the reduced atmospheric pressure, dives conducted at altitude require more decompression than identical dives conducted at sea level. Standard air decompression tables, therefore, cannot be used as written. Some organizations calculate specific decompression tables for use at each altitude. An alternative approach is to correct the altitude dive to obtain an equivalent sea level dive, then determine the decompression requirement using standard tables. This procedure is commonly known as the "Cross Correction” technique and always yields a sea level dive that is deeper than the actual dive at altitude. A deeper sea level equivalent dive provides the extra decompression needed to offset effects of diving at altitude. If diving at altitudes above 300 feet refer to the US Navy dive manual for guidance.

5.14.1 Flying After Diving

Leaving the dive site may require temporary ascent to a higher altitude. Ascent to altitude after diving increases the risk of decompression sickness because of the additional reduction in atmospheric pressure the higher the altitude, the greater the risk. Pressurized commercial airline flights are addressed in Note 3 of Table 5-1.

Table 5-1 gives the surface interval (hours: minutes) required before making a further ascent to altitude. The surface interval depends on the planned increase in altitude and the highest repetitive group designator obtained in the previous 24-hour period. Enter the table with the highest repetitive group designator obtained in the previous 24-hour period. Read the required surface interval from the column for the planned change in altitude.

Required Surface Interval Before Ascent to Altitude After Diving

Repetitive Group Designator

Increase in Altitude

	1000	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**	**10000**
A	00:00	00:00	00:00	00:00	00:00	00:00	00:00	**00:00**	00:00	00:00
B	00:00	00:00	00:00	00:00	00:00	00:00	00:00	**00:00**	00:00	02:11
C	00:00	00:00	00:00	00:00	00:00	00:00	00:00	**00:00**	03:06	08:26
D	00:00	00:00	00:00	00:00	00:00	00:00	00:09	**03:28**	07:33	12:52
E	00:00	00:00	00:00	00:00	00:00	00:51	03:35	**06:54**	10:59	16:18
F	00:00	00:00	00:00	00:00	001:12	03:40	06:23	**09:43**	13:47	19:07
G	00:00	00:00	00:00	01:23	03:34	06:02	08:46	**12:05**	16:10	21:29
H	00:00	00:00	01:31	03:26	05:37	08:05	10:49	**14:09**	18:13	23:33
I	00:00	01:32	03:20	05:15	07:26	09:54	12:38	**15:58**	20:02	24:00
J	01:32	03:09	04:57	06:52	09:04	11:32	14:16	**17:35**	21:39	24:00
K	03:00	04:37	06:25	08:20	10:32	13:00	15:44	**19:03**	23:07	24:00
L	04:21	05:57	07:46	09:41	11: 52	14:20	17:04	**20:23**	24:00	24:00
M	05:35	07:11	09:00	10:55	13:06	15:34	18:18	**21:37**	24:00	24:00
N	06:43	08:20	10:08	12:03	14:14	16:42	19:26	**22:46**	24:00	24:00
O	07:47	09:24	11:12	13:07	15:18	17:46	20:30	**23:49**	24:00	24:00
Z	08:17	09:54	11:42	13:37	15:49	18:17	21:01	**24:00**	24:00	24:00

Table 5-1. *Exceptional Exposure- Wait 48 hours before flying

NOTE 1: When using Table 5-1, use the highest repetitive group designator obtained in the previous 24-hour period.
NOTE 2: Table 5-1 may only be used when the maximum altitude achieved is 10,000 feet or less.
NOTE 3: The cabin pressure in commercial aircraft is maintained at a constant value regardless of the actual altitude of the flight. Though cabin pressure varies somewhat with aircraft type, the nominal value is 8,000 feet. For commercial flights, use a final altitude of 8000 feet to compute the required surface interval before flying.
NOTE 4: No surface interval is required before taking a commercial flight if the dive site is at 8000 feet or higher. In this case, flying results in an increase in atmospheric pressure rather than a decrease.
NOTE 5: No repetitive group is given for air dives with surface decompression on oxygen or air. For these surface decompression dives, enter the standard air table with the sea level equivalent depth and bottom time of the dive to obtain the appropriate repetitive group designator to be used.
NOTE 6: For ascent to altitude following a non-saturation helium-oxygen dive, wait 12 hours if the dive was a no-decompression dive. Wait 24 hours if the dive was a decompression dive.

5.15 Emergency Procedures

Diving and the performance of work underwater, places a man in a situation that has inherent and unavoidable dangers. Even when using the best equipment manned by properly trained personnel, the possibility of and emergency may exist. Emergencies are by nature unexpected and differ form a routine failure in that they require prompt correct action to recover and prevent further deterioration of the situation. The emergency procedures (EP's) that follow for surface supplied diving operations outline the steps required to recover from known possible emergencies.

The cardinal rule of emergency procedures is the most difficult to follow – DON'T PANIC. While it is much easier to say than do, a panicky response will more than likely be wrong, and result in the further complication of the situation. While actions taken in an emergency must be quick, they must also be correct, and correct decisions are not made if you do not have a complete grasp on the situation. If the diver finds himself in an emergency situation, he should take time to assess the situation determine the correct action and what he can do for himself.

The following emergency procedures that may affect the health and safety of personnel are offered as minimum guidelines to assist companies in developing their own specific detailed emergency procedures. The steps that are listed may not be in order of preference.
Each emergency will dictate its own priorities. In general, every emergency will cause the dive to be aborted until the cause has been fully remedied.

The pneumofathometer should always contain the same mixture as the diver breathing media. Emergency procedure drills should be performed on a periodic basis to ensure familiarity by the crews.

LOSS OF BREATHING MEDIA

1. Re-establish breathing media supply by:
    a. Diver going on diver-worn or carried EGS (bailout);
    b. Activating topside secondary breathing media supply; or
    c. If applicable, put breathing media to diver's pneumo hose and confirm that the diver has bubbles before insertion of the pneumo hose into the diver's neck dam.
2. Alert standby diver.
3. Diver goes to bell/stage/surface, as applicable.
4. If required, send standby diver to diver's assistance.
5. Terminate dive.

LOSS OF COMMUNICATIONS

1. Attempt to reestablish electronic communications.
2. If communication cannot be reestablished, attempt to communicate through line-pull signals.
3. If applicable, put breathing media to diver's pneumo.
4. Alert standby diver.
5. Diver proceeds to downline/bell stage or surface as applicable (if bell, attempt to use bell communications).
6. Bring diver to first stop once line-pull signals are established.
7. If required (unable to establish any form of communications with diver), send standby diver to diver's assistance prior to bringing diver to his or her first stop.
8. Terminate dive.

FOULED OR ENTRAPPED DIVER

1. Avoid panic and ensure diver does not ditch equipment.
2. Diver informs topside.
3. Alert standby diver.
4. Diver determines extent of entrapment.
5. Diver attempts to free himself or herself.
6. If required, send standby diver to diver’s assistance.
7. When diver is free, if unable or unwilling to continue the dive, or if standby diver was required to go to diver’s assistance, terminate dive.

INJURED DIVER IN WATER

1. Diver informs topside, and dive is aborted.
2. Alert standby diver.
3. Diver determines nature and extent of injury.
4. If required, send standby diver down to assist diver, administer first aid and evaluate injury. Standby diver should remain with injured diver.
5. Monitor diver’s breathing. If diver stops breathing, overpressure his or her regulator, if possible.
6. If applicable, standby diver assists injured diver to surface, following proper decompression procedures, except when severity of injury indicates a greater risk than omitting decompression.
7. Institute planned diver recovery procedure.
8. Request required medical assistance and emergency evacuation, if required.

SEVERANCE OF DIVER’S UMBILICAL - GAS HOSE ONLY

1. Activate breathing media to diver’s pneumo hose.
2. Diver activates bailout bottle.
3. Alert standby diver.
4. If required, diver inserts pneumo hose inside of helmet/mask after confirmation of bubbles to the pneumo hose.
5. Diver returns to bell/stage/surface.
6. If applicable, diver activates and uses emergency breathing media on bell/stage.
7. Terminate dive and follow proper decompression procedure.
8. If required, send standby diver down with additional bailout bottle or hose.

SEVERANCE OF COMPLETE UMBILICAL

1. Diver activates bailout bottle and returns to bell/stage/surface. If applicable, diver activates and uses emergency gas on bell/stage.
2. Alert standby diver.
3. Deploy standby diver if the diver has not immediately surfaced.
4. If applicable, deploy marker buoy at diver’s last known location.
5. If applicable and available, standby diver provides new hose/bailout bottle. Otherwise, send standby diver down the downline or bell stage cable.
6. Terminate dive and follow proper decompression procedure.

FIRE

Topside fire:

1. Employ standard fire emergency procedures.
2. If required, suspend diving activities and evacuate diving station.

Fire inside PVHO:

1. Each chamber must have a means of extinguishing a fire in the interior.
2. Notify topside there is a fire in the chamber; evacuate to another chamber or lock if available or possible.
3. Divers inside the chamber should put on the BIBS with emergency gas.
4. Secure electrical power to non-essential systems.
5. Extinguish fire.
6. Vent the chamber.
7. Establish condition of the chamber occupants.

EQUIPMENT FAILURE

Diver in the water:

1. Evaluate effect on diver.
2. Inform diver of problem and action planned.
3. Alert standby diver.
4. Alert deck crew.
5. Diver informs topside of his or her readiness.
6. Activate plan and terminate dive.

ADVERSE ENVIRONMENTAL CONDITIONS

As a minimum, a JHA or specific procedure should be developed to address the following, as applicable:

- Adverse environmental conditions, including but not limited to:
    - Weather
    - Sea state
    - Currents
    - Lightning
    - Winds
    - Methane/swamp gas
    - Dangerous marine life

OXYGEN TOXICITY IN WATER

1. Supervisor notes signs, or diver reports symptoms to topside.
2. Reduce oxygen partial pressure (switch to air), or lower PPO2 of mixed gasses.
3. Deploy standby diver.
4. Continue decompression on appropriate table unless a 50/50 nitrox mix is available for in-water decompression use.

OXYGEN TOXICITY DURING TREATMENT

1. Diver reports to topside.
2. Instruct diver to remove oxygen mask for 15 minutes. After all symptoms disappear, start oxygen again. Do not count time not on oxygen. Recommence decompression where oxygen stopped.
3. Tender shall be locked in.
4. If oxygen toxicity symptoms occur for the second time, repeat step 2.
5. If oxygen toxicity symptoms occur for the third time, discontinue oxygen, and immediately request medical advice and assistance from designated point of contact.

EMERGENCY EVACUATION

1. Notify diver and all surrounding personnel of emergency and terminate dive.
2. Decompress diver according to proper decompression procedures. If not possible, follow omitted decompression procedures.
3. Evacuate all unnecessary personnel to safe platform.
4. Inform management of conditions as soon as possible.
5. Additional emergency procedures should be developed as needed, possibly including, but not limited to:
    a. Loss of power supplies.
    b. Loss of SDC (bell).
    c. Loss of ROV.
    d. Adverse environmental conditions.

ACCIDENT REPORTING

Association of Diving Contractors International Requirements:
ADCI requires ALL General Member Companies and Associate Member Schools to report industry-related fatalities/catastrophic injuries. Procedures: ADCI member companies can submit the reports on either their own company documents or the ADCI accident report form (See Section 7.2.1: Accident Report Form).

FOR U.S.-BASED COMPANIES:
Federal Regulatory Requirements 46 CFR – Department of Transportation – Coast Guard Subchapter V-Marine Occupational Safety and Health Standards, Part § 197.484, requires the person in charge to notify the officer in charge, marine inspection, as soon as possible after a diving casualty occurs, if the casualty involves any of the following:

- Loss of life.
- Diving-related injury to any person causing incapacitation for more than 72 hours.
- Diving-related injury to any person requiring hospitalization for more than 24 hours.

Part §197.486 defines the form of the written report of casualty and requires:

- That the report be furnished on Form CG-2692 when the diving installation is on a vessel; or
- That a written report, in narrative form, be used when the diving installation is on a facility. In either instance, the report must furnish the following information:
- Name and official number (if applicable) of the vessel or facility.

- Name of the owner or agent of the vessel or facility.
- Name of the person in charge.
- Name of the diving supervisor.
- Description of the casualty, including presumed cause.
- Nature and extent of the injury to persons.

29 CFR – Department of Labor – Occupational Safety and Health Administration Subpart T – Commercial Diving Operations, §1910.440, requires that an employer record the occurrence of any diving-related injury or illness that requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

In May 1994, OSHA further clarified and defined the reporting requirement to state: Employers are required to orally report any occupational fatality or catastrophe involving in-patient hospitalization of three or more workers within eight hours, per 29 CFR §1910.8. The report must include the following information:

- Company name.
- Location and time of incident.
- Number of fatalities or hospitalized employees.
- Contact person for the company.
- Phone number(s) for the company contact person.
- Brief description of the incident. EXEMPTIONS FROM FATALITY AND CATASTROPHIC ACCIDENT REPORTING DO NOT EXIST! Even though most commercial diving companies are exempt from record-keeping requirements (SIC7389), all are required to:
- Orally report as defined above.
- Maintain a log of occupational injuries and illnesses

5.16 Contaminated Water Diving Operations

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

The information presented in this section has been generated as guidance material only that must be considered when planning the conduct of contaminated water diving operations. A primary consideration during contaminated water diving operations is to minimize the length of time during which members of the dive team are exposed to contaminants.

Dives should be scheduled to require no in-water decompression so as to limit the diver’s exposure to waterborne hazards (5.37.1 TRAINING):

a. All personnel who are likely to participate in contaminated water diving operations should receive training consistent with regulatory requirements for the area where operations are to be conducted, such as 29 CFR 1910.120 (U.S. OSHA) – Hazardous

Waste Operations and Emergency Response (HAZWOPER).

b. Specific training must be furnished in:
   - Dry suits
   - Personal protective equipment for topside and diving personnel
   - Decontamination procedures, including preparation of the disinfectant or other solution intended for use
   - Decontamination of personnel and equipment used during operations

SITE EVALUATION

When operations will take place where the water is suspected or known to be contaminated, a site assessment must be conducted.

This assessment should include:

- Any suspected contaminants and potential hazards.
- Testing of the dive environment: It is not always possible to tell whether an environment is contaminated either by sight or smell. Any diving environment should be approached with caution, and when contamination is suspected, the water should be tested prior to commencing operations.
- Wind: In situations where there may be toxic fumes, the dive station, compressor and topside personnel must be situated up-wind from any source of contamination to the air.
- Current: Both on the surface and underwater, the diver should approach any known point-source of contaminant from the up current side whenever possible. This will allow the current to carry contaminants away from the diver.
- Perimeter: Whenever possible, a perimeter should be established around the dive station and dive site to keep unprotected persons away from any possible contamination.
- Established zones: Zone management should be employed when applicable to keep unprotected personnel and equipment outside of the hot zone.

TOPSIDE PERSONNEL PROTECTIVE EQUIPMENT: EPA SELECTION GUIDELINES

To aid in the selection of complete protective ensembles, including chemical protective clothing and respirators, the United States Environmental Protection Agency's (EPA) Office of Emergency and Remedial Response has designated four levels of chemical hazards, ranging from extremely dangerous or unknown: (Level A) to situations where only basic work-wear; (Level D) is the required protection.

The OSHA standard recommends the use of these guidelines, which can assist employers in complying with the protective equipment requirements of the standard. The following is a brief review of the EPA guidelines.

- Level A calls for a vapor-tight suit (total-encapsulating) that is non-permeable to the chemicals to which a worker will be exposed. Also necessary is an approved, positive-pressure, self-contained breathing apparatus (SCBA) or a NIOSH-approved, positive pressure air-line respirator with escape SCBA having no less than a five-minute air cylinder. Outer and inner chemical-resistant gloves and chemical-resistant boots with a steel toe and shank should also be used.
- Level B necessitates the same level of respiratory protection and complete skin coverage

as Level A. However, protective clothing does not have to be vapor tight.

- Level C calls for a full-face piece, or half-mask air-purifying respirator; splash garments used with outer and inner chemical resistant gloves; and chemical resistant boots with a steel toe and shank.
- Level D calls for basic work-wear such as long sleeve coveralls, hard-soled shoes and face shields or goggles.

a. Before any diving operation is conducted in contaminated water, a risk assessment is vital. Personal protective equipment (PPE) must be selected based on its known ability to protect workers from the specific hazards present or suspected. This applies to the diver and the topside personnel. There are four different categories of topside PPE, from the least protective (Level D) to total encapsulation (Level A). Requirements for these levels are set forth in Table 1 in this section.

b. The key variables that must be considered when selecting PPE are:
    - Identification of the hazard(s).
    - Route of potential hazard to employees, e.g., inhalation, skin absorption, ingestion and eye or skin contact.
    - The performance of PPE materials, seams, visors and all other vital components
    - Matching PPE durability of materials such as seam, tear, burst and abrasion strength to dive site-specific conditions.
    - Matching site environmental conditions to PPE effect on employees (e.g., heat stress, hypothermia, dehydration, duration of task, etc.).
    - Equipment selection (PPE). Site-specific variables must be considered and protection geared to the worst case situation if those variables are not positively identified. The more that is known about the site, the easier it will be to customize suitable PPE to ensure protection of the dive team topside members.

DIVER-WORN OR CARRIED EQUIPMENT AND ACCESSORIES

a. Selection of the diver-worn equipment must be based on the level of contamination protection required. The following equipment configurations are only recommendations. Responsibility for selection of equipment and diving technique must be made by the persons engaged in the diving activity as identified in the dive plan and/or job safety analysis.

b. Equipment that supports the diver must also be compatible with the contaminants that may be encountered.

c. There are three levels of protection for diver-worn equipment and accessories, from the most protective

d. (Level One) to the least protective (Level Three).

e. All diver-worn equipment should be tested for integrity and function prior to the diving operation.

f. WORN OR CARRIED EQUIPMENT AND ACCESSORIES LEVEL ONE (Most Protective) LEVEL TWO LEVEL THREE (Least Protective)
    - For diving in waters containing biological contamination, petroleum fuel, lubricating oils and industrial chemicals known to cause long-term health risks or death
    - Helmeted surface-supplied diver with mated non-porous dry suit with attached boots, gloves, and a return line exhaust or double exhaust valve system NOTE: The use of Level One protection should take into consideration the chemical compatibility of the equipment being used and the resultant permeation of waterborne contamination into the

equipment. (Consult manufacturer's data). Diving in waters containing strong chemicals or nuclear contamination where even minor exposure could cause a serious threat will require special consideration and planning, equipment precaution, and training

- Biological or chemical contamination that will cause short-term health effect but will not cause lasting injury, disability or death
- Surface-supplied umbilical with dry suit with attached and sealed hood, gloves and boots
- Full-face mask that overlays the dry suit hood face seal
- Recommended for diving in waters that are considered to pose a minimal health risk • Scuba/surface-supplied umbilical with half-mask or full mask, chafing overalls, and hand and foot protection Any actual or suspected breach of a Level One diving system is cause for the immediate termination of diving operations.

DECONTAMINATION PROCEDURES

In certain highly contaminated diving situations, the following procedures may be applied but are not necessarily applicable for every job:

a. The area surrounding the diving control station may be divided into three zones for proper isolation of contamination. The zone immediately surrounding the point of water entry/exit is deemed "high contamination." The zone where divers and gear progress after initial decontamination is termed "low contamination." The final zone into which the divers progress after they have been decontaminated and all diving gear removed is "clean."
b. An effective color-coding system may be employed to communicate clearly the demarcation point of the decontamination area. One system might be to use red to identify all "high" areas, yellow for "low" areas and green for "clean" areas. If at all feasible, the "clean" zone should be positioned up-wind of the contaminated zones.
c. Initial freshwater rinse: Spray off bulk of contaminants using high-pressure, clear freshwater rinse. If effluent does not require capture, begin hosing diver as he or she initially exits water to limit quantity of contaminants transferred to the dive station.
    - Take precautions to direct water flow away from potential points of leakage of diver's rig, such as exhaust valves, seal junctions, etc. A high-pressure jet of water directed at such potential breach points may inject contaminants inside of the protective gear and into contact with the diver. Care should be taken to ensure the removal of the bulk of contaminants at this stage in order to afford the greatest efficacy of subsequent decontamination steps.
d. Oversuit: If a reasonable expectation exists for encountering bulky, adherent contaminants in the course of a dive, the use of a disposable oversuit is strongly encouraged. Disposable, hazardous material protective suits may be secured to a diver after he or she has been outfitted with the entire diving rig.
    - No effort to make the oversuit water-tight should be attempted. Such action could complicate the dive by creating air pockets that could affect buoyancy of the diver. As the diver arrives on the dive station, the oversuit should be cut away to allow for decontamination of the diver and equipment. At this time, removal of dive gear such as harnesses, weight belts, emergency gas supply (bailout) tanks, etc., should be performed with these items themselves being properly decontaminated.
e. Scrub down: After the diver has been initially rinsed and his or her equipment removed, he or she may be scrubbed with a stiff bristle synthetic brush and a cleaning solution as applicable. Long-handled brushes may facilitate the cleaning process. Hand-held brushes may be

employed for detailed cleaning of the dive helmet and the neck-dam interface.

- Once the diver has been thoroughly scrubbed with cleaning solution applied from head to toe, he or she should be rinsed with fresh water. Care should be taken to ensure the diver has been cleaned of all visible contamination, most notably in the area adjacent to the neck-dam, helmet and dry suit.
- The composition of the cleaning solution should be appropriate for the contaminant to be removed.

f. Undress diver: Once the diver has been adequately decontaminated and moved into the "low contamination" zone, the dive gear should be removed. First, disconnect the locking mechanism from the helmet to dry suit and remove the helmet. Then, remove the dry suit and gloves and finally, the undergarments.
   - If there are no indications that the diving rig has been breached during the dive, the diver may proceed to the "clean" zone and, if applicable, take a post-dive shower.
   - If there are positive indications of dermal exposure to contaminants, additional decontamination measures may be required.

g. Clean equipment: After removal from the diver, all equipment should undergo secondary decontamination.

h. Capture effluent: In some circumstances it will be necessary to capture all fluids used to rinse, wash and re-rinse the diver and equipment and dispose of them in a manner appropriate for hazardous materials. If necessary, the above procedures will need to be altered to ensure that all decontamination procedures take place within a water-impermeable capturing area.

HAZARD EVALUATION AND IDENTIFICATION

a. When the threat of a chemical hazard is suspected, consider conducting a historical review of the site. Items such as spill history, known chemicals present, volume of chemicals, active discharges, air quality, present and past nature of operations, and presence of extremely hazardous substances should be examined. Facility safety officers, plant supervisors or technicians may provide useful information.

b. When planning contaminated water diving operations, water temperature needs to be considered when determining the proper equipment to be used.

c. Check with local, state or federal water quality agencies for current advisories on biotoxins, waterborne pathogens, microbial contamination, fish or shellfish advisories, beach closures or storm events, any of which may indicate pollutants to be present.

d. When hazardous contaminants are suspected, consider water or sediment sampling and analysis. The selected laboratory can provide proper containers and procedures for sample collection, handling and shipping.

e. If the pollutants have been identified, rapid on-site test kits for selected chemicals in sediment or water are, in some cases, available. If severe contamination is known to be present at the planned site of diving operations, consideration should be given to using an ROV if possible.

f. Hand-held detectors for monitoring a class of airborne chemicals, such as volatile organics, can be utilized for:
   - Initial entry into the staging area during mobilization if the air quality is unknown.
   - Continuous monitoring with alarms during diving operations to rapidly notify the participants if air quality changes.
   - Scanning the diver upon water exit and after decontamination to determine if

contaminants are present.

g. Lists of very dangerous chemicals that may readily penetrate diving equipment or cause substantial harm after a brief exposure can be obtained from the suit manufacturer. If a diver or topside crew member suspects exposure, blood, urine or other biological samples may be gathered for medical review

5.17 Underwater Excavation Operations Guidelines

The purpose of this section is to identify potential hazards and recommend safety precautions when conducting underwater operations below the mud line (deep ditch). This recommended procedure is applicable for all sectors of the commercial diving community, both inland and offshore.

FACTORS TO CONSIDER

1. When performing a variety of tasks, divers are often required to excavate areas or enter excavated areas.
2. Hand-jetting and airlifting material from the natural bottom can pose a threat of burial.
3. Extra precautions should be taken through the performance of pre-dive safety assessments.
4. Variations in bottom conditions can cause changes in stability, which might warrant a more conservative approach to operations than the outlined recommendations of this document. No standard can cover all potentialities that might be encountered. JHAs, common sense and extra attention to detail by the entire dive team are to be considered essential components for approaching operations of this nature. JHAs should be updated as work progresses to reflect the current conditions.

DEFINITIONS

Ditch: An excavation area/trench/channel created to gain access to the working area.
Deep ditch: Any excavation or channel that is deeper than 6 feet (2 meters) from natural bottom (top of the subsurface ditch) to the bottom of the subsurface ditch. Natural bottom: Depth of the seabed prior to any excavation.

RESPONSIBILITY

The dive supervisor is responsible for the welfare and safety of the dive team. The diver is responsible for ensuring that he or she is performing the assigned tasks in a safe and responsible manner.

POTENTIAL HAZARDS ASSOCIATED WITH DEEP-DITCH OPERATIONS

1. Ditch wall collapses and traps the diver and/or his or her umbilical.
2. Unintentional creation of a tunnel by the diver while hand-jetting.
3. Malfunction of jet nozzle or other component of hand-jetting tool.
4. Injury to diver or his or her equipment due to jet hose or water directed from the hand-jet.
5. Injury to topside personnel due to component malfunction of hand-jetting equipment.
6. Injury to diver or damage to his or her equipment due to airlift suction.

RECOMMENDED WAYS TO MITIGATE POTENTIAL HAZARDS ASSOCIATED WITH DEEP-DITCH OPERATIONS

1. Situational awareness on the part of the diver and topside personnel: The diver should always inspect the condition of the ditch wall prior to beginning or resuming work.
   a. Hose management/regular communication.
   b. Diver should routinely ensure that an adequate slope to depth ratio be established and maintained. At a minimum, it is recommended that for every 1 foot/meter excavated downward, 3 feet/meter need to be excavated in an outward direction (3:1 ratio).
2. Periodic and regular physical checks need to be made by the diver on his or her exact location. The diver should periodically remove himself or herself from the ditch and return to natural bottom to assess any potential hazards to him or herself, his or her umbilical, or hand-jet equipment. There are no guarantees that equipment malfunctions will not occur during the course of operations. Routine pre-dive and post-dive checks of all equipment and systems are the best ways to guard against malfunction.
3. The diver should always ensure that he or she is capable of handling the force of pressure being emitted from the jet nozzle. Proper balance, footing and positioning of the diver is the best way to ensure that back or frontal spray from the jet nozzle does not injure the diver or damage his or her equipment. Sending gas to the diver's pneumo and partially activating the diver's "free flow" are other recommended practices while conducting deep-ditch operations.

MINIMUM PERSONNEL REQUIREMENTS FOR DEEP-DITCH OPERATIONS

On all deep-ditch operations, a minimum of five crew members are required, consisting of:

- One (1) Dive Supervisor
- One (1) diver
- One (1) standby diver
- Two (2) diver/tenders

(The stand-by diver's equipment and thermal protection shall be dressed/outfitted to at least equal that of the diver.)

MINIMUM EQUIPMENT REQUIREMENTS FOR DEEP-DITCH OPERATIONS

Redundant jetting equipment and a greater length of jet hose shall be present at the dive site. In addition, the redundant jetting equipment shall be primed and running at an idle pressure at all times that the primary system is in use. **NOTE**: Deep-Ditch Operations are considered construction work. A helmet that totally surrounds the diver's head is the only acceptable form of head gear for personnel working in this type of setting.

PERSONNEL QUALIFICATIONS

All members of the dive team should be trained and experienced for the tasks to be performed. In the case of deep-ditch operations, underwater personnel should be properly screened to ensure that they understand the scope of work to be performed, the potential hazards involved, and the procedures for rescuing a trapped or injured diver.

HAND JETTING ON PIPELINES – PIPE MOVEMENT
NOTE: Hand jetting on a live pipeline requires several factors to be considered, such as the contents of the pipeline, external and environmental factors, as well as the age, condition and diameter of the pipeline.

The following guidelines are based on CFR 49 Transportation of Hazardous Liquids by Pipeline Subpart F – Operation and Maintenance. (See below)

Pipe Movement

a) No operator may move any line pipe unless the pressure in the line section involved is reduced to not more than 50 percent of the maximum operating pressure. Hand jetting to expose a live pipeline does not require a reduction in pressure.
b) No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are joined by welding unless: (1) Movement when the pipeline does not contain highly volatile liquids is impractical; (2) The procedures of the operator under §195.402 contain precautions to protect the public against the hazard in moving pipelines containing highly volatile liquids, including the use of warnings, where necessary, to evacuate the area close to the pipeline; and (3) The pressure in that line section is reduced to the lower of the following:
    i. Fifty percent or less of the maximum operating pressure; or
    ii. The lowest practical level that will maintain the highly volatile liquid in a liquid state with continuous flow, but not less than 50 psi. (345 kPa) gage above the vapor pressure of the commodity.
c) No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are not joined by welding unless:
    1) The operator complies with paragraphs b) (1) and (2) of this section; and
    2) That line section is isolated to prevent the flow of highly volatile liquid.

Both operator and contractor should perform a thorough risk assessment analysis, ensuring that all of the above requirements are met and that there are no other external conditions which could compromise adherence of this Code of Federal Regulation. It is not recommended that live pipelines be moved in an upward direction (lifted).

5.18 High-Pressure Water Blasting

INTRODUCTION
High-pressure water jets are employed in a variety of ways to accomplish cleaning and cutting tasks underwater. These units typically operate at pressures of 1,000 to 40,000 psig and higher. Water blasters are dangerous and can cause serious injuries. Recommended practices and procedures do not replace the proper training necessary to operate high-pressure water blasting systems. Injuries caused by water blasters are highly susceptible to infection and should be given immediate treatment. Anyone who suffers an injection should immediately stop working, report to their supervisor and seek medical advice on treatment.

GENERAL

- Personnel assigned to water blasting operations, particularly diving personnel, should be trained by qualified personnel and properly demonstrate their knowledge and ability to perform a task prior to being required to do so.
- Serious harm and injury may result from the misuse of water-blasting equipment and from the use of improperly selected fittings, hoses or attachments. All components of the system should be checked against the manufacturer's instructions to ensure that they are compatible and of the correct thread size and pressure rating for the intended service.
- All dive team members (divers, tenders and supervisors) should be familiar with the equipment intended for use and with the hazards associated with their operation.
- Prior to operation, all equipment should be inspected for damage and deterioration, with particular attention paid to high pressure hoses, fittings and gun trigger function.
- Prior to use in diving operations, the water-blasting equipment should be fully assembled and functionally tested, including emergency shutdown or dump valve operation.

PLANNING AHEAD FOR WATER BLASTER SAFETY

- Be a good observer. Look out for yourself and others. Review what to look for and act on what you see. Use your Stop Work Authority.
- JHA: Unsafe work conditions and unsafe behavior are the main reasons for injuries and accidents. Identify and minimize risk, and assign responsibilities to produce a safe working environment.
- Stop Work Authority: Every worker has the responsibility to stop an unsafe act or task. Shut down the operation and reassess the potential problem. Revise your JHA and resume safe operations.
- Report all incidents: Properly report all incidents, document the event, and obtain medical care if needed. Reporting incidents, no matter how minor, is the key to injury prevention.

POTENTIAL HAZARDS

- The safety point for water blasters is the rupture disc. Do not use coins to replace the disc. There are reasons that cause discs to rupture (wrong tip or blockage).
- Using the wrong tips in the underwater gun will rupture the disc or lower discharge pressure.
- Diver inadvertently directs the front pressure stream onto himself or herself, his or her umbilical, or equipment.
- The baffle tube comes loose from the control valve block and exposes the retro nozzle assembly. Unaware of the situation, the diver continues blasting and inadvertently directs the stream from the exposed retro nozzle onto him or her.
- A hose or fitting failure allows leaking pressure stream to contact and injure topside personnel or diver.
- Topside personnel inadvertently direct the front or retro pressure stream onto themselves or others when preparing, testing or using the system.
- Airborne debris created when using the water blaster topside causes persons in the area to have particles carried by mist into their eyes.
- Topside personnel strain their backs while handing hose.
- Water supply to the pump is used up, shut off or blocked, and the pump overheats and damages occur. (The water cools and lubricates the pump machinery and, if the pump is

operated dry, it will quickly heat up and seize.)
- Tools or items of equipment fall or are dropped and cause injury to personnel or damage to the pump.

PRIOR TO COMMENCEMENT OF UNDERWATER WATER BLASTING OPERATIONS
A survey of the underwater site should be undertaken to identify potential hazards. A job hazard analysis should be done or reviewed by the dive team. The job hazard analysis should include, but not be limited to, the following provisions:
- Tending of the diver's umbilical and the high-pressure water hose during water blasting operations.
- System to be pressurized only on request from the diver.
- Ability to quickly shut down pressure to the gun.
- System pressure is shut down prior to the diver leaving the worksite.
- A thorough risk assessment analysis must be conducted if more than one diver is performing high pressure water blasting operations at the same time. Safe distance and other considerations must be provided to each diver and their applicable equipment.
- Due to the high noise levels generated, commands and signals should be agreed to and reviewed between the diver and topside.
- Ear protection for the diver is necessary. Limit diver exposure time due to the noise hazard.
- Trigger mechanism shall be of a dead-man type and shall not be tied back or wedged in the flow or "open" position under any circumstances.
- Careful check of the retro jet nozzle guard, as this could present a hazard to the diver and his or her hose if it is not properly guarded and diffused.
- Nozzle selection should be appropriate for the work intended (the smaller angle of rifle barrel nozzle being the most dangerous due to its cutting ability).
- The ADCI recommends against the miss-matching of high-pressure hoses, water blast guns and any high-pressure connections between different company units

6. SCUBA Diving
Caldwell Marine International does not conduct SCUBA diving operations.

7. Live Boating
7.1 Limits
Live Boating is a diving technique where a single surface-supplied diver performs work underwater while his hose is being tended from the bow of a vessel which is manually operated by the vessel master and underway using its main propulsion system.

ADDITIONAL CONSIDERATIONS
Due to the inherent risks of live boating operations, all other means of diving operations should be considered if possible.

If live boating has been determined to be the method of diving to be executed, these additional considerations should be considered to ensure safe operations:
- Performance of a thorough risk assessment

- Performance of drills for diver recovery, loss of breathing media to diver, and to test the vessel's emergency shutdown device
- Depending on the vessel, shaft rotation indicators, propeller guards, and other barriers to prevent the diver and standby diver's umbilical from coming into contact with the vessel propellers should be considered for utilization
- An assessment of work to be performed, water depth, and the communications available on the vessel should factor into the manning levels of the crew
- Ensure that the dive supervisor has a clear line of sight of the diver's umbilical entering the water and diver's bubbles
- Ensure that there are direct communications between the captain, diving supervisor, standby diver, and tender

7.2 Minimum Requirements

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

If a diving operation requires a hand-held tool that is separately tended from the diver, it is highly recommended that it be performed by methods other than live boating. However, if the job can be performed only through live boating, only one surface powered tool can be used at a time.

Small umbilicals, (e.g., CP probes and pipe trackers) should be married to the diver's umbilical.

The following are minimum requirements for live boating operations:

- No live boating operation may include planned in-water decompression.
- No live boating operation shall be conducted on scuba.
- No live boating shall be performed within another vessel or barge's anchor spread.
- The maximum depth for conducting live boating operations is 130 fsw (39.6 msw).

In all cases, personnel and equipment shall be selected to ensure maximum safety during operations. On small boats/vessels of less than 33 feet (10.05 meters), it may be permissible for the crew to consist of no fewer than three persons (diving supervisor, diver and tender/diver) due to space limitations.

Live boating diving operations (0 – 130 fsw [39.6 msw]) (Vessels larger than 33 feet / 10.05 meters). The dive crew shall consist of a minimum of seven (7) diving qualified personnel.

- One (1) Dive Supervisor
- One (1) Diver
- One (1) Standby Diver
- Two (2) Tender/Divers
- Two (2) personnel that are qualified divers to assist with rescue boat operations

DIVING SUPERVISOR

Must be experienced and knowledgeable in live boating operations.

7.3 Procedures

a. Continuous and easily understandable communications will be maintained between the dive station and wheelhouse at all times.
b. The vessel master is notified before the diver enters or exits the water and the propulsion system must be disengaged.
c. The boat will be maneuvered in such a manner so as to permit the tender/diver or diving supervisor to continuously monitor the direction of the diver's umbilical with respect to the dive control station.
d. The vessel's propulsion system should be stopped before the diver enters or exits the water.
e. Live boating shall not be done:
    - In seas that impede the station-keeping ability of the vessel.
    - In other than daylight hours.
    - During periods of restricted visibility. (Restricted visibility means any condition in which vessel navigational visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.)
    - Any time existing conditions make live boating unsafe in the opinion of the vessel captain and/or supervisor.
f. A standby diver will be continuously prepared to enter the water when directed by the diving supervisor.
g. All live boating operations shall be tended from the bow, and the boat shall be operated from the wheelhouse or flying bridge.

MINIMUM EQUIPMENT

a. The vessel shall be acceptable to the diving company and the diving supervisor.
b. A "kill switch" shall be in the immediate vicinity of the operator of the boat for instantaneous shutdown of the engines.
c. For operations on dynamically positioned vessels (see DP System Section 7.4).
d. A diver-worn or carried emergency gas supply bottle shall be worn by the diver.
e. A mechanical device to prevent dive umbilical entanglement in the vessel's propulsion system.
f. During live boating operations, a third diving hose connected to the manifold shall be available for emergency use except in the case of a vessel 33 feet/10.05 meters or less.
g. A boat ready to be launched with crew in the event of an emergency (for vessels larger than 33 feet/10.5 meters).
h. A method of clear communication between the tender/diver and dive supervisor.
i. For emergency purposes; a means must be available to provide a stable platform for the diver for in-water decompression for vessels over 33'

VESSEL OPERATOR

The vessel operator must be experienced in live boating operations and familiar with the scope of underwater tasks including depth and duration of dive.

7.4 Dynamically Positioned Vessels

INTRODUCTION

These guidelines relate to and are intended to assist in the design and operation of dynamically positioned (DP) diving support vessels. Their purpose is to provide a basis from which designers, suppliers, builders, vessel owners, diving contractors, masters, diving supervisors, and charterers can develop the most suitable equipment and operating procedures for each vessel and to provide a yardstick against which the suitability of dynamically positioned vessels for diving operations can be assessed. Implementation of the guidelines will vary from vessel to vessel, and the characteristics of each vessel will affect its suitability for particular operations. Even in the short term, this may alter in the light of changes in personnel and system components. It is therefore important that these guidelines be used not only by owners in preparing vessels (or diving operations), but also by potential charterers in assessing vessels suitable for their particular needs. The general conduct of diving operations from DP vessels should follow the same principles as for other diving operations. In addition, no effort should be spared to establish DP operational reliability and ensure that the effects on the divers are minimized if the vessel does lose station. All those connected with the operation should keep this in mind at all times. Owners/operators should implement an in-house DP competency assurance process for key DP personnel which is structured, systematic and progressive. It should be noted that DPO certification is only one element in the competency assurance process. In accordance with IMO, the ADCI requires, at a minimum, vessels to be DP2.

PRINCIPLES

These guidelines are built around three main and interrelated principles that are simply stated in this section. The remaining sections contain guidance on their implementation. Though they cover many aspects of DP diving systems and operations, they are not definitive, and decisions about operations not covered should still be based on these main principles.

<u>Single-point Failures</u>

A "catastrophic failure" is defined in these guidelines as a failure that would cause risk to divers. In effect, this means that the failure would cause the vessel to move from its intended position. A fundamental principle of all DP diving vessel design and operation is that no single fault should cause a catastrophic failure. This principle immediately introduces the concept of redundancy. In doing so, it must be stressed that redundancy can be achieved in several ways (not merely by duplication).

<u>Capabilities and Limitations of DP Diving Systems</u>

Any system can operate satisfactorily provided it is not subjected to conditions that are outside its operating capabilities. A fundamental principle of DP diving vessel operation is that the operating requirements of the system are never allowed to exceed the vessel's capabilities in any respect. This principle requires that the vessel's capabilities and limitations are clearly understood and updated with experience and that indications are provided when predetermined limits are being approached.

<u>Personnel Capabilities</u>

Any equipment or system can work as intended only if it is operated correctly. The more complicated the equipment or system, the greater the demands upon personnel operating it. A fundamental principle of DP diving vessel operation is that relevant personnel should be fully capable of performing the tasks entrusted to them. This requires them to have the necessary background and experience or to have received appropriate training and guidance.

DP System

Implementation of the first principle (single-point failures) involves correct system design. In the context of these guidelines, the DP system is defined as "all equipment and components involved in retaining the vessel in its required position." The principle states that "no single fault should cause a catastrophic failure." To ensure that a DP system adheres to this principle, a failure modes and effects analysis of the main components should always be carried out. Where such an analysis indicates that a single fault could lead to a catastrophic failure, the relevant component, sub-system or its operating procedures should be redesigned to avoid or take account of the effects of the single point of failure.

Thrust Units

1. Configuration- Thrust unit installations should be designed to minimize potential interference of wash with other thrust units, sensor systems, the diving system and the divers, and the effect of hull surfaces on thrust unit efficiency within the constraint of ship design.
2. Redundancy- Thrust units and, where appropriate, rudders, should be situated to achieve fore and aft, athwart ships, and rotational thrust must be configured so that the loss of any one thrust unit always leaves sufficient thrust in each direction to ensure that the vessel holds position and heading when operating within its forecast operational capability.
3. Failure Mode- In the event of pitch, azimuth, motor speed control malfunction, or when control error becomes unacceptable, the function controlled may remain the same as it was at the time of failure, the pitch may be automatically set to zero, or the thrust unit may be automatically stopped and deselected. Under no circumstances should thrust units assume maximum thrust condition on failure.
4. Emergency Stop- Means should be available whereby any thrust unit may be stopped from any DP control without using the DP computer to generate the command. The means provided should be adequately protected against inadvertent operation.
5. Condition Monitoring- The following list indicates the main functions that, where applicable, should be monitored either by permanent remote means or by local means at frequent intervals:
    - Status (online/offline).
    - Thruster motor stator winding temperature (high only).
    - Thrust unit rpm/pitch ordered and indicated (with display or 80 percent thrust output). • Oil pressure.
    - Hydraulic power-pack status.
    - Azimuth ordered and indicated.
    - Thrust-bearing temperature.
    - Power supply loss.
    - Lube oil/hydraulic fluids — pressure/temperature/level.
    - Response to command signal deviation.

Note: Monitoring of diesel engines, where used to drive thrusters by direct drive, should be in accordance with design parameters of the system.

Power System

1. Power Factors- Power system design should, so far as possible, provide for generators to be run at power factors that effectively match the characteristics of the load.
2. Redundancy- The power source system, whether individual diesels or central electricity generation plants, should be capable of producing sufficient power to meet the vessel's operational capability subsequent to the failure of any single power unit.
3. Power Management- Arrangements should be provided to ensure that when diving operations are being carried out, non-essential loads are shed in reverse order of importance before power consumption reaches maximum available supply. Power supplies to thrusters to maintain station, as well as to the diving system, should be safeguarded. Arrangements should also be made to ensure that sufficient power is always available to enable the vessel to retain position within a predetermined accuracy in prevailing and foreseeable conditions if any one on-line power unit fails. This may mean providing for running up and bringing online additional power units as power consumption increases.
4. Essential Services- Essential services such as fuel, oil, ventilation and generator cooling should also be designed to avoid system failures stemming from failures of critical components, e.g., filters, pumps, power supplies, etc.
5. Operating Limits- Power operating limits should be specified and alarmed for diesel engines, turbines, motors and generators to avoid engine damage and power factor problems.
6. Distribution Network- Power distribution systems should be such that no single failure can prevent distribution or sufficient power to thrusters to permit the operation of the vessel within its full operational limitations.
7. Condition Monitoring- The following list indicates the main functions that, if applicable, should be monitored either by permanent remote means or by routine local means at frequent intervals:
    - Distribution Network - Circuit breaker status (auto connect/disconnect equipment). - Bus bar voltage. - User current levels. - Load-shedding trips (online and tripped). - Backup power supplies availability (emergency generator or accumulator batteries).
    - Diesel Engines - RPM. - Oil pressure/temperature. - High main bearing temperature indication. - Auto-start equipment and sequence. - Bank and individual exhaust temperature. - Oil level. - On-line fuel tank level. - Fuel pressure. - Fuel rack setting (if applicable). - Clutch status (if applicable). - Jacket water pressure and temperature. - Salt water-cooling pressure. - Change air pressure (where applicable).
    - Generator/Motors - Bearing lube oil flow and temperature. - Terminal voltage. - Current. - Stator winding temperature (high only). - Frequency (low)/speed. - Status (shutdown, standby, online).

DP Information Input Systems

1. Position Sensor Redundancy- It is recommended that at least three independent position sensors be available. These need not all work on different principles, but if similar systems are to be considered as independent, they should not be subject to common mode failures (e.g., no single factor should affect more than one system). Whenever DP diving operations are being carried out, at least three independent sensors should be deployed, connected to the DP computer(s), and in use. It is recommended that the third sensor, if

not online, should be ready for immediate use as a backup. To aid the correct use of sensors in particular circumstances, manufacturers must provide information about the performance and operational limitations of any position reference sensors supplied for use by DP diving support vessels.

2. Vertical Reference Units/Systems- Two vertical reference units/vertical reference systems should be operating whenever DP diving operations are being carried out and position reference sensors requiring their input are in use. At least one of them should be online.
3. Wind Sensors- Care should be taken in the placement of the wind sensors to minimize the effect of turbulence from superstructures. The effect of helicopter downdraft, though normally limited, should be borne in mind. Two wind sensors should be installed in physically separated positions to take account of failures and false readings resulting from external factors. In some circumstances where interference is unavoidable, the inaccuracies caused by switching off wind sensors may be less than those caused by their false information.
4. Heading Reference Sensors- Two independent heading reference sensors (e.g., gyrocompass) should be running with either both online or one online and one available as immediate back up during DP diving operations. Automatic or manual selection of the on-line compass may be provided.
5. Reliability- Sensors should be designed and proven for continuous reliability in the exposed positions in which they operate.
6. Condition Monitoring- Monitoring of DP information input systems should include:
   - Facilities for regular full-function checks.
   - Alarms for transducer or circuitry failures.
   - Detection of data deviation or corruption.
   - Alarm for power supply loss.
7. Position Data Processing Data from all position sensors should be automatically processed (not manually selected):
   - To reject spurious data.
   - To stabilize output in the event of failure.
   - To select preferred data.
   - To alarm if system develops bad geometry or signal loss occurs.
   - To permit a smooth changeover between systems.
   - To monitor the sensor status.

COMPUTER/CONTROL SYSTEM

1. Purpose- The primary purpose of the DP control system computer is to calculate and order the necessary thrust unit operations required to maintain a vessel in its chosen position. Though it is possible to use the computer for many ancillary functions (e.g., data processing and presentation, power management, etc.), care should be taken to ensure that these cannot prejudice its proper operation in its primary role.
2. Control System Redundancy- There should be at least one backup method of controlling the vessel's thrust units in order to retain position in the event of a failure of the online control system. A second automatic control system can best fulfill this role. If a second automatic system is not fitted, then a joystick control system would be an acceptable backup, provided:

- It affords manual control of fore and aft, athwartships and rotational thrust with automatic control of heading.
- The joystick control lever is situated in the DP control area and located in such a position that the operator has a clear view of the vessel and everything in its vicinity.
- The joystick control system and its power supply are independent of the failed automatic control unit, but provision is made to ensure smooth continuity of thrust unit operation on failure of the automatic control unit.
- Data from a gyrocompass are input directly to the joystick control system.
- A simple display of vessel position relative to its required position is provided independent of the failed unit, but with the means to ensure its correct alignment with the failed unit at the time of failure.
- It is used only to maintain position for short periods of time, e.g., to recover divers in an emergency. It is recommended that the automatic control system(s) incorporate a joystick facility to assist in maneuvering the vessel onto location.

3. Power Supplies- Provision should he made to ensure that power supplies to computer(s)/controller(s) are safeguarded at all times. This could involve provision of duplicated conversion machinery and a backup battery supply. Batteries should have sufficient capacity to maintain the necessary supplies for at least 30 minutes, and a warning of batteries not being fully charged should be provided.
4. Services Redundancy- Where possible, the design should ensure that services are duplicated and are so divided that if local ventilation and cooling fail, or fire or flooding occurs, sufficient services are retained to enable the divers to be recovered safely.
5. DP Console Location- The DP console should be situated so that the DP operator can observe DP controls, see outside the vessel and be aware of deck operations and the vessel's relationship to surface structures, etc.
6. Monitoring Information- Overall monitoring information should be displayed or made available for call-up in a manner that avoids information overload on the DP operator. Data should be displayed in the simplest manner for easy assimilation. The following information should be available to assist in monitoring overall DP performance:
   - Thrust unit configuration and rpm or pitch levels ordered and indicated (with display of 80 percent thrust).
   - Consumed online power as percentage of total of available (with special indications at 80 percent).
   - Available thrust units on standby.
   - Position sensor status and validity.
   - DP system status and validity.
   - Vessel's target and indicated position.
   - Vessel's target and indicated heading.
   - Alert-level status (manually operated).
   - Limited history event recording system. This should provide an automatic record of changes in the main parameters concerned with the vessel's performance, such as:
   - Wind speed and direction.
   - Position and heading errors.
   - Position reference sensor availability and use.
   - Thrust unit availability and use.
   - Power unit availability and use.

- Computer availability and use.

COMMUNICATION SYSTEMS

1. Internal Voice Communications As a minimum requirement, voice communications should be available to ensure the immediate and clear transfer of information between all responsible parties. As a minimum requirement, direct communications should be provided between DP console and dive control; dive control bell and diver; dive control and life support control; dive control and bell handling control; dive control, DP console and ship's derrick or crane; DP console and master's cabin; dive control, DP console and senior diving supervisor's cabin; and DP console and engine (control) room. All essential voice communications systems should be provided with 100 redundancy where practicable, either through duplication or provision of an alternative system. Terminals should be situated close to the normal operating positions of personnel for whom they are provided. Primary systems should provide clear voice reproduction and should not detract from users' abilities to perform their main functions.
2. DP Alert System A system of lights shall be provided in the saturation control room, air or mixed-gas diving control area, working deck and, where applicable, the ROV or submersible control position manually activated from and repeated in the DP control room. The following lights should be used:
   - Steady green light to indicate vessel under automatic DP control, normal operational status and confirming the alert system is functional.
   - Flashing yellow light to indicate degraded DP operating alert.
   - Flashing red light to indicate DP emergency.
   - A distinctive alarm should sound in the saturation control room, air or mixed-gas diving area, master's cabin, operations superintendent's cabin (if applicable), and senior diving supervisor's cabin in conjunction with the flashing red light. Provision of a means of cancelling the audio and flashing functions of the signals from the receiving positions when they have been noted should be made.

MAINTENANCE OF EQUIPMENT

Proper maintenance of equipment is essential to its correct performance. Clear instructions about the type and frequency of maintenance required by all components of DP systems should be compiled by vessel owners with the aid of manufacturers and suppliers. These should be issued to vessels together with a system to monitor their correct implementation.

CAPABILITIES AND LIMITATIONS

Vessel's Operational Capability- The maximum continuous operational station-keeping capabilities for DP diving should be forecast for each DP diving support vessel. They should be expressed in terms of direction and magnitude of wind, associated wave drift force and current combinations. They should be defined as "those environmental conditions in which the vessel could maintain chosen position and heading to a satisfactory confidence level with any single-thrust or power unit failed and with power available for the foreseeable diving requirements and the vessel's essential services." Capability plots or envelopes of these maximum tolerable environmental forces and their relative heading should be produced to assist in defining this information. These should include a statement of the position and heading tolerances, as well as the corresponding confidence levels associated with the capability plots. It should be clearly appreciated that they are only a guide to a vessel's position-keeping capabilities and an indication of those capabilities under certain conditions. Capability plots should be based initially on vessel design information but should be modified in the light of practical experience. Care should be taken that such modifications are properly reviewed and authorized by the vessel's owner. Detailed explanations of the assumptions made in producing these plots should be provided.

For example, the power consumption of the diving system and emergency domestic load, the definition of wind speed and thrust output, the assumed wave drift and current conditions, and details of the means to identify the position-keeping tolerance and corresponding confidence levels should be included. It should be noted that the requirement to hold station and heading within operational limits with any single-thrust or power unit failed assumes a "worst case" failure. Therefore, in determining the operational limit "envelope," the chosen "worst case" thrust unit will probably vary depending on the relative direction of environmental forces. This should be taken into account. When determining the vessel's position-holding capability, consideration should also be given to any interactions between thrust units, hull and relative water movement. To simplify the calculation/presentation task, it is proposed that the current force be based on a one-knot current running in the same direction as the chosen wind and wave forces and that the number of "directions" chosen for these coincident forces may be limited to 30û increments

Degraded Operational Capability

The principle of ensuring that no single fault can cause a catastrophic failure allows the vessel to be operated with confidence within its designed operational limitations. If the operational capability is degraded, the operation of the vessel should reflect the new status. There is one principal source of degradation of operational capability, namely loss of redundancy of a subsystem.

Positioning Accuracy

The positioning accuracy of a DP vessel is subject to several sources of error that can act cumulatively. A forecast of the position and heading tolerances and the corresponding confidence levels should be included with capability plots and should be taken into account when planning operations close to other vessel installations. Excursions around the intended position, even if causing no worse problems, tend to swing the bell in a manner that, if it becomes excessive, may be dangerous. With surface-supplied air or mixed-gas diving operations, excessive excursions of the vessel could cause hazard to the diver. Reduction to the minimum achievable level should be a matter of priority both on setting up on DP and, if necessary, in the course of DP operations.

Operating Procedures

The objective of all operations should be to ensure that a vessel operates effectively and safely. To achieve this, using the design principles already stated, carefully prepared operating procedures should be adopted. These should themselves be based on three main principles:

- Systems are checked on installation and after relevant modification, before starting new charters, and immediately before and periodically during use.
- Operational capability is matched by operational status.

- The procedures adopted should take account of the limitations of the system.
- These principles lead to several outline operating procedures, which are explained below.

1. DP Proving Trials- All the precautions and procedures described herein will be to no avail if the DP system includes uncorrected faults remaining after its original construction. Before a DP diving vessel undertakes DP diving operations after construction or any relevant modification, it should undergo a full series of trials. These should include testing and tuning in harbor, followed by sea trials, during which the vessel's position-keeping system should be thoroughly tested under normal and breakdown conditions, and should culminate in a DP bell dive. It is stressed that commissioning of systems, piece by piece, cannot replace the need for thorough testing of the total system under working conditions. It is likely that such trials, if properly conducted, would take several days. Where possible, they should be performed partly in a situation where accurate monitoring of the vessel's position can be achieved and partly in open water under realistic environmental conditions. The results of these trials should be used to confirm or refine the vessel's performance capability statements.
   As an indication of appropriate DP proving trials, checks of the following could be made:
   - In Harbor - Correct fitting and mounting of all equipment and cabling. - Correct wiring of all power supplies, data cabling and equipment. - Correct functioning of all equipment (including data input systems, computers, interfacing equipment, thruster units and power supplies) by electronic and functional testing.
     - Effective shielding of all potential sources of electrical interference (including those that may be used only intermittently)
     - Software checks and tuning.
     - Correct functioning of all condition monitoring systems and alarms.
   - At Sea - Correct functioning of all data input systems.
     - Correct functioning of computers and interfacing.
     - Correct functioning of power management systems.
     - Correct functioning of thrust units, including response times.
     - Optimum position-keeping performance by fine-tuning of software.
     - Ensure position-keeping accuracy using independent means.
     - Correct functioning of all automatic and manual change-over arrangements and procedures from primary to backup systems.
     - Correct functioning of offset and heading change control.
     - Satisfactory operation of DP system, with bell running and then with divers in water.
     - Position-keeping per ordinance in rough weather.

     It is stressed that this list is not definitive but is included as an indication of the type of testing required.
2. New Charter- Assessments In fulfilling their responsibilities under national regulations, diving contractors and field operators whose operations involve the use of DP diving vessels should, before they permit DP diving operations to be carried out, satisfy themselves about the vessel's suitability for the operations planned. This could involve a thorough assessment of a vessel's DP arrangements in line with these guidelines, including a study of relevant documentation, such as operations manual, FMEA report, capability plot and any other form of DP system assessment available together with summaries of the experience of personnel involved with DP operations based on their

operators logs. It should also include a short sea trial during which the actual capability of the vessel and crew to support DP diving in both primary and breakdown conditions is assessed. Such trials could, if the vessel is satisfactory, be completed in eight to 10 hours.

3. Operating Checks- A program of functional checks designed to test the operation of a DP system, including the selection and operation of backup systems, should be performed whenever setting up on DP. For example, these could include (but are not limited to) simulation of failures of online components such as a DP computer, a position reference sensor, a gyro, a generator, or a thrust unit. They could also include commanding offsets in both direction and heading. In addition to the successful completion of these checks, the vessel should have held station automatically within the defined degree of accuracy until the master and senior diving supervisor are confident that the system is reliably set up before diving operations are permitted to start. This may take at least 30 minutes. Repositioning of a vessel under DP control would not require a repeat of this check period. It is recommended that some or all these checks be repeated periodically while on DP, but when diving is not being carried out and position keeping is not crucial. By doing so, the continued correct functioning of the system can be checked while the readiness of operators to deal with emergencies is enhanced. Instructions for the performance of these checks should be prepared and written by the vessel owner with the assistance of the DP system manufacturer and could be produced in the form of a checklist in a card or folder for ease of use. A more comprehensive arrangement could be provided by a purpose-built simulator.
4. DP Alerts- When diving on DP, a clear system to indicate and guide responses to operational capability is important. This system should be based on a minimal number of standard operating status levels representing the capability of the DP system to retain the vessel on station within safe limits. It is recommended that these levels should represent the following conditions:
    - Normal Operational Status (Green Light) The vessel can be defined as in normal operational status when all the following conditions apply: - The vessel is under DP control, and the DP system is operating normally with appropriate backup systems available. - Thruster outputs and total power consumption (where applicable) do not exceed 80 percent of maximum thrust and total available power, respectively, for more than brief and isolated periods. - Vessel's indicated position and heading is within predetermined limits for all but brief and isolated periods. These limits should he determined for each location. - No risk of collision exists.
    - Degraded Operational Status (Yellow Alert) The vessel can be defined as being in degraded operational status when any of the following conditions applies: - There is a failure in a sub-system, leaving the DP system in an operational state (possibly after reconfiguration) but with no suitable backup available so that an additional fault occurrence could result in DP system breakdown and assumption of emergency status. - Available power units are reduced to the extent that failure of one more could prevent the vessel holding position or heading in existing or foreseeable conditions. - Available thrust units are reduced to the extent that failure of one more could prevent the vessel holding position or heading in existing and foreseeable conditions. - With all available thrust and power units online, any thrust unit output exceeds 80 percent of its maximum thrust, or total power consumption exceeds 80 percent of total available power for more than brief and isolated periods. Vessel's indicated position

deviates beyond predetermined limits for more than brief and isolated periods. - Risk of collision exists. - Weather conditions are judged to be becoming unsuitable for DP diving.
    - Emergency Status (Red Alert) A vessel can be defined as in emergency status if either of the following conditions applies: - System failure results in inability to maintain positioning or heading control. - Any external condition exists, including imminent collision, which prevents the vessel from maintaining position.
5. Alert Level Responses- The following responses could be made to different alert levels. Visual and audible signals should be manually initiated by the DP operator.
    - Normal Operational Status (Green Light) Full DP diving operations can be undertaken.
    - Degraded Operational Status (Yellow Alert) The master and senior diving supervisor should be informed. The diving supervisor should be informed. The diving supervisor should order the diver(s) to return immediately to the bell and obtain a seal. A decision should be taken by the senior diving supervisor, in conjunction with the master, in the light of prevailing conditions and any possible mitigating actions available, whether to abort the dive or, where surface-supplied diving is being conducted, prepare to return to the surface. Under this condition, air or mixed-gas divers should be ordered to return to the surface.
    - Emergency Status (Red Alert) The diver(s) should be ordered immediately to return to the bell and obtain a seal. The diving supervisor should order the bell to be recovered as soon as possible after consideration of hazards involved in doing so (e.g., fouling of anchor wires, jacket members, etc.) or, where surface-supplied diving is being conducted, prepare to return to the surface. The DP operator should use all means available to maintain the vessel in position until the divers are sealed in the bell and the bell is clear of obstructions. The diving supervisor and master should be verbally informed as soon as possible. Under this condition, air or mixed-gas divers should be ordered to return to the surface.
6. Communications- Communications between the dive control position and the DP console should be regular and frequent. Each watch-keeper should inform the other about any change in operational circumstances that occurs or that is planned. The following list gives an indication of the type of information that should be passed:
    - Dive Control to DP Operator
        - Bell status.
        - Diver status.
        - Intention to use water jetting or other underwater equipment.
        - Possibility of divers, bell equipment, etc., blanking or moving acoustic reference signals.
        - Any situation that could develop into an emergency.
    - DP Operations to Dive Control
        - Intention to move vessel.
        - Any change in operational status
        - Background information on causes of changes in operational status.
        - Any forecast or actual significant changes in weather.
        - Ship and helicopter movements in the vicinity.
        - Intention to handle down-lines of any description, including repositioning taut

wire weight.
   - Intent to bring small boats alongside.
   - Intent to place anything into the water.

The following list indicates the type of information needed by the DP operator about activities in the vessel:

- Intention to perform and notification of completion of any electrical or mechanical system maintenance or modification that could directly affect online DP equipment or make standby equipment unavailable.
- Intention to start and stop ancillary air/hydraulic units that may reduce pressure on DP or diving-associated equipment.
- Intention to start and stop pumping of bilges, discharge of sewage, galley waste, etc.
- Intention to start and stop the use of radio and radar equipment that may affect the DP system.
- Intention to handle equipment that may affect the trim of the vessel.
- Imminent arrival or departure of helicopter or vessel alongside.

The following list indicates the type of information that should he passed between the DP operator and the platform:

- Platform to DP Operator
  - Planned movements of vessels and helicopters.
  - Planned crane lifts or outside platform work that could interfere with the diving operation, beacon or transponder sites.
  - Intention to discharge mud, galley waste, etc.
  - Planned blackouts in communications or power and hazardous operations (e.g., well-tests).
  - Weather information.
  - Other subset operations.
- Taut Wire Systems
  - Regular inspection and maintenance of the wire should be carried out. It should also be cut back and re-secured to the weight frequently to ensure that wear does not become excessive at either the weight or the sheave.
  - Care should be taken in the choice of its position in the vessel to minimize the mechanical limitations of the system. This is particularly important in higher sea states due to the movement of the vessel. It should also be situated as far as practicable from the moon pool or other diving position.
  - Care should be taken to ensure that the taut wire does not lift off the bottom or, if it does, that an indication of it having done so is given automatically to the DP operator. Measures should be taken to prevent danger to divers if the taut wire is moved and to avoid interference with the taut wire by divers.
  - The taut wire should be lowered to a position as far as possible from subsea pipelines, flow lines or cables, any of which may move. The mechanical limitations to the angle at which the taut wire can effectively operate introduce a limit to the distance from the intended position to which a vessel may deviate. This is of particular importance in shallow water.
- Short-Range Radio Systems

- Vessel operators should be aware of the possibility of temporary loss of information (e.g., due to blanking by other vessels, helicopters, platform equipment, or occasionally rain squalls), and action should be taken to avoid or minimize the effects of this.
- Remote beacons or transponders mounted on manned production platforms are vulnerable to manual interference. Steps should be taken to ensure that they are not tampered with or "blanked off" and that their power supplies are not interrupted. This could include providing battery backup, connection to the platform's essential service supplies, and placement in accessible positions in accessible positions. A warning signal should indicate that the main power supply has been cut and the system is working on batteries. The owner of the platform should be responsible for the security of equipment located on the platform.
- Where possible, alterative frequencies or codes should be prepared to cover the possibility of interference but should be allocated with care.
- The vessel's position and resulting reference station geometry should be carefully considered whenever a move is contemplated.
- Interference from radar can cause temporary signal failure or error.

7. Down-line Handling and Interference with DP Sensors- The handling of all down-lines from DP ships requires special care in the following respects:
    - Taut Wire Errors- Long, horizontally slung objects that can pivot when suspended in the water can and have come into contact with taut wires that are providing positioning information. Care should be exercised to avoid this.
    - Snagging of Divers- Any down-line can snag a diver. Down-lines should be handled only by people experienced in doing so and under supervision of the diving supervisor, if necessary, via the bridge. This is particularly relevant when the vessel is being moved.
    - Moving Acoustic Beacons or Transponders- Acoustic devices should be moved only by divers under the supervision of the diving supervisor and on the direct authority of the master, who should be continuously advised of their movement.
    - Down-lines- Down-lines should be made up to include a breaking section to reduce the chances of injury to divers.
8. Uncontrolled Movement- The conduct of diving operations from DP vessels, as opposed to other types, requires particular attention to the risk to divers due to vessel movement. The effect of the vessel moving off station can cause failure of main lift wires, life-support and/or communication arrangements between the vessel and bell, vessel and diver(s), or bell and diver(s). Operating and emergency procedures should be established to minimize the risks, and adequate arrangements should be made for the provision of emergency life-support, communications, and relocation devices to allow a successful recovery. The bell or divers should always be positioned with care, and whenever possible, above the level of potential obstructions. The possibility of releasing the tension on the winch wire, umbilical, and clump weight wire, while the bell is deployed, should be considered to avoid dragging it if position is lost. Generally, divers should not enter confined spaces when diving from DP vessels. However, in special circumstances and with due regard to the provision of particular means to ensure their safety in case of DP failure, such operations may be permitted.
9. Operations Plot and Emergency Plans- A plot displaying the relative positions of the vessel, the bell, divers, the worksite and any known obstruction (e.g., platform, other

vessels, mooring wires, wellheads, etc.) together with ship's heading and wind direction and speed should be maintained at all times at the DP control position. The DP watch-keepers should ensure that this plot is always kept up-to-date and that planned emergency procedures have been approved by the diving supervisor to provide for the action to be taken in case of DP or other emergency. These plans should be produced in advance of any diving operations and be reviewed and modified as appropriate.

10. Vessel Movement Limitations- When the bell is launched or divers are deployed, DP diving vessels should be moved only with the full knowledge and consent of those concerned (in particular the divers) under very restricted and controlled circumstances, as follows:
    - Under automatic DP control.
    - Generally, the vessel should not be moved while divers are in the water. However, in special circumstances and with due regard to hazardous obstructions, the master, with the agreement of the diving supervisor, should be able to authorize limited vessel movements with the divers in the water directed by the diving supervisor. Such movements should not exceed the limitations of the reference sensors and should be made at slow speed. Heading changes should not exceed 15%. When moving, bell divers should be in the close vicinity of the bell (i.e., on the clump weight).
    - Limited movements of the vessel that are greater than those described above should be made only where divers have been recovered to the vessel and with bell divers inside the bell recovered to the vessel or positively clear of any potential hazardous obstructions, including the seabed.
    - When moving the vessel on DP, particular consideration should be given to:
        - Where the bell is cross-hauled or the vessel's vertical axis of rotation does not coincide with the moon pool, in addition to the limitations established above, heading changes should not exceed an angle that causes a 10-meter movement of the bell.
        - The possible snagging of down-lines with the bell winch wire and umbilical.
11. DP Operations in Vicinity of Platforms, Etc.- Care must be exercised when operating on DP in close proximity to fixed objects, such as production platforms, mooring buoys, etc. When DP diving is undertaken in the vicinity of anchor wires and cables, the inaccuracy in the knowledge of their actual position at any time, and the resulting need to keep the bell and bell wires as far from them as possible, should be considered.
12. Visual Reference Points- When close to fixed structures, their value as a visual reference to provide an early additional indication of DP failure should be considered.
13. DP Operations in Vicinity of other DP Vessels- When operating on DP close to one another, DP vessels are potentially subject to several forms of mutual interference. These include thruster wash, which may affect both hulls and taut wires; acoustic and radio position reference sensor signals; and intermittent shelter from wind and sea. These factors should be considered when planning such operations and due allowance made for them. This may take the form of assuming less-accurate position-keeping tolerance than would nominally be expected, but it could also include coordination of choice of position reference sensors and frequencies and careful choice of the relative positions of the vessels.
14. DP Operations in Shallow Water- During shallow-water operations, there are indications

that the limitations of acoustic and taut-wire reference sensors, in terms of the distance from the intended position at which these sensors can operate correctly, can introduce an extra hazard above those normally associated with their use in deep water. The need to use a surface reference sensor as one of the sensors in such operations is therefore of particular importance. The effect or the strong tidal streams and currents sometimes associated with shallow water should also be considered in relation to the position-keeping capabilities of DP vessels.

15. Weather Precautions- Due regard should be paid to any indications of impending weather changes; in particular sudden wind shifts and/or gusts. In winter, sudden changes in direction and increases in strength of wind often occur. The use of onboard meteorological instruments, including barometers, barographs, wind sensors (both fixed and portable), and wet and dry thermometers is necessary to ensure that timely action is being taken to reduce the possibility of loss of position. In conditions where wind and waves are from opposite sides of the fore and aft line of a vessel, particular care is required, as a wind shift to coincide with wave direction is likely to cause rapid change in resultant force on the vessel. A warning of instability when the weather is from roughly ahead or astern, to be obtained from thrust unit movements alternating frequently through 180º using appreciable thrust. A case has occurred of a complete power failure resulting from a DP ship being struck by lightning. All reasonable precautions in accordance with good marine practice should be taken to ensure that forecasts of changing weather conditions are obtained and acted upon. These precautions should include:
    - Obtaining regular and frequent weather forecasts for the area of operations and use of facsimile facilities and charts.
    - Seeking information by radio from other units in the vicinity about prevailing weather conditions in their areas.
    - Use of experience and a "seaman's eye" in assessing the prevailing conditions and likely trends.
    - The presentation of environmental information measured by the DP system and any trends in conditions that it can provide.
16. Collision Risk Care should be exercised at all times to ensure that the correct lights and shapes are displayed in accordance with the latest international collision regulations. By the present rules, whereas power-driven and sailing vessels are required to keep out of the way of a vessel restricted in its ability to maneuver (e.g., a DP diving vessel), a vessel engaged in fishing when underway is required only "so far as possible" to do so. The master of a DP diving vessel should give early warning that it is unable to maneuver to any vessel that appears to be on a collision course using visual and sound signals. The potential use, if properly employed, of a simple automatic collision warning system should not be overlooked. In conditions of reduced visibility, decisions about the suitability of conditions for diving should rest with the master of the vessel.

PERSONNEL CAPABILITIES

The third principle (personnel capabilities) concerns the ability of the personnel onboard to perform the tasks entrusted to them. There should be sufficient personnel having suitable training and experience to ensure the safety of the vessel and all those on board. Authorities Nothing in these guidelines shall supersede the spirit or letter of legislation covering the authorities of masters of merchant vessels, of supervisory staff responsible for diving, project control, and of offshore installations. It is, however, of fundamental importance that the authorities of all personnel concerned with the management of diving operations conducted from DP vessels be thoroughly and clearly defined.

1. The Master
The master of the vessel is ultimately responsible for the safety of his or her vessel and all personnel on board and has ultimate authority to forbid the start or order the termination of diving and DP operations on grounds of safety to personnel on the vessel.

2. Operations Superintendent
The operations superintendent, where present, is responsible for the conduct of all operations carried out from the vessel. As such, he or she has authority to forbid the start or order the termination of diving operations for safety or other reasons. The operations superintendent may not order the start of diving operations.

3. The Diving Supervisor
The diving supervisor is appointed by the employer of the divers to be in overall charge of all diving operations from the vessel and is responsible for all aspects of diving safety. He or she has ultimate authority to permit or forbid the start and order the termination of any diving operations on grounds of diving safety. Other diving supervisors may, as necessary, be appointed by the diving contractor but should be under the control of the diving supervisor. For the purposes of these guidelines, it is assumed that any additional diving supervisors have been vested with the authority and operational responsibility of the diving supervisor when on duty and until relieved.

4. The Client's Representative
The client's onboard representative should, in conjunction with the contractor's senior onboard representative, be responsible to the client for the proper performance or all work in accordance with the contract. He or she may request the start of DP or diving operations and should have the authority to veto the start or order the termination of diving or DP operations on any grounds.

5. Project Liaison
In view of the additional safety factors involved in DP operations, it is essential that close liaison be maintained between the various authorities concerned. Some organizations may include additional supervisory roles, but the above four authorities should represent the minimum forum for planning meetings concerning DP supported diving operations.

6. Priorities
Priorities should be clearly established for dealing with a DP emergency. The authorities of the master and diving supervisor are of fundamental importance at such times. They should cooperate closely to these priorities so that there is no room for doubt or dissension. Priorities should consider that:

• The safety of life is the first priority. The master has ultimate authority to assess and decide on courses of action in this respect. The advice of the supervisor should be taken into account.
• The safety of property is of lower priority. No effort should be made to safeguard property at the expense or safety to life, but the potential danger to life which some threats to property pose should not be overlooked. The advice of the client's representative and offshore installation

owner should be heeded where possible in respect of the safety of offshore installations and equipment.

7. Manning for DP Diving Operations

The requirements for numbers of qualified DP operators will vary. However, every DP vessel engaged in diving operations should meet the following requirements:

- The master of a DP diving support vessel, when performing DP diving operations, should be appropriately trained to be responsible for operating the DP system without supervision.
- DP Operators should be present in the DP control room whenever DP diving operations are being carried out. One of them should hold an appropriate deck officer's qualification to be in charge of the navigational watch. One should be responsible for operating the DP system without supervision. The other should have received suitable instruction on the principles and operation of DP systems. The second watch-keeper may leave the DP control room to attend to ship's business.
- An appropriately trained technician capable of minor fault-finding and maintenance of the DP system should be onboard at all times when DP operations are taking place.
- The period of time for which the watch-keeper referred to above continuously operates the DP system should be limited to avoid loss of concentration. It is unlikely that continuous periods of longer than two hours would be satisfactory, and in some circumstances, this may need to be shortened.
- Engine rooms (or engine control rooms) should be manned at all times when on DP.

Training and Experience

The amount of training and experience needed by personnel to perform their functions safely varies. However, the following minimum standards are recommended, but some may need to be exceeded in some cases:

1. No person should be responsible for operating the DP system in a DP diving vessel without supervision while diving operations are in progress, until he or she has:
    - Received suitable instructions on the principles and operation of DP systems.
    - Attained satisfactory practical experience by completing a suitable period of supervised DP watch-keeping offshore during which he or she has simulated the main subsystem failures, including failure of automatic computer control. It is suggested that a suitable period would be at least 200 hours.
    - Satisfactorily completed approximately 50 hours supervised DP watch-keeping on the vessel concerned during which he or she has simulated the main sub-system failures. To assist the owners to monitor this training, it is recommended that all DP operators maintain a personal log of their DP experience.
    - The technician(s) responsible for minor fault finding and maintenance of the DP control system should have satisfactorily completed a suitable training course.

Operations Manual and Records

Clear guidance about the operation of each individual DP diving vessel should be contained in an operations manual prepared specifically for that vessel. The manual should contain sections on at least the subjects outlined in the following subparagraphs.

1. Vessels Operational Limitations and Alert Procedure

    a. DP Alerts should be clearly stated.
2. Manning
    a. This section should detail the minimum manning arrangements for the vessel when operating on DP and during diving operations.
3. Responsibilities, Authorities and Duties
    a. The duties, responsibilities, and authorities of senior personnel.
4. DP Operations
    a. A description of the DP system fitted on the vessel and guidance on the performance of all DP operations, including procedures for:
        - Operating checks.
        - Operations of position-reference sensors.
        - Duration of DP operating periods.
        - Operations in the vicinity of platforms, etc.
        - Standard alert levels (with description of warning signals).
        - Precautions about weather.
        - Measures to prevent collision.
5. Diving Operations
    a. An up-to-date description of the diving system(s) and guidance on the conduct of diving operations as they may be affected by the DP vessel itself, including procedures for:
        - Actions to be taken in case of changes in alert-level status.
        - Operation of divers in free-flooding and enclosed spaces
        - Precautions to guard against thrust unit wash or suction effect.
        - Surface support and down-line handling.
        - Information to be provided to dive control positions.
        - Preparation and use of emergency plans.
        - Moving vessel.
6. Priorities
    a. Guidance should be given on the priorities to be adopted in case of emergency
7. Communications
    a. Guidance and procedures concerning the transfer of information should be modified to suit the particular vessel. This section should also contain a description of the voice communication systems and alarm systems that are available and should define emergency situations.
8. Records and Report
    a. Details of all records and reports required by the master, senior diving supervisor and others.

REFERENCES
International Maritime Organization Publication 645 Guidelines for Vessels W/D 8.3.9

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

Minimum Personnel:

- One air or mixed-gas diving supervisor (NOT part of the dive rotation).
- One manifold operator when mixed-gas [HeO_2] diving.
- One diver.
- One standby diver.
- Two tender/divers.
- Two LARS/Winch Operators

Surface-Oriented Diving:
The following conditions must be met to perform surface diving from a DP vessel in the DP mode whether over the side or through the moon pool:

- Utilization of an open-bottom bell with emergency on-board gas. (For air or nitrox dives, a stage with emergency on-board gas may be substituted for an open-bottom bell.)
- A tending point on the surface or in-water from which the diver's umbilical can be securely tended. Allowable tending methods need to be addressed in the project JHA and may include the following items:
    - A tender located on the vessel;
    - A tender located in a stage above the surface;
    - An unmanned in-water tending point (e.g. open-bottom bell, diver's hoop {golden gate};
    - An in-water tender;
- Divers (and, if utilized, in-water tender) to have access to surface and on-board gas.
- The bell umbilical and/or diver's umbilical supplying the wet bell and/or divers with appropriate services must be secured to the main lift wire (or secondary lift wire).
- The Diver's (excursion) umbilical is secured to the wet bell so that it is at least <u>16 feet shorter than the distance to the closest hazard.</u> The umbilical must be appropriately marked.
- Bell umbilical and surface umbilical management plan (should be filed with JHA).
- The diving supervisor must be provided with relevant DP alarms and communications systems to the bridge and/or DP control station.
- The topside tenders must be able to hear all communications between the divers and the supervisor and must be able to talk directly to the supervisor.
- Written procedures, as most regulations in effect in other nations, must be prepared for emergency situations (e.g. changes in alert-level status, alarms, loss of communications, moving the vessel, etc.).
- The dive crew must be familiar with the vessel's overall design and operating characteristics (e.g. position of thrusters, propellers, intakes, obstructions, etc.).

NOTE: During diving operations, it is recommended that all structures or debris should be deeper than the deepest point of the bell to protect the bell in the event of runoff or black ship circumstances. Operations where the bell is below the shallow point of the underwater obstruction shall require a management of change (MOC). The following requirements for surface and saturation diving operations conducted from a vessel are in effect only when the vessel is operating in the DP mode. "DP mode" is defined as whenever there is any form of motive power in operation, e.g. thrusters or propellers, which automatically maintains the vessel's position (fixed or a predetermined track) by means of thruster force. The DP system consists of a power system, a thruster system, a DP-controlled system with the redundancy built in to maintain or restore its function, e.g. DP II and DP III. Diving operations conducted from a DP II or DP III vessel should not be considered "Live Boating" and may be performed at any time during the day or night, provided a thorough hazard assessment has been performed. The requirements are based on the premise that at no time should the length of umbilical from the tending point to the diver allow the diver to come into contact with the nearest thruster or propeller that is in operating mode. Very great care is needed in the planning and execution of shallow and surface-oriented diving operations to minimize the effect of thrust units on the divers. The effects of thrust unit wash or suction should be carefully considered, and precautions should be taken to guard against them, particularly when the bell or divers pass the potential wash zone. These precautions could include appropriate computer software to avoid any hazardous effects on the operation of the bell or divers. The use of thrust diagrams when planning dives can also help. Inhibiting or deselecting certain thrusters may be necessary, and the resulting reduction in the vessel's operational limitations should be considered. Divers' umbilical lengths and the manner of deploying them (e.g. over the side, from the bell, etc.) should be so chosen that divers and their umbilical are physically restrained from going to positions where they or their equipment could come into contact with the thrust units or be adversely affected by their wash. Furthermore, care should always be taken to prevent umbilical developing a bight, and to respond at once to any indications of a diver being in difficulty, such as unusual tension on or at the angle of the umbilical. There is no simple approach to the problem due to the differences encountered in the vessels and worksites.

8. Recompression Treatment

This section is a very basic overview of recompression procedures outlined in the US NAVY Dive Manual revision 7. It is the responsibility of International Telecom divers to read and understand the procedures outlined in the US NAVY Dive Manual revision 7 Volume 2.

8.1 Omitted Decompression

Certain emergencies, such as uncontrolled ascents, an exhausted air supply, or bodily injury, may interrupt or prevent required decompression. If the diver shows symptoms of decompression sickness or arterial gas embolism, immediate treatment using the appropriate oxygen or air recompression treatment table is essential. Even if the diver shows no symptoms, omitted decompression must be addressed in some manner to avert later difficulty.

8.1.1 Ascent from 20 Feet or Shallower (Shallow Surfacing) with Decompression Stops Required

If the diver surfaced from 20 feet or shallower feels well and can be returned to stop depth within 1 minute, the diver may complete normal decompression stops. The decompression stops from which ascent occurred is lengthened by 1 minute. If the diver cannot be returned to the depth of the stop within 1 minute and the diver remains asymptomatic, return the diver to the stop from which the diver ascended. Multiply each decompression stop time missed by 1.5. Alternatively, if the surface interval is less than 5 minutes, the diver may be placed in a recompression chamber and treated on a Treatment Table 5 (or 1A if no oxygen is available). If the surface interval is greater than 5 minutes, the diver may be placed in a recompression chamber and treated on Treatment Table 6 (or 2A if no oxygen is available). The diver should be observed for 1 hour after surfacing and/or completing treatment.

8.1.2 Ascent from 20 Feet or Shallower with No Decompression Stops Required

No recompression is required if the diver surfaces from 20 feet or shallower but was within no-decompression limits. The diver should be observed on the surface for 1 hour.

8.1.3 Ascent from Deeper than 20 Feet (Uncontrolled Ascent)

Any unexpected surfacing of the diver from depths more than 20 feet is considered an uncontrolled ascent. If the diver is within no-decompression limits and asymptomatic, he should be observed for at least 1 hour on the surface. Recompression is not necessary unless symptoms develop.

8.1.4 Asymptomatic Uncontrolled Ascent

Asymptomatic divers who experience an uncontrolled ascent and who have missed decompression stops are treated by recompression based on the amount of decompression missed as follows:

- Oxygen Available. Immediately compress the diver to 60 feet in the recompression chamber. If less than 30 minutes of decompression (total ascent time from the tables) were missed, decompress from 60 feet on Treatment Table 5. If more than 30 minutes of decompression were missed, decompress from 60 feet on Treatment Table 6.
- Oxygen Not Available. Compress the diver to 100 feet in the recompression chamber and treat on Table 1A if less than 30 minutes of decompression were missed; compress to 165 feet and treat on Table 2A if more than 30 minutes were missed.

8.1.5 Development of Symptoms

If the diver shows no ill effects, decompress in accordance with the treatment table. Consider any decompression sickness that develops during or after this procedure to be a recurrence. Try to keep all surface intervals as short as possible (5 minutes or less). If an asymptomatic diver who has an uncontrolled ascent from a decompression dive has more than a 5-minute surface interval, recompress to 60 feet on Treatment Table 6 or treat on Table 2A, even if the missed decompression time was less than 30 minutes.

8.1.6 In-Water Procedure

When no recompression facility is available, use the following in-water procedure to make up omitted decompression in asymptomatic divers for ascents from depths below 20 feet. Recompress the diver in the water as soon as possible (preferably less than a 5- minute surface interval). Keep the diver at rest, provide a standby diver, and maintain good communication and depth control. Use the decompression schedule appropriate for the diver's depth and bottom time. Follow the procedure below with 1 minute between stops:

- Return the diver to the depth of the first stop.
- Follow the schedule for stops 40-fsw and deeper.
- Multiply the 30-, 20-, and 10-fsw stops by 1.5.

8.1.7 Symptomatic Uncontrolled Ascent

If a diver has had an uncontrolled ascent and has any symptoms, he should be compressed immediately in a recompression chamber to 60 fsw. Conduct a rapid assessment of the patient and treat accordingly. Treatment Table 5 is not an appropriate treatment for symptomatic uncontrolled ascent. If the diver surfaced from 60 fsw or shallower, compress to 60 fsw and begin Treatment Table 6. If the diver surfaced from a greater depth, compress to 60 fsw or depth where the symptoms are significantly improved, not to exceed 165 fsw, and begin Treatment Table 6A. Symptoms developing during the surface interval or during a period of observation on no-decompression dives are treated as Type II DCS. Consultation with a Diving Medical Doctor should be made as soon as possible. For uncontrolled ascent deeper than 165 feet, the diving supervisor may elect to use Treatment Table 8 at the depth of relief, not to exceed 225 fsw. Treatment of symptomatic divers who have surfaced unexpectedly is difficult when no recompression chamber is on site. Immediate transportation to a recompression facility is indicated if this is impossible.

8.1.8 Transporting the Patient

In certain instances, some delay may be unavoidable while the patient is transported to a recompression chamber. While moving the patient to a recompression chamber, the patient should be kept lying horizontally. Do not put the patient head-down. Additionally, the patient should be kept warm and monitored constantly for signs of blocked airway, cessation of breathing, cardiac arrest, or shock. Always keep in mind that a number of conditions may exist at the same time. For example, the victim may be suffering from both decompression sickness and severe internal injuries.

8.1.9 Medical Treatment During Transport

Always have the patient breathe 100 percent oxygen during transport, if available. If symptoms of decompression sick-ness or arterial gas embolism are relieved or improve after breathing 100 percent oxygen, the patient should still be treated as if the original symptom(s) were still present. Always ensure the patient is adequately hydrated. Give fluids by mouth if the patient can take them. Otherwise, intravenous fluids should be started before transport. If the patient must be transported, initial arrangements should have been made well in advance of the actual diving operations. These arrangements, which would include an alert notification to the recompression chamber and determination of the most effective means of transportation, should be posted on the Job Site Emergency Assistant Checklist for instant referral.

8.1.10 Transport by Unpressurized Aircraft

If the patient is moved by helicopter or other unpressurized aircraft, the aircraft should be flown as low as safely possible, preferably less than 1,000 feet. Any unnecessary altitude means an additional reduction in external pressure and possible additional symptom severity or complications. If available, always use aircraft that can be pressurized to one atmosphere.

8.1.11 Communications with Chamber

Call ahead to ensure that the chamber will be ready and that qualified medical personnel will be standing by. If two-way communications can be established, consult with the doctor as the patient is being

8.2 Treatment Tables

Oxygen Treatment Tables are more effective and, therefore, preferable over Air Treatment Tables. Treatment Table 4 can be used with or without oxygen but should always be used with oxygen if it is available.

8.2.1 Treatment of Symptoms During Sur-D Surface Interval

If surface decompression procedures are used, symptoms of decompression sickness may occur during the surface interval. Because neurological symptoms cannot be ruled out during this short period, the symptomatic diver is treated as having Type II symptoms, even if the only complaint is pain.

8.2.2 Treating for Exceeded Sur-D Surface Interval

If the prescribed surface interval is exceeded but the diver remains asymptomatic, the diver is treated with Treatment Table 5, or Treatment Table 1A if no oxygen is available. If the diver becomes symptomatic, the diver is treated as if Type II symptoms were present. Any symptoms occurring during the chamber stops of Surface Decompression Tables are treated as recurrences.

8.2.3 Recompression Treatments When Oxygen Is Not Available

If no oxygen is available, select the appropriate Air Treatment Table in accordance with Use Table 1A if pain is relieved at a depth less than 66 feet. If pain is relieved at a depth greater than 66 feet, use Table 2A. Table 3 is used for treatment of serious symptoms where oxygen cannot be used. Use Table 3 if symptoms are relieved within 30 minutes at 165 feet. If symptoms are not relieved in less than 30 minutes at 165 feet, use Table 4.

8.2.4 Descent/Ascent Rates for Air Treatment Tables

The Air Treatment Tables (1A, 2A, 3, and 4 using air) are used when no oxygen is available. They are not as effective as the Oxygen Treatment Tables. The descent rate is 20 feet per minute the ascent rate is not to exceed 1 foot per minute.

8.2.5 Recompression Treatments When Oxygen Is Available

Use Oxygen Treatment Tables 5, 6, 6A, 4, or 7, the descent rate is 20 feet per minute. Upon reaching treatment depth not to exceed 60 fsw, place the patient on oxygen. For depth deeper than 60 fsw, use treatment gas if available. Additional guidelines for each treatment table are given below.

8.2.6 Treatment Table 5

Treatment Table 5 may be used for the following:

- Type I (except for cutis-marmorata) symptoms when a complete neurological examination has revealed no abnormality.
- Asymptomatic omitted decompression of shallow surfacing (20 fsw or less) Asymptomatic omitted decompression of rapid ascent (from deeper than 20 fsw) if the missed decompression is less than 30 minutes

Asymptomatic divers who have exceeded surface interval limits following a Sur-D dive Treatment of resolved symptoms following in-water recompression:

- Follow-up treatments for residual symptoms
- Carbon monoxide poisoning

8.2.7 Performance of Neurological Exam at 60 fsw

After arrival at 60 fsw a neurological exam shall be performed to ensure that no overt neurological symptoms (e.g., weakness, numbness, incoordination) are present. If any abnormalities are found, the stricken diver should be treated using Treatment Table 6.

8.2.8 Extending Oxygen Breathing Periods on Treatment Table 5
Treatment Table 5 may be extended by two oxygen-breathing periods at 30 fsw. Air breaks are not required prior to an extension, between extensions, or prior to surfacing. In other words, the Diving Supervisor may have the patient breathe oxygen continuously for 60 minutes at 30 fsw and travel to the surface while breathing oxygen. If the Diving Supervisor elects to extend this treatment table, the tender does not require additional oxygen breathing than currently prescribed.

8.2.9 When Use of Treatment Table 6 is Mandatory
Treatment Table 6 is mandatory if:

- Type I pain is severe and immediate recompression must be instituted before a neurological examination can be performed, or
- A complete neurological examination cannot be performed, or any neurological symptom is present.
- These rules apply no matter how rapidly or completely the symptoms resolve once recompression begins.

8.2.10 Complete Relief after 10 Minutes
If complete relief of Type I symptoms is not obtained within 10 minutes at 60 feet, Table 6 is required.

8.2.11 Musculoskeletal Pain Due to Orthopedic Injury
Symptoms of musculoskeletal pain that have shown absolutely no change after the second oxygen breathing period at 60 feet may be due to orthopedic injury rather than decompression sick-ness. If, after reviewing the patient's history, the Diving Medical Officer feels that the pain can be related to specific orthopedic trauma or injury, Treatment Table 5 may be completed. If no Diving Medical Doctor is on site, Treatment Table6 shall be used.

NOTE: Once recompression to 60 feet is done, Treatment Table 5 shall be used even if it was decided symptoms were probably not decompression sickness. Direct ascent to the surface is done only in emergencies.

8.3 Treatment Table 6
Treatment Table 6 is used for the following:

- Type I symptoms where relief is not complete within 10 minutes at 60 feet or where a neurological exam is not complete
- Type II symptoms Cutis marmorata
- Severe carbon monoxide poisoning, cyanide poisoning, or smoke inhalation
- Arterial gas embolism
- Symptomatic uncontrolled ascent
- Asymptomatic divers with omitted decompression greater than 30 minutes Treatment of unresolved symptoms following in-water treatment Recurrence of symptoms shallower than 60 fsw

8.3.1 Treating Arterial Gas Embolism

Arterial gas embolism is treated by initial compression to 60 fsw. If symptoms are improved within the first oxygen-breathing period, then treatment is continued using Treatment Table 6. Treatment Table 6 may be extended for two oxygen-breathing periods at 60 fsw (20 minutes on oxygen, then 5 minutes on air, then 20 minutes on oxygen) and two oxygen breathing periods at 30 fsw (15 minutes on air, then 60 minutes on oxygen, then 15 minutes on air, then 60 minutes on oxygen). If there has been more than one extension, the tenders' breathing period is extended 60 minutes at 30 feet.

8.4 Treatment Table 6A

Arterial gas embolism or severe decompression symptoms are treated by initial compression to 60 fsw. If symptoms improve, complete Treatment Table 6. If symptoms are unchanged or worsen, assess the patient upon descent and compress to depth of relief

(Significant improvement), not to exceed 165 fsw. Once at the depth of relief, begin treatment gas (N_2O_2, HeO_2) IAW Table 21-5 if available. Stay there for 30 minutes. A breathing period of 25 minutes on treatment gas, interrupted by 5 minutes of air, is recommended at depth to simplify time keeping. The patient may remain on treatment gas during ascent from treatment depth to 60 fsw since the PO_2 will continually decrease during ascent. Decompress to 60 fsw at a travel rate not to exceed 3 ft./min. Upon arrival at 60 fsw, complete Treatment Table 6. Consult with a Diving Medical Officer at the earliest opportunity. The Diving Medical Officer may recommend a Treatment Table 4. Treatment Table 6A may be extended for two oxygen breathing periods at 60 fsw and two oxygen breathing periods at 30 fsw. If deterioration is noted during ascent to 60 feet, treat as a recurrence of symptoms.

8.5 Treatment Table 4

If a shift from Treatment Table 6A to Treatment Table 4 is contemplated, a Diving Medical Doctor shall be consulted before the shift is made. Treatment Table 4 is used when it is determined that the patient would receive additional benefit at depth of significant relief, not to exceed 165 fsw. The time at depth shall be between 30 to 120 minutes, based on the patient's response.

8.6 Treatment Table 7

Treatment Table 7 is considered a heroic measure for treating non-responding severe gas embolism or life-threatening decompression sickness. Committing a patient to a Treatment Table 7 involves isolating the patient and having to minister to his medical needs in the recompression chamber for 48 hours or longer. Experienced diving medical personnel shall be on scene.

8.7 Treatment Table 8

Treatment Table 8 is an adaptation of a Royal Navy Treatment Table 65 mainly for treating deep uncontrolled ascents (see Volume 3) when more than 60 minutes of decompression have been missed. Compress symptomatic patient to depth of relief not to exceed 225 fsw. Initiate Treatment Table 8 from depth of relief. The Table 8 schedule from 60 feet is the same as Treatment Table 7.

9. Record Keeping

9.1 Record Keeping Requirements

The employer shall record the occurrence of any diving-related injury or illness, which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

9.2 Availability of Records

Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g):

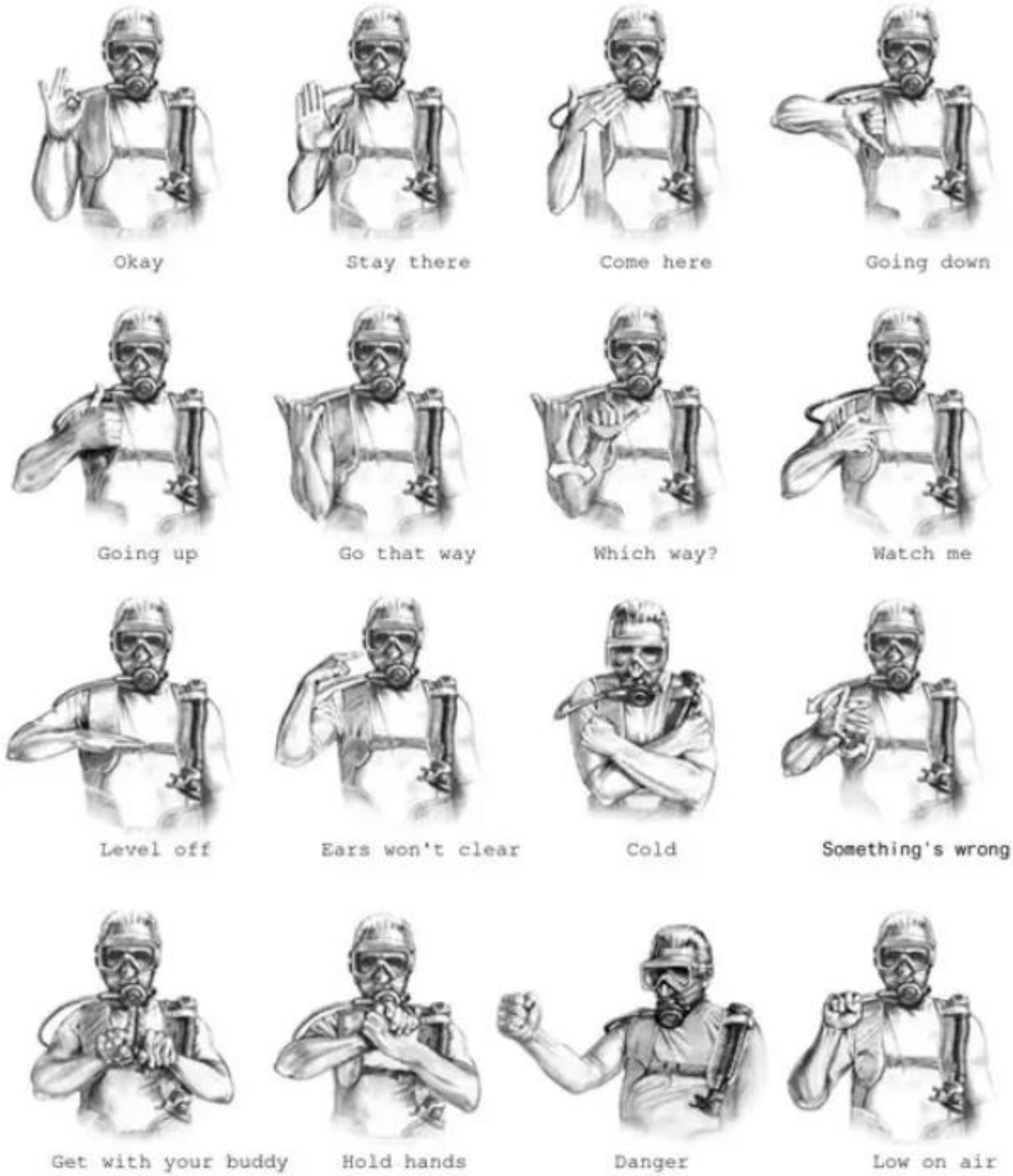
- Safe practices manuals (1910.420), depth-time profiles (1910.422), recordings of dives (1910.423), decompression procedure assessment evaluations (1910.423), and records of hospitalizations (1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (1910.430) shall also be provided upon request to employees and their designated representatives.
- Records and documents required by this standard shall be retained by the employer for the following period:
- Dive team member medical records (physician's reports) (1910.411) - 5 years.
- Safe practices manual (1910.420) - current document only.
- Depth-time profile (1910.422) - until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness.
- Recording of dive (1910.423) - 1 year, except 5 years where there has been an incident of decompression sickness.
- Decompression procedure assessment evaluations (1910.423) - 5 years.
- Equipment inspections and testing records (1910.430) - current entry or tag, or until equipment is withdrawn from service.
- Records of hospitalizations (1910.440) - 5 years.
- After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

10. Definitions

"Acfm": Actual cubic feet per minute.
"ASME Code or equivalent": ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.
"ATA": Atmosphere absolute.
"Bell": An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.
"Bottom time": The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.
"Bursting pressure": The pressure at which a pressure containment device would fail structurally.
"Cylinder": A pressure vessel for the storage of gases.
"Decompression chamber": A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.
"Decompression sickness": A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.
"Decompression table": A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.
"Dive location": A surface or vessel from which a diving operation is conducted.
"Dive-location reserve breathing gas": A supply system of air or mixed-gas (as appropriate) at the dive location, which is independent of the primary supply system and sufficient to support divers during the planned decompression.
"Dive team": Divers and support employees involved in a diving operation, including the designated person-in-charge.
"Diver": An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.
"Diver-carried reserve breathing gas": A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.
"Diving mode": A type of diving requiring specific equipment, procedures, and techniques (SCUBA, surface-supplied air, or mixed gas).
"Fsw": Feet of seawater (or equivalent static pressure head).
"Heavy gear": Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.
"Hyperbaric conditions": Pressure conditions more than surface pressure.
"In-water stage": A suspended underwater platform which supports a diver in the water. "Live-boating": The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.
"Mixed-gas diving": A diving mode in which the diver is supplied in the water with a breathing gas other than air.
"No-decompression limits": The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives", U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.
"Psi(g)": Pounds per square inch (gauge).

"Scientific diving" means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.
"SCUBA diving": A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.
"Standby diver": A diver at the dive location available to assist a diver in the water. "Surface-supplied air diving": A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.
"Treatment table": A depth-time and breathing gas profile designed to treat decompression sickness.
"Umbilical": The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions and includes a safety line between the diver and the dive location.
"Volume tank": A pressure vessel connected to the outlet of a compressor and used as an air reservoir.
"Working pressure": The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

ADDENDUM # 1 – DIVER HAND SIGNALS



ADDENDUM # 2 – DIVER AIR CHART

Caldwell Marine INTERNATIONAL
A JAG COMPANY

1333 CAMPUS PKWY
WALL TOWNSHIP, NJ 07753
(732) 557-6100

DIVE AIR CHART			DATE	
LOCATON:	WATER TEMP	SEA STATE	VISIBILITY	CURRENT
NAME OF DIVER:	DIVING RIG	HELMET	TYPE DRESS	BAILOUT(PSIG)
STAND-BY DIVER:	DIVING RIG	HELMET	TYPE DRESS	BAILOUT(PSIG)
LEFT SURFACE (LS)	DEPTH(FSW)	REACHED BOTTOM	DESCENT TIME	
LEFT BOTTOM (LB)	TOTAL BOTTOM TIME	TABLE & SCHEDULE	TIME TO FIRST STOP	
REACHED SURFACE	TOTAL TIME OF DIVE	TOTAL DECOMPRESSION TIME	LAST PRESSURE EXSPOSURE	REPET GROUP

DESCENT	ASCENT	DEPTH OF STOPS	DECOMPRESSION TIME		TIME	
			WATER	CHAMBER	WATER	CHAMBER
		10			**L** **R**	**L** **R**
		20			**L** **R**	**L** **R**
		30			**L** **R**	**L** **R**
		40			**L** **R**	**L** **R**
		50			**L** **R**	
		60			**L** **R**	
		70			**L** **R**	
		80			**L** **R**	
		90			**L** **R**	
		100			**L** **R**	
		110			**L** **R**	
		120			**L** **R**	
		130			**L** **R**	

PURPOSE OF DIVE	REMARKS
DIVERS CONDITION	DIVING SUPERVISOR / DIVER

ADDENDUM # 3 – SURFACE SUPPLIED DIVE OPS CHECKLIST

SURFACE-SUPPLIED DIVING OPERATIONS CHECKLIST

A. Basic Preparation:

___1. Verify that proper signals indicating underwater operations being conducted are displayed correctly and Notice to Mariners have been posted.
___2. Ensure that all personnel concerned, or in the vicinity, are informed of diving operations.
___3. Determine that all valves, switches, controls, and equipment components affecting diving operation are in the off position and cannot be activated during the diving operation.
___4. Verify the Emergency Bill.

B. Equipment:

___1. Check all equipment for superficial wear, tears, dents, distortion, or other discrepancies.
___2. Check all masks, helmets, view ports, faceplates, seals, and visors for damage.
___3. Check that all accessory equipment – tools, lights, special systems, spares, etc., – are on site and in working order. In testing lights, tests should be conducted with lights submerged in water and extinguished before removal, to prevent overheating and failure.
___4. Erect diving stage or attach diving ladder. In the case of the stage, ensure that the screw pin shackle connecting the stage line is securely fastened with the shackle pin seized with wire or a safety shackle is used to help prevent opening.

C. Preparing the Diving System:

___1. Check that a primary and suitable back-up air supply is available with a capacity in terms of purity, and supply pressure to completely service all divers including decompression, recompressions and accessory equipment throughout all phases of the planned operation.
___2. Compressors:
____a. Determine that sufficient fuel, coolant, lubricants, and antifreeze are available to service all components throughout the operation. All compressors should be fully fueled, lubricated, and serviced (with all spillage cleaned up completely
____b. Verify that the diving system has been properly to aliged.
____c. Verify that all compressor controls are properly marked and any remote valving is tagged with "Divers Air Supply - Do Not Touch"signs.
____d. Ensure that compressor is secure in diving craft and shall not be subject to operating angles, caused by roll or pitch, that will exceed 15 degrees from the horizontal.
____e. Verify that oil in the compressor is an approved type. Check that the compressor oil does not overflow Fill mark; contamination of air supply could result from fumes or oil mist.
____f. Check that compressor exhaust is vented away from work areas and, specifically, does not foul the compressor intake.
____g. Check that compressor intake is obtaining a free and pure suction without contamination.

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___h. Bleed off all condensed moisture from filters and from the bottom of volume tanks. Check all manifold drain plugs, and that all petcocks are closed.
____i. Check that all belt-guards are properly in place on drive units.
____j. Check all pressure-release valves, check valves and automatic unloaders.
___k. Verify that all supply hoses running to and from compressor have proper leads, do not pass near high-heat areas such as steam lines, are free of kinks and bends, and are not exposed on deck in such a way that they could be rolled over, damaged, or severed by machinery or other means.
____l. Verify that all pressure supply hoses have safety lines and strain reliefs properly attached.

D. Activate the Air Supply

___1. Compressors:
____a. Ensure that all warm-up procedures are completely followed.
____b. Check all petcocks, filler valves, filler caps, overflow points, bleed valves, and drain plugs for leakage or malfunction of any kind.
____c. Verify that there is a properly functioning pressure gauge on the air receiver and that the compressor is meeting its delivery requirements.

___2. Cylinders:
____a. Gauge all cylinders for proper pressure.
____b. Verify availability and suitability of reserve cylinders.
____c. Check all manifolds and valves for operation.
____d. Activate and check delivery.

E. Diving Hoses:

___1. Blow down umbilical's check that hoses are free of moisture, packing material, or chalk.
___2. Ensure umbilical markings are in good order

F. Test Equipment with Activated Air Supply

___1. Check all exhaust and non-return valves.
___2. Hook up all air hoses to helmets; make connections between back up supply and primary supply manifold.
___3. Verify flow to helmets and masks
___4. Hook up and test all communications.
___5. Check airflow from both primary and back-up supplies to the hats.

G. **Recompression Chamber Checkout (Predive only):**

___1. Check that chamber is completely free and clear of all combustible materials.
___2. Check primary and back-up air supply to chamber and all pressure gauges.
___3. Check that chamber is free of all odors or other "contaminants."
___4. Hook up and test all communications.
___5. Check airflow from both primary and back-up supplies to chamber.

Final Preparations:
___1. Verify that all necessary records, logs, and timesheets are on the diving station.
___2. Check that appropriate decompression tables are readily at hand.
___3. Place the dressing bench in position, reasonably close to the diving ladder or stage, to minimize diver travel.
__4. Verify that First Aid and Emergency Equipment are available on the dive station and ready for use.

Diving Supervisor __________________________

Date: ______________________

ADDENDUM # 4 – PRE-DIVE HELMET CHECKLIST

PRE-DIVE HELMET CHECKLIST

Date:
Helmet Serial #
Associated Equipment Serial #(s)
Diver / Tender

STEP	PROCEDURES	INITIALS
1.1 Yoke/Neck Clamp Assembly Note: Applicable to SL-17 A/B Only. For all other helmet models skip to step 1.2	**Diver/Tender – Check the following (a-c)**	
	a. Visually inspect the Yoke/Neck Clamp Assembly for sign of damage. Check the Neck Dam for tears, holes, and/or cuts. Ensure the Neck Dam of proper size and fit.	
	b. Test-mate the Yoke Assembly to the Helmet and check for proper Neck Clamp adjustment. Adjust if necessary	
	c. Ensure the Latch Catch Assembly works properly, is not bent of deformed. Also Check that the Safety Pin is present and Attached with Lanyard.	
1.2 Neck Dam Ring Assembly	**Diver/Tender Check the following (a-d)**	
	a. Visually inspect the Neck Dam Ring Assembly of signs of damage. Check the Neck for tears holes, and /or cuts. Ensure the Neck Dam is of the proper size and fit.	
	b. Inspect Neck Ring O-ring. Lightly lubricate the O-ring if it appears dry	
	c. Test Mate the Neck Dam Ring assembly to the Helmet and check for proper adjustment.	
	d. Ensure the sealed Pull Pins work properly	
2. Visually Inspect the Helmet	**Diver/Tender Check the following (a-d)**	
	a. Visually inspect Helmet Shell interior and exterior for damage and/or contamination. Check that the Oral Nasal Valve is correctly installed and the Oral Nasal Mask is installed on the Regulator Mount Nut. Ensure the Nose Clearing Device operates smoothly	
	b. Ensure Earphone and Microphones are installed correctly	
	c. Inspect the Head Cushion for proper fit broken snaps, tears, and/or rips.	
	d. Check the O-ring at the base of the Helmet for signs of damage. Ensure the O-ring is lightly lubricated (SL-17 A/B only)	
3. EGS Inspection	Diver/Tender – Check the following (a-d)	
	a. Visually inspect all EGS hoses for signs for damage	
	b. Check the hydro date and ensure the cylinder is within the VIP and Hydrostatic date. Visually inspect the cylinder and valve for obvious signs of damage.	
	c. Ensure the First Stage Regulator pressure and Over-Pressure Bleed/Relief Valve settings have been checked within the past month	
	d. Inspect the Safety Harness and Cylinder Retainer for wear and/or damage.	

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STEP	PROCEDURES	INITIALS
4. Check the Helmet EGS	**Diver/Tender – Check the following (a-f)**	
	a. Check the Non-Return Orally or with hand vacuum pump	
	b. Connect the First Stage Regulator to the EGS Cylinder and the Helmet Emergency Supply Valve. With the cylinder turned off, open and close the side Block Emergency Valve to check for smooth operation. Then open and close the Steady Flow Valve to verify smooth operation	
	c. Rotate the regulator adjustment Knob in fully (clockwise), then rotate out (counterclockwise) 3-4 rotations to check for smooth operation.	
	d. Open the EGS Supply Valve on the cylinder. Log the pressure ___________ psig. Next open the Emergency Supply Valve on the Side Block	
	e. Momentarily open the Helmet Steady Flow ¾ to 1 full turn. Check for strong flow of the gas out of the Air Train, then close	
	f. Check for gas escaping from the Non-Return Valve. If any gas flow is detected the Non-Return Valve should be overhauled or replaced.	
5. Check the Demand Regulator Adjustment Note: If the Purge Button Travels further than 1/8" before gas start flowing or has a weak flow of gas when fully depressed, the adjustment if the Regulator is Necessary	**Diver /Tender – Check the following (a-d)**	
	a. Rotate the Demand Regulator Adjustment Knob out (counterclockwise) until a slight free flow develops. Next rotate in the (clockwise) until the free flow stops.	
	b. Slowly depress the purge button to check for excessive travel. The Purge Button should travel no less than 1/16" and no more than 1/8" before gas flow is heard	
	c. Depress the purge Button all the way and verify a strong surge of gas	
	d. Ensure the Side Block Emergency Valve is shut and the Bail Out Cylinder Valve is open Log the cylinder pressure__________psig.	
Diver Signature Once pre Dive Day	**The above steps 1 through 5 have been performed and the Dive Helmet Serial #_____________________is in a safe condition to dive.** **Diver Signature________________________Date: _________________**	
6. Attach the Umbilical	**Tender Perform the following**	
	a. Blow down the umbilical and attach it to the Non-Return Valve.	
7. Check Communications	**Diver Preform the following**	
	Check Com's	

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8. Check the Hot Water Supply If Applicable	**Tender Perform the following**	
	Check the hot water supply and connections	
STEP	PROCEDURES	INITIALS
9. Check the Dry Suit Inflation Hose if Applicable	Tender Perform the Following	
	Check the dry suit Inflation Hose Connection. Ensure the dry suit Inflation Valve and Exhaust Valve function properly	
10 Tender Check the Entire Rig	Tender Perform the following	
	a. Soap and leak check the Helmet gas fittings and connections including the EGS	
	b. Check Neck Yoke is properly attached to the helmet and all locking pins engaged	
	c. Check Safety Harness is properly adjusted and in good condition	
	d. Check Umbilical Strain Release	
	e. Check EGS Hose Quick Disconnect	
	f. Check Boots, gloves, knife, tools and other accessories	
11. Tender Signature	**Tender Signature**______________________**Date:** ________________	

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ADDENDUM # 5 – PRE-DIVE CHECKLIST

PRE-DIVE CHECKLIST

Please print or type all information

COMPANY INFORMATION			
COMPANY NAME: CALDWELL MARINE INTERNATIONAL	TIME:	DATE OF INSPECTION:	
COMPANY ADDRESS: 1333 CAMPUS PKWY SUITE 100	CITY: WALL TOWNSHIP	STATE: NJ	ZIP CODE: 07753
JOB NUMBER:			
LOCATION:			
VESSEL/PLATFORM:			
PERSON(S) Performing Safety Check			
Name:	Title:		
Name:	Title:		

DIVE TEAM MEMBERS AND ASSIGNMENTS		
Name:	Title:	Certification#:
Name:	Title:	Certification#:
Name:	Title:	Certification#:
Name:	Title:	Certification#:
Name:	Title:	Certification#:

(All personnel assigned to the dive team must have a valid ADCI Certification Card on record)

Place a check next to each item and record all applicable information

DIVE STATION REQUIRED DOCUMENTATION			
JSA:_____	DECO Tables/Schedules:______	Dive Safety Manuel: ______	Dive Plan, EMP, Emergency Contacts and Information: __________
Daily Dive Log: _________	Deepest Depth/Max Depth_______		

DIVE STATION EQUIPMENT AND SYSTEMS		
First Aid Kit/ First Aid Manual: ______________ (REQUIRED BY ADCI/USCG)		
Defibrillator/Bag Type Manuel Resuscitator: ____________ Backboard: _____________ Emergency 02 Administration Equipment: _______________ **(REQUIRED BY ADCI/USCG)**		
Primary Breathing Gas	Air ______________	HeO_2 ___________

DIVE STATION EQUIPMENT AND SYSTEMS CONTINUE	
Compressors(s): **Volume Tank (s):**	Fluids / Fuel / Filters:

Compressed Air Banks/Bottle (Standby Air)		
Pressure (PSI/Bar) ______________	Check on Delivery and Activation of Gas __________	Valves___________
Gas Supply		
HeO_2	Number of Banks/Bottles:________	Online Pressure (PSIG/Bar):________
50/50	Number of Banks/Bottles:________	Online Pressure (PSIG/Bar):________
O_2	Number of Banks/Bottles:________	Online Pressure (PSIG/Bar):________
Air	Number of Banks/Bottles:________	Online Pressure (PSIG/Bar):________
Bailout	Air: _______	HeO_2: ______(%_______)
COMMUNICATIONS: _____________ (Ensure all communications are hooked up and tested)		
Two-way communications on site for emergencies: __________ (Required by ADCI/USCG)		
CHAMBER(S): U.I. ___________ S.N _____________National Board#:______________Dimensions: ____________Date of Manufacture: __________		
All gas is hooked up and delivery tested: ____________	O_2 online: ____________ (PSIG/Bar: ________	
BIBS and back up BIBS: _____________	Backup gas supply ready for delivery: _________	
GAUGES:		
U.I._________________	Last Date Tested: ____________	
U.I._________________	Last Date Tested: ____________	
Tested for Calibration: _____________ (Required by ADCI/USCG)	Verifying Documentation: __________ (Required by ADCI/USCG)	
ALPHA FLAGS/DAY SHAPES/NIGHT LIGHTS: _________ (Required by ADCI/USCG)		
DIVE LADDER: ___________ Ensure that it is secured to vessel/platform and in a safe location_____________ A minimum of 3 feet below the waterline ________________		
BELL/STAGE: _______ (Ensure that all breathing gasses and delivery systems have been checked) Compressed Air (PSIG/Bar: ________ HeO_2 (PSIG/Bar: ________ 50/50 (PSIG/Bar: _________ Rack Box / Manifold: __________________ Pressure-Reducing Regulators:___________________		
DIVE HOSES/UMBILICALS: ____________ (Check all diving hoses for proper hook-up, staging and serviceability)		
Primary Diver:	U.I________________	I.D. and Length ________________
Standby Diver:	U.I________________	I.D. and Length ________________
DIVE HOSES/UMBILICALS CONTINUE: _______________ (Check all diving hoses for proper hook-up, staging and serviceability		
Deck Whips:		
LP Comp to VT:	U.I. _______________	I.D. and Length ________________
VT to Filter:	U.I. _______________	I.D. and Length ________________
Filter to Rack Box:	U.I. _______________	I.D. and Length ________________
EGS to Rack Box:	U.I. _______________	I.D. and Length ________________

HARNESSES: _____________ (Check for serviceability)	
BAILOUTS/REGULATORS: ____________ (Ensure that EGS has been activated at the bottle; bailout check and hose pressurization prior to water entry	
Primary Diver: U.I._________ Hydro Date: ________ VIP________	First Stage: U.I. ________ Model & Make: ________ Last date serviced: _________
Standby Diver: U.I._________ Hydro Date: ________ VIP________	First Stage: U.I. ________ Model & Make: ________ Last date serviced: _________
LOTO (Lock Out Tag Out): ______________	
NOTE: Hardhats, safety glasses, steel-toed boots, and personal floatation devices adequate for the project are required by ADCI/USCG Helmets & Masks: Type: Primary Diver: Standby Diver:	
COMMENTS:	
Signature(s) of Person(s) Completing Dive Site Audit Form Safety Checklist	
Name:	Signature:
Name:	Signature:
Name of Designated Person-in-Charge /Supervisor: (Required by ADCI/USCG)	
DPIC/Supervisor's Name:	Signature:

Additional Comments by Auditor

ADDENDUM # 6 – POST-DIVE CHECKLIST

POST-DIVE CHECKLIST

Please print or type all information

COMPANY INFORMATION			
COMPANY NAME: CALDWELL MARINE INTERNATIONAL	TIME:	DATE OF INSPECTION:	
COMPANY ADDRESS: 1333 CAMPUS PKWY SUITE 100	CITY: WALL TOWNSHIP	STATE: NJ	ZIP CODE: 07753
JOB NUMBER:			
LOCATION:			
VESSEL/PLATFORM:			
PERSON(S) Performing Safety Check			
Name:	Title:		

DIVE TEAM MEMBERS AND ASSIGNMENTS		
Name:	Title:	Certification#:
Name:	Title:	Certification#:
Name:	Title:	Certification#:
Name:	Title:	Certification#:
Name:	Title:	Certification#:

DIVERS CONDITION:
Physical problems or adverse physiological effects, including symptoms of decompression sickness or gas embolism.

NOTES:

ADVISED OF DECOMPRESSION CHAMBER LOCATIONS	**YES/NO**

ADVISED OF POTENTIAL HAZARDS OF FLYING	**YES/NO**

ADVISED OF POTENTIAL HAZARDS OF TRAVELING TO HIGHER ELEVATION	**YES/NO**

DIVE OUTSIDE THE NO-DECOMPRESSION TIME/DEPTH LIMITS

1. Take reasonable steps to have the diver remain awake and in the vicinity of the decompression chamber for at least one hour.

NOTES:

2. Instruct such divers to remain within two hours travel time of the decompression chamber for an additional five hours.
3. Instruct such divers of the hazards of flying after diving.

ON ANY DIVE THAT RESULTS IN DECOMPRESSION SICKNESS, PROPER MEDICAL AUTHORITY SHOULD BE CONSULTED TO THE DIVER FLYING AFTER TREATMENT

Signature(s) of Person(s) Completing Dive Site Audit Form Safety Checklist	
Name:	Signature:
Name:	Signature:
Name of Designated Person-in-Charge /Supervisor: (Required by ADCI/USCG)	
DPIC/Supervisor's Name:	Signature:

ADDENDUM # 7 – DIVER/TENDER CHECKLIST

POST DIVE CLEANING, MAINTENANCE, AND INSPECTION CHECKLIST

POST DIVE CLEANING AND INSPECTION SHOULD BE PERFORMED AT THE END OF DAILY DIVING OP- ERATIONS OR AT LEAST EVERY 24 HOURS DURING CONTINUOUS DIVING OPERATION.

NOTE: Helmets being used in extreme environments will require more frequent inspection.

NOTE: During removal of components for inspection, O-rings and other consumable items may be reused, providing they are clean and a visual inspection does not reveal any damage or deterioration.

NOTE: This cleaning and maintenance schedule is recommended for all Diving Helmets and should be performed at least on a **DAILY** basis.

NOTE: Detailed instructions are located in the Modular O & M Manual.

Date: ____

Helmet Model: ____

Helmet Serial Number: ____

Associated Equipment Serial #(s): ____

Diver/Tender *(print name)*: ____

Reference: Kirby Morgan®
Deep Sea Diving Helmets
SL 17 A/B, 17C, 17K, 27, KM 37/SS, 47, 57, 77, 97

DIVER/TENDER – CHECK THE FOLLOWING:

Procedures	Initials
1) Secure and bleed down gas supplies.	
2) Disconnect and cap or tape the Helmet Gas Connections and disconnect the communication wires. Cap or tape the Umbilical End.	
3) Wash the exterior surface of the Helmet with a solution of mild detergent and fresh water, then rinse. Inspect for signs of damage.	
4) Remove the Head Cushion Assembly. Inspect for damage. If the Head Cushion has gotten wet with perspiration or water, clean and hang-up for drying or airing.	
5) Remove the Demand Regulator Clamp, Cover, and Diaphragm Assembly. Inspect the Diaphragm for signs of degradation, mineral deposits (if present, clean), tears, holes OR separation and replace, if necessary. Wash the interior of the Demand Regulator with mild detergent and fresh water, then rinse thoroughly. **NOTE:** While rinsing the interior of the Demand Regulator DO NOT depress the Purge Button lever. This action will introduce foreign matter into the Inlet Valve and Seat.	
6) Dislodge the earphones. If the interior of the Helmet and Liner has gotten wet, remove the earphone protective covers, wash with mild detergent solution, rinse with fresh water and allow to dry.	
7) Remove the microphone from the Oral Nasal Mask. Wash with a mild detergent solution and rinse with fresh water.	
8) Wipe interior of the Helmet, including the Oral Nasal Mask. Wash with a mild detergent solution and rinse with fresh water.	
9) Rotate the Regulator Adjustment Knob fully out (counter clockwise). Close the Emergency Supply and Steady Flow Valves.	

Reference: Kirby Morgan®
Deep Sea Diving Helmets
SL 17 A/B, 17C, 17K, 27, KM 37/SS, 47, 57, 77, 97

Procedures	Initials
10) Clean the Neck Dam and Neck Clamp and Latch Catch Assembly with a mild detergent solution. Operate the Neck Clamp and Latch Catch, rinse with fresh water. Clean the Neck Ring, and Pull Pin Assemblies with mild detergent solution, thoroughly rinse with fresh water.	
11) Wipe all surfaces with a clean, dry towel to remove water droplets. Allow to air dry.	
12) Cap or tape the Emergency Gas Whip on the First Stage Regulator. Wash the exterior of all EGS components, the First Stage Regulator, the Gas Cylinder, the Submersible Pressure Gauge, and the Harness Assembly with a mild detergent solution and rinse with fresh water.	
13) Note any damage or discrepancies found during cleaning.	

Diver/Tender Signature:__________________________________Date: ___________________________

Comments: ____

ADDENDUM # 8 – ADCI PHYSICAL EXAM FORM

Association of Diving Contractors International

PHYSICAL EXAMINATION FORM

Employer	Date	Date of Birth	Age
1. Last Name	First Name	Middle Name	2. Last 4 No. of SSN or PASSPORT No.

3. Height (inches)	4. Weight (pounds)	5. Body Fat (%) (Optional)	6. BMI (Optional)

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

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

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

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

NEUROLOGICAL EXAMINATION

42. CRANIAL NERVES

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

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

43. REFLEXES

DEEP TENDON

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

PATHOLOGICAL

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

SUPERFICIAL

	Present	Absent	NE
Upper Abdomen			
Lower Abdomen			
Cremasteric			

44. CEREBELLAR FUNCTION

	0	1	2	3	4
Ataxia					
Tremor (intention)					

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

45. MUSCLE

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

46. PROPIOCEPTION

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

47. NYSTAGMUS

	Present	Absent
End Point Lateral Gaze		
Pathological		

48. SENSATION

	Normal	Abnormal
Hot		
Cold		

	Normal	Abnormal
Sharp		
Soft		

Two Point Discrimination	
Normal	
Abnormal	

49. RHOMBERG

Absent	
Present	

50. MISCELLANEOUS REMARKS

____
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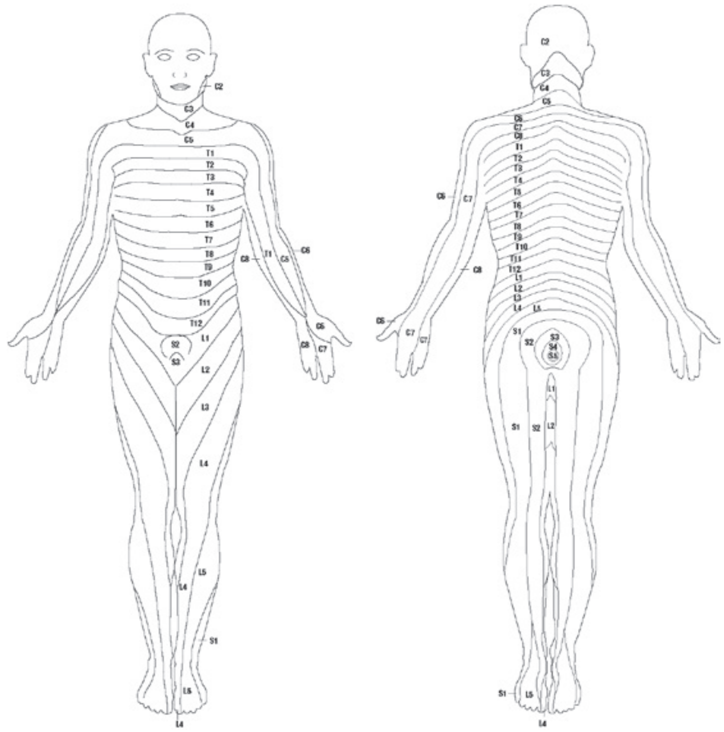

LABORATORY FINDINGS

51. Urinalysis

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

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

52. Blood Tests

CBC
Normal ☐
Abnormal ☐

Sickle Cell ☐ Pos ☐ Neg

Attach Reports
RPR ☐ Pos ☐ Neg

53. Cardiac Risk Score

No. of Points ______

10 year risk ______

54. Pulmonary Function

FVC ______
FEV1 ______
FEV1/FVC ______

55. X-ray/MRI	Normal	Abnormal	(Describe)
Chest	☐	☐	______
Lumbar Spine	☐	☐	______
Long Bones	☐	☐	______
MRI	☐	☐	______

56. Electrocardiogram

Static ______
Exercise Stress ______

57. Audiogram

Hz	500	1000	2000	3000	4000	6000	8000
Left							
Right							

58. Comprehensive Metabolic Panel Attach Report

Normal ☐
Abnormal ☐

Lipid Panel (if done)

Normal ☐
Abnormal ☐

Comments: ______

59. Drug Screen

☐ Not collected
☐ Collected, results sent to employer

Work Status:

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

Comments: ______

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

Revision 2016

Page 4 of 4

ADDENDUM # 9 – INCIDENT FORMS

INJURY REPORT – FORM # 1

(Completed by Investigating Supervisor)

Report Only ☐

Complete Within 8 Hours or Before End of Shift
email to: safety@jaginc.co

Location:		**Investigation #**	
		Work Comp#	
Date of Incident:	**Time of Incident:** ☐ AM ☐ PM		
Date Reported:	**Shift:** ☐ 1 ☐ 2 ☐ 3 ☐ OTHER		
Location of Incident:	**Length of Shift:** ☐ 8 ☐ 10 ☐ 12 ☐ OTHER		
Type of Incident:	☐ **Injury** ☐ **Illness** ☐ **Near Miss** ☐ **Other:** _______		
Incident Description:			

PERSON INVOLVED

1.	**Name of Person involved:**	
2.	**Employment Status:**	☐ **Employee** ☐ **Sub-Contractor** ☐ **General Public**
3.	**Date of Hire/Assignment:**	
4.	**Job Title/Craft/Position:**	
5.	**Department:**	
6.	**Manager/Supervisor:**	
7.	**Gender:**	☐ **Male** ☐ **Female**
8.	**How long in Current Position:**	**Yrs.** **Months**
9.	**List the possible witnesses of the incident – Attach witness statement (Form #2):**	
10.	**Photographs taken** ☐ **Yes** ☐ **No**	**(PICTURE MUST BE TAKEN WHENEVER POSSIBLE)**
11.	**Is the employee involved employed anywhere other than JAG Companies ?** ☐ **Yes** ☐ **No** **If yes, where and what does s/he do?**	
12.	**What day of the week did the incident occur?**	☐ M ☐ Tu ☐ W ☐ Th ☐ F ☐ Sa ☐ Su
13.	**What consecutive day of the employee's work week was it?**	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
14.	**Was the employee working overtime at the time of the incident?**	☐ **Yes** ☐ **No**
15.	**Was the employee doing their regularly assigned/scheduled job duties?** ☐ **Yes** ☐ **No** **If "NO", then please explain**	

NOTE: Multiple Injuries – If more than one person is injured in an incident, a separate incident form will need to be completed for each person. Keep all the information for these incidents together and submit as one package.

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INJURY / ILLNESS

1. What type of injury / illness occurred?

☐ Abrasion ☐ Amputation ☐ Bruise ☐ Concussion ☐ Dislocation
☐ Fracture ☐ Foreign Body ☐ Laceration ☐ Sprain/Strain ☐ Loss of Consciousness
☐ Other:

2. To what part (s) of the body? ☐ Right ☐ Left ☐ Both
☐ Right ☐ Left ☐ Both

3. What was the initial type of treatment was provided? ☐ First Aid ☐ Medical Clinic ☐ Hospital
☐ None - Not Needed or Requested at Time of Incident

Name and Location of treating facility: ______________________________

4. Was the injury/illness reported in a timely manner? ☐ Yes ☐ No

If not, why?

5. Onset of condition ☐ Gradual ☐ Sudden

6. Has the employee experienced a similar injury, pain, or discomfort previously?
☐ Yes ☐ No ☐ Unknown

If “Yes” explain

7. Did the incident result in a lost time accident? ☐ Yes ☐ No ☐ Unknown

If Yes, what was the date of the last day worked?

8. Has the person to been assigned light duty or job transfer? ☐ Yes ☐ No ☐ Unknown

9. When the employee was sent for post incident drug & alcohol test? ☐ Yes ☐ No

Supervisor (print):	Signature:	Date:
Time of this Report: ☐ AM ☐ PM		

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
Incident Report– Form # 1	Investigating Supervisor	Within 8 hour or End of shift
Incident Statement –Form # 2	Person Involved in Incident	Within 24 hours
Incident Investigation-Form #3	Witness / Description - Extension for Form 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

Call EH&S Director ASAP with Details of the Incident - Lucky Abernathy at (908) 433-3755

NOTE: Initial report within 8hrs and a complete report with Incident Statement(s) within 24hrs

INCIDENT STATEMENT – FORM# 2

Complete within 24 email to: Safety@jaginc.co

STATEMENT FORM

Company: ______________________ **email to: Safetey@jaginc.co**

Statement By:	☐ Person/Employee Involved ☐ Witness	☐ Employee Witness ☐ Contractor	☐ Manager/Supervisor ☐ Temporary	☐ Visitor
Name:		**Date of Incident:**	***Time of Incident:***	

STATEMENT

Print Name:	**Signature:**	**Date:**
Supervisors Review:	**Date:**	

JAG COMPANIES

INCIDENT INVESTIGATION FORM # 3

(Completed by Investigating Supervisor)

Complete within 24 Hours or before end of shift
email to: Safety@jaginc.co

Investigation #	
Work Comp#	

Company: ______________________

Date of Incident:	**Time of Incident:** ☐ AM ☐ PM

Type of Incident: ☐ Injury ☐ Illness ☐ Property Damage ☐ Other: ☐ Fire ☐ Near Miss ☐ Equipment Damage

Incident Description: ______________________

PERSON INVOLVED

1.	Name of Person(s) involved	
2.	Employment Status	☐ Employee ☐ Temporary ☐ Sub-Contractor ☐ Visitor
4.	Job Title/Position	
5.	Department	
6.	Manager/Supervisor	

ROOT CAUSE ANALYSIS

1. What unsafe acts and or conditions contributed to the incident?

☐ Failure to Lockout/tagout	☐ Not wearing PPE	☐ Defective tool / equipment
☐ Lack of training or knowledge	☐ Wearing unsafe clothing	☐ Willful disregard of safety policy
☐ Improper guarding	☐ Inattentiveness / distraction	☐ Failed to recognize hazard
☐ Poor housekeeping	☐ Over exertion / pushing / pulling	☐ Other:

Other – please explain:

2. What is the root causes(s) of the incident?
(Please list or describe) ______________________

____

____

____

3. Did the person(s) involved violate a Company safety rule/regulation? ☐ Yes ☐ No

If so, which one and describe? ______________________

____

____

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Name: **DOI:**

EQUIPMENT / MATERIAL ANALYSIS N/A ☐

1. **Was the equipment/machine/tool involved suited for the purpose?** ☐ Yes ☐ No

   If No, please explain

2. **Was the equipment/machine/tool involved in good condition?** ☐ Yes ☐ No

   If No, please explain

3. **Were the safeguards in place?** ☐ Yes ☐ No

   If No, please explain

ENVIRONMENT N/A ☐

1. **Was the area where the incident occurred well lit?** ☐ Yes ☐ No

   If No, please explain

2. **Walking/Working Surface:** ☐ Slippery ☐ Wet ☐ Dry ☐ Level ☐ Not level ☐ Cracked ☐ N/A

   Other:

CORRECTIVE ACTIONS N/A ☐

1.
2.
3.

Supervisor (print)		**Signature**		**Date**	

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
1. Incident Report	Investigating Supervisor	Within 8 hour or end of shift
2. Incident Statement	Person involved in incident	Within 24 hours
3. Incident Statement	Witness or description extension for Form 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

NOTE: Initial report within – 8hrs and a complete report with Incident Statement(s) within 24hr.

FIRST AID LOG – FORM # 4 Week of / /

Submit to Safety@jaginc.co Monthly

THIS FIRST AID LOG IS TO BE COMPLETED FOR ANY INJURY REPORTED TO A SUPERVISOR OR ANY FIRST-AID TREATEMENT PROVODED BY THE SUPERVISOR

Employee Name: *Jose Nunes* **Date:** *11/11/11* **Time:** *10:30* X AM ☐ PM
Type of Injury: *Cut right hand* **Description of Injury:** *Jose was opening a can with a screwdriver and cut his hand.*
The palm of his had was cut about ½” across
Treatment Given: *Cleaned the cut and put on a band-aid. Told Jose to check in with me in the morning.*
Person Treating: *John Smith*

1) **Employee Name:** ______ **Date:** ______ **Time:** ______ ☐ AM ☐ PM
Type of Injury: ______ **Description of Injury:** ______
Treatment Given: ______
Person Treating:

2) **Employee Name:** ______ **Date:** ______ **Time:** ______ ☐ AM ☐ PM
Type of Injury: ______ **Description of Injury:** ______
Treatment Given: ______
Person Treating:

3) **Employee Name:** ______ **Date:** ______ **Time:** ______ ☐ AM ☐ PM
Type of Injury: ______ **Description of Injury:** ______
Treatment Given:
Person Treating:

4) **Employee Name:** ______ **Date:** ______ **Time:** ______ ☐ AM ☐ PM
Type of Injury: ______ **Description of Injury:** ______
Treatment Given:
Person Treating:

5) **Employee Name:** **Date:** **Time:** ☐ AM ☐ PM
Type of Injury: ______ **Description of Injury:** ______
Treatment Given:
Person Treating:

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EQUIP/GL INCIDENT REPORT # 5

Complete Within 8 hours or before the End of Shift
email to: Safety@jaginc.co

Report Only	☐
Investigation #	

Company:		**Vehicle #:**	
Date of Incident:	**Time of Incident:**	☐ AM ☐ PM	
Date Reported:		**Shift:**	☐ 1 ☐ 2 ☐ 3 ☐ OTHER
Incident Location:		**Length of Shift:**	☐ 8 ☐ 10 ☐ 12 ☐ OTHER
City:	**State:**		

What day of the week did the incident occur : ☐ Mon ☐ Tue ☐ Wed ☐ Thur ☐ Fri ☐ Sat ☐ Sun

Type of Incident: ☐ Motor Vehicle Accident ☐ Equipment Damage ☐ Property Damage ☐ Theft ☐ Fire ☐ Near Miss ☐ Unsafe Condition ☐ Other:

Incident Description:

Accident / Incident Description

Driver/Operator Name:	**How long in Current Position:** Yrs. months
Employment Status: ☐ Employee ☐ Temporary ☐ Contractor ☐ Owner Operator	
Any Injuries: ☐ Yes ☐ No * ☐ Fatality If so, Who:	**Was anyone removed from the scene by ambulance?** * ☐ Yes ☐ No If so, Who:
Was any vehicle towed: * ☐ Yes ☐ No	**Which vehicle:** ☐ Yours ☐ Other driver ☐ Both
Was a police report made: ☐ Yes ☐ No	**Report # :** **Was Driver ticketed:** * ☐ Yes ☐ No

Other Driver's Insurance Information :	**Name:**	**Insurance:**	**Unavailable:** ☐
Other Vehicle Make:	**Model:**	**Ins. Carrier :**	**Policy #**
List the possible witnesses of the incident:	**1)**	**2)**	**3)**

Photographs taken: ☐ **Yes** ☐ **No** **(PICTURES MUST BE TAKEN!!!!)** **If not, why:**

Diagram of Incident :

Provide a drawing of the roadway configuration and all vehicles or objects that were invoilved in the incident.

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Accident / Incident Description - Continued

Incident Occurred during:	☐ **Loading** ☐ **Unloading** ☐ **In route (driving)** ☐ **Backing up** ☐ **Moving Forward** ☐ **Excessive Speed** ☐ **Unexpected Movement** ☐ **Unsafe Operation** ☐ **Turning** ☐ **Other :**
Vehicle Type:	☐ **Forklift** ____Ton ☐ **Tractor** ☐ **Trailer** ☐ **Straight Truck** (26,000 or below) ☐ **Auto** ☐ **Other**
Weather Conditions:	☐ **Clear** ☐ **Rain** ☐ **Snow** ☐ **Wind** ☐ **N/A** (In-side) ☐ **Sun Glare** ☐ **Other**
Road Conditions:	☐ **Dry** ☐ **Wet** ☐ **Snow covered** ☐ **Icy** ☐ **Dark** ☐ **Other**
Damage to:	☐ **Tire/wheels** ☐ **Cab** ☐ **Body** ______(Location) ☐ R ☐ L ☐ **Windshield** ☐ **N/A** ☐ **Drive Train** ☐ **Frame/Suspension** ☐ **Bumper -** ☐ Front ☐ Rear ☐ **Other**

Note: If the DOT driver received a ticket or answered yes to two (2) or more of the questions above with an asterisk (*) by it, then the driver must report for a Post-Accident Drug/ Alcohol Testing directly!!!

When was the Post Incident Drug & Alcohol Test done:

DOT D & A Test: ☐	**NON- DOT D & A Test:** ☐	**If a test was not performed, Why?**
Date:	**Time:** ☐ AM ☐ PM	**Location:** **State:**

Reminders for the Drivers:
- ☐ Completer drivers report of accident
- ☐ Protect the vehicle and cargo
- ☐ Set warning devices and move to A Safe location
- ☐ Discuss the incident with ONLY proper authorities
- ☐ Obtain information i.e. Other vehicle info/witness names and numbers etc.
- ☐ Pictures, Pictures, Pictures

Driver/Operator (print):	**Signature:**	**Date:**
Supervisor (print):	**Signature:**	**Date:**

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
Equipment Incident Report– Form # 5	Investigating Supervisor	Within 8 hour or End of shift
Incident Report – Form # 1	Supervisor (If Employee Injury Involved)	Within 8 hour or End of shift
Incident Statement –Form # 2	Person involved in incident	Within 24 hours
Incident Investigation-Form #3	Witness / Description extension for Parts 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

NOTE: Initial report within 8hrs/end of shift and a complete report with Incident Statement(s) etc. within 24hrs.

ADDENDUM # 10 – CONFINED SPACE FORM

CONFINED SPACE ENTRY PERMIT

LOCATION and DESCRIPTION of Confined Space:			
PURPOSE of Entry:			
DEPARTMENT:			
SUPERVISOR:			
Permit Type: ☐ **Specific Entry**	☐ **Duration of Job**	☐ **Annual**	☐ **Special/Hot Work**
Hazards: ☐ **O_2** ☐ **Other (specify)-**	☐ **Flammability**	☐ **Toxic Chemical (specify)-**	
KEY PERSONEL (Initialed by Individual)			

Authorized Entrants	Attendant(s)	Rescue Personnel
	1st -	
	2nd -	

ENTRY CHECKLIST

Item	YES	N/A	Item	YES	N/A
Lockout - De-energize/electrical			**Lifelines**		
Lockout - Mechanical/valves			**Fire Extinguisher(s)**		
Purge - Flush and Vent			**Rescue Personnel Available**		
Positive Ventilation			**Lighting**		
Secure Area, Barriers in Place			**Protective Clothing**		
Emergency SCBA at Site			**Oxygen Meter**		
Escape Harness			**Combustible Gas Meter**		
Tripod Emergency Escape Unit			**Chemical Detector**		

Special Precautions & Equipment:

Air Monitoring

Test Parameter	Permitted Condition	Perform Test		Initial Results	2	3	4	5
		YES	NO		Time	Time	Time	Time
% Oxygen	19.5 - 23%							
% of LEL	< 10 %							
% of CO	< 25 %							
Hydrogen Sulfide	< 10 %							

[QUALIFIED PERSON] has verified that all of the above conditions have been satisfied and authorizes work to proceed as specified:

Name: ________________________________ **Title:** ____________________________ **Date:** ______________________

ADDENDUM # 11 – LOTO FORMS

Figure 1 - Specific Equipment Lockout Procedures

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LOCKOUT TAGOUT FORMS
HSE SECTION 039

SPECIFIC EQUIPMENT LOCKOUT PROCEDURES		
Department:	Equipment No:	Energy Source:
LOCK ID ASSIGNMENT		
LOCK ID NUMBER	*COLOR*	*ASSIGNED TO*

PROCEDURE FOR SHUTDOWN List number of steps required to isolate machine or equipment. Write N/A on lines not used or add additional steps if necessary.	
STEP	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Additional Information:

____

____

____

____

____

Prepared By:	Signature:	Date:	Company: ☐ NRC ☐ CMI ☐ HXTT

This procedure is to be communicated to all authorized and affected employees and kept on file at location of machine or equipment.

Figure 2 – Sample TAG

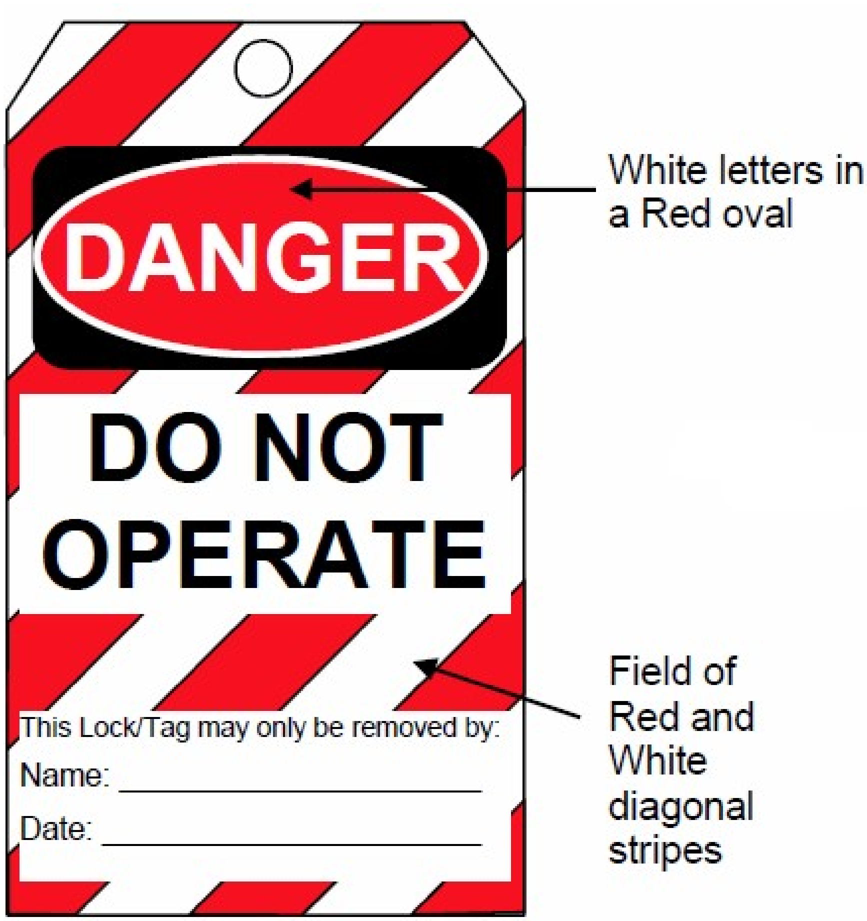

Figure 3 – Isolation Log

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LOCKOUT TAGOUT FORMS
HSE SECTION 039

ISOLATION LOG	
Date of Isolation:	Description of Work:
List of Equipment Out of Service:	Necessary Requirements of Clear Isolation:

Authorized Employee:	Signature:	Date:
Person Continuing Work:	Signature:	Date:

LOCKS/TAGS FOR GROUP LOCKOUT OR MULTIPLE LOCKS/TAGS				
Lock # or Tag	*Date Installed*	*Date Remover*	*Print Name (for Group Lockout)*	*Signature*

Prepared By:	Signature:	Date:	Company: ☐ NRC ☐ CMI ☐ HXTT

Figure 4 – Annual Audit of the Control of Hazardous Energy Program

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LOCKOUT TAGOUT FORMS
HSE SECTION 039

ANNUAL AUDIT OF THE CONTROL OF HAZARDOUS ENERGY PROGRAM
I certify that an audit of JAG Companies' Control of Hazardous Energy Program was conducted and that the below employees have demonstrated that they have been properly trained in the recognition and procedures to lockout equipment they may be required to work on or may be affected by.

Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:

I further acknowledge that the current procedure is adequate to safely lockout equipment in this department for servicing and/or maintenance.			
Department:	Manager (or Representative):	Signature:	Date:

ADDENDUM # 12 – 11.10 U.S. FEDERAL REG. - COMMERCIAL DIVING OPERATIONS

11.10 U.S. FEDERAL REGULATIONS REGARDING COMMERCIAL DIVING OPERATIONS

U.S. FEDERAL REGULATIONS REGARDING COMMERCIAL DIVING OPERATIONS

INTRODUCTION The following information on U.S. government regulations is provided for reference only. The Association of Diving Contractors International (ADCI) is an international organization and, therefore, each contractor will need to have knowledge of the applicable governmental regulations that apply to the diving operations in his or her specific area of operations. Nothing herein contained is intended to replace or supplant regulations, codes or standards applied by flag state or national bodies. The ADCI recognizes the validity of codes and standards developed by other recognized international organizations, such as, but not limited to, ship classification societies, IMCA, IMO, standards institutes, etc. Member companies of this association operating outside U.S. jurisdiction may have a need to follow such codes and standards prepared by others. However, if required to also comply with other standards or codes, member companies remain pledged to comply with not less than the minimum requirements of these standards in addition to any other requirements that may apply.

11.10 SUBCHAPTER V—MARINE OCCUPATIONAL SAFETY AND HEALTH STANDARDS PART
197—GENERAL PROVISIONS Subpart A [Reserved]
Subpart B—Commercial Diving Operations

GENERAL

197.200 Purpose of subpart.
197.202 Applicability.
197.203 Right of appeal.
197.204 Definitions.
197.205 Availability of standards.
197.206 Substitutes for required equipment, materials, apparatus, arrangements, procedures, or tests.
197.208 Designation of person-in-charge.
197.210 Designation of diving supervisor.

EQUIPMENT

197.300 Applicability. 197.310 Air compressor system.
197.312 Breathing supply hoses.
197.314 First aid and treatment equipment.
197.318 Gages and timekeeping devices.
197.320 Diving ladder and stage.
197.322 Surface-supplied helmets and masks.
197.324 Diver's safety harness.
197.326 Oxygen safety.
197.328 PVHO—General.
197.330 PVHO—Closed bells.
197.332 PVHO—Decompression chambers.
197.334 Open diving bells.
197.336 Pressure piping.
197.338 Compressed gas cylinders.
197.340 Breathing gas supply.
197.342 Buoyancy-changing devices.
197.344 Inflatable flotation devices.
197.346 Diver's equipment.

OPERATIONS

197.400 Applicability.
197.402 Responsibilities of the person-in charge.
197.404 Responsibilities of the diving supervisor.
197.410 Dive procedures.
197.420 Operations manual.

SPECIFIC DIVING MODE PROCEDURES

197.430 SCUBA diving.
197.432 Surface-supplied air diving.
197.434 Surface-supplied mixed gas diving.
197.436 Liveboating.

PERIODIC TESTS AND INSPECTIONS OF DIVING EQUIPMENT

197.450 Breathing gas tests.
197.452 Oxygen cleaning.
197.454 First aid and treatment equipment.
197.456 Breathing supply hoses.
197.458 Gages and timekeeping devices. 197.460 Diving equipment.
197.462 Pressure vessels and pressure piping.

RECORDS

197.480 Logbooks.
197.482 Logbook entries.
197.484 Notice of casualty.
197.486 Written report of casualty.
197.488 Retention of records after casualty.

Subpart B—Commercial Diving Operations GENERAL § 197.200 Purpose of subpart. This subpart prescribes rules for the design, construction, and use of equipment, and inspection, operation, and safety and health standards for commercial diving operations taking place from vessels and facilities under Coast Guard jurisdiction.

197.202 Applicability. (a) This subpart applies to commercial diving operations taking place at any deepwater port or the safety zone thereof as defined in 33 CFR part 150; from any artificial island, installation, or other device on the Outer Continental Shelf and the waters adjacent thereto as defined in 33 CFR part 147 or otherwise related to activities on the Outer Continental Shelf; and from all vessels required to have a certificate of inspection issued by the Coast Guard including mobile offshore drilling units regardless of their geographic location, or from any vessel connected with a deepwater port or within the deepwater port safety zone, or from any vessel engaged in activities related to the Outer Continental Shelf; except that this subpart does not apply to any diving operation— (1) Performed solely for marine scientific research and development purposes by educational institutions; (2) Performed solely for research and development for the advancement of diving equipment and technology; or (3) Performed solely for search and rescue or related public safety purposes by or under the control of a governmental agency. (b) Diving operations may deviate from the requirements of this subpart to the extent necessary to prevent or minimize a situation which is likely to cause death, injury, or major environmental damage. The circumstances leading to the situation, the deviations made, and the corrective action taken, if appropriate, to reduce the possibility of recurrence shall be recorded by the diving supervisor in the logbook as required by § 197.482(c).

197.203 Right of appeal. Any person directly affected by a decision or action taken under this subchapter, by or on behalf of the Coast Guard, may appeal therefrom in accordance with subpart 1.03 of this chapter. [CGD 88–033, 54 FR 50382, Dec. 6, 1989]

197.204 Definitions. As used in this subpart: ACFM means actual cubic feet per minute. ANSI Code1 means the B31.1 American National Standards Institute ''Code for Pressure Piping, Power Piping.'' ASME Code means the American Society of Mechanical Engineers ''Boiler and Pressure Vessel Code.'' ASME PVHO–1 means the ANSI/ ASME standard ''Safety Standard for Pressure Vessels for Human Occupancy.'' ATA means a measure of pressure expressed in terms of atmosphere absolute (includes barometric pressure). Bell means a compartment either at ambient pressure (open bell) or pressurized (closed bell) that allows the diver to be transported to and from the underwater work site, allows the diver access to the surrounding environment, and is capable of being used as a refuge during diving operations. Bottom time means the total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time to the next whole minute that the diver begins ascent. Breathing gas/breathing mixture means the mixed-gas, oxygen, or air as appropriate supplied to the diver for breathing. Bursting pressure means the pressure at which a pressure containment device would fail structurally. Commercial diver means a diver engaged in underwater work for hire excluding sport and recreational diving and the instruction thereof. Commercial diving operation means all activities in support of a commercial diver. Cylinder means a pressure vessel for the storage of gases under pressure. Decompression chamber means a pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system especially equipped to recompress, decompress, and treat divers. Decompression sickness means a condition caused by the formation of gas or gas bubbles in the blood or body tissue as a result of pressure reduction. Decompression table means a profile or set of profiles of ascent rates and breathing mixtures designed to reduce the pressure on a diver safely to atmospheric pressure after the diver has been exposed to a specific depth and bottom time. Depth means the maximum pressure expressed in feet of seawater attained by a diver and is used to express the depth of a dive. Dive location means that portion of a vessel or facility from which a diving operation is conducted. Dive team means the divers and diver support personnel involved in a diving operation, including the diving supervisor. Diver means a person working beneath the surface, exposed to hyperbaric conditions, and using underwater breathing apparatus. Diver-carried reserve breathing gas means a supply of air or mixed-gas, as appropriate, carried by the diver in addition to the primary or secondary breathing gas supplied to the diver. Diving installation means all of the equipment used in support of a commercial diving operation.

Diving mode means a type of diving requiring SCUBA, surface supplied air, or surface-supplied mixed-gas equipment, with related procedures and techniques. Diving stage means a suspended platform constructed to carry one or more divers and used for putting divers into the water and bringing them to the surface when in-water decompression or a heavy-weight diving outfit is used. Diving supervisor means the person having complete responsibility for the safety of a commercial diving operation including the responsibility for the safety and health of all diving personnel in accordance with this subpart. Facility means a deepwater port, or an artificial island, installation, or other device on the Outer Continental Shelf subject to Coast Guard jurisdiction. Fsw means feet of seawater (or equivalent static pressure head). Gas embolism means a condition caused by expanding gases, which have been taken into and retained in the lungs while breathing under pressure, being forced into the bloodstream or other tissues during ascent or decompression. Heavy-weight diving outfit means diver-worn surface-supplied deep-sea dress. Hyperbaric conditions means pressure conditions in excess of surface atmospheric pressure. Injurious corrosion means an advanced state of corrosion which may impair the structural integrity or safe operation of the equipment. Liveboating means the support of a surfaced-supplied diver from a vessel underway. Maximum working pressure means the maximum pressure to which a pressure containment device can be exposed under operating conditions (usually the pressure setting of the pressure relief device). No-decompression limits means the air depth and bottom time limits of appendix A. Pressure vessel means a container capable of withstanding an internal maximum working pressure over 15 psig. Psi(g) means pounds per square inch (gage). PVHO means pressure vessel for human occupancy but does not include pressure vessels for human occupancy that may be subjected to external pressures in excess of 15 psig but can only be subjected to maximum internal pressures of 15 psig or less (i.e., submersibles, or one atmosphere observation bells). Saturation diving means saturating a diver's tissues with the inert gas in the breathing mixture to allow an extension of bottom time without additional decompression. SCUBA diving means a diving mode in which the diver is supplied with a compressed breathing mixture from diver carried equipment. Standby diver means a diver at the dive location available to assist a diver in the water. Surface-supplied air diving means a diving mode in which the diver is supplied from the dive location or bell with compressed breathing air including oxygen or oxygen enriched air if supplied for treatment. Surface-supplied mixed-gas diving means a diving mode in which the diver is supplied from the dive location or bell with a compressed breathing mixture other than air. Timekeeping device means a device for measuring the time of a dive in minutes. Treatment table means a depth, time, and breathing gas profile designed to treat a diver for decompression sickness. Umbilical means the hose bundle between a dive location and a diver or bell, or between a diver and a bell, that supplies the diver or bell with a lifeline, breathing gas, communications, power, and heat as appropriate to the diving mode or conditions. Vessel means any waterborne craft including mobile offshore drilling units required to have a Certificate of Inspection issued by the Coast Guard or any waterborne craft connected with a deepwater port or within the deepwater port safety zone, or any waterborne craft engaged in activities related to the Outer Continental Shelf. Volume tank means a pressure vessel connected to the outlet of a compressor and used as an air reservoir. Working pressure means the pressure to which a pressure containment device is exposed at any particular instant during normal operating conditions.

197.205 Availability of standards. (a) Several standards have been incorporated by reference in this subchapter. The incorporation by reference has been approved by the Director of the Federal Register under the provisions of 1 CFR part 51. (b) The standards are available from the appropriate organizations whose addresses are listed below: (1) American National Standards Institute, 11 West 42nd Street, New York, NY 10036. (2) American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017. [CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 96–041, 61 FR 50735, Sept. 27, 1996]

197.206 Substitutes for required equipment, materials, apparatus, arrangements, procedures, or tests. (a) The Coast Guard may accept substitutes for equipment, materials, apparatus, arrangements, procedures, or tests required in this subpart if the substitute provides an equivalent level of safety. (b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, material, apparatus, arrangement, procedure, or test is unreasonable or impracticable, the Commandant may permit the use of alternate equipment, material, apparatus, arrangement, procedure, or test to such an extent and upon such condition as will insure, to his satisfaction, a degree of 11.10 International Consensus Standards For Commercial Diving And Underwater Operations 305 safety consistent with the minimum standards set forth in this subpart.

197.208 Designation of person-in-charge. (a) The owner or agent of a vessel or facility without a designated master shall designate, in writing, an individual to be the person-in-charge of the vessel or facility. (b) Where a master is designated, the master is the person-in charge.

197.210 Designation of diving supervisor. The name of the diving supervisor for each commercial diving operation shall be— (a) Designated in writing; and (b) Given to the person-in-charge prior to the commencement of any commercial diving operation.

EQUIPMENT

197.300 Applicability. (a) Each diving installation used on each vessel or facility subject to this subpart must meet the requirements of this subpart. (b) In addition to the requirements of this subpart, equipment which is permanently installed on vessels and is part of the diving installation must meet Subchapters F and J of this chapter. (c) All repairs and modifications to pressure vessels used for commercial diving operations must be made in accordance with the requirements of section VIII, division 1 or division 2 of the ASME Code, ASME PVHO–1, part 54 of this chapter, or 49 CFR 173.34, as applicable. (d) All repairs and modifications to pressure piping used for commercial diving operations must be made in accordance with the requirements of the ANSI Code or part 56 of this chapter, as applicable.

197.310 Air compressor system. A compressor used to supply breathing air to a diver must have— (a) A volume tank that is— (1) Built and stamped in accordance with section VIII, division 1 of the ASME Code with— (i) A check valve on the inlet side; (ii) A pressure gage; (iii) A relief valve; and (iv) A drain valve; and (2) Tested after every repair, modification, or alteration to the pressure boundaries as required by § 197.462; (b) Intakes that are located away from areas containing exhaust fumes of internal combustion engines or other hazardous contaminants; (c) An efficient filtration system; and (d) Slow-opening shut-off valves when the maximum allowable working pressure of the system exceeds 500 psig.

197.312 Breathing supply hoses. (a) Each breathing supply hose must— (1) Have a maximum working pressure that is equal to or exceeds— (i) The maximum working pressure of the section of the breathing supply system in which used; and (ii) The pressure equivalent of the maximum depth of the dive relative to the supply source plus 100 psig; (2) Have a bursting pressure of four times its maximum working pressure; (3) Have connectors that— (i) Are made of corrosion-resistant material; (ii) Are resistant to accidental disengagement; and (iii) Have a maximum working pressure that is at least equal to the maximum working pressure of the hose to which they are attached; and (4) Resist kinking by— (i) Being made of kink-resistant materials; or (ii) Having exterior support. (b) Each umbilical must— (1) Meet the requirements of paragraph (a) of this section; and (2) Be marked from the diver or open bell end in 10-foot intervals to 100 feet and in 50-foot intervals thereafter.

197.314 First aid and treatment equipment. (a) Each dive location must have— (1) A medical kit approved by a physician that consists of— (i) Basic first aid supplies; and (ii) Any additional supplies necessary to treat minor trauma and illnesses resulting from hyperbaric exposure; (2) A copy of an American Red Cross Standard First Aid handbook; (3) A bag-type manual resuscitator with transparent mask and tubing; and (4) A capability to remove an injured diver from the water. (b) Each diving installation must have a two-way communications system to obtain emergency assistance except when the vessel or facility ship-to shore, a two-way communications system is readily available. (c) Each dive location supporting mixed-gas dives, dives deeper than 130 fsw, or dives outside the no-decompression limits must meet the requirements of paragraph (a) of this section and have— (1) A decompression chamber; (2) Decompression and treatment tables; 11.10 International Consensus Standards For Commercial Diving And Underwater Operations 306 (3) A supply of breathing gases sufficient to treat for decompression sickness; (4) The medical kit required by paragraph (a)(1) of this section that is— (i) Capable of being carried into the decompression chamber; and (ii) Suitable for use under hyperbaric conditions; and(5) A capability to assist an injured diver into the decompression chamber.

197.318 Gages and timekeeping devices. (a) A gage indicating diver depth must be at each dive location for surface- supplied dives. (b) A timekeeping device must be at each dive location.

197.320 Diving ladder and stage. (a) Each diving ladder must— (1) Be capable of supporting the weight of at least two divers; (2) Extend 3 feet below the water surface; (3) Be firmly in place; (4) Be available at the dive location for a diver to enter or exit the water unless a diving stage or bell is provided; and (5) Be— (i) Made of corrosion-resistant material; or (ii) Protected against and maintained free from injurious corrosion. (b) Each diving stage must— (1) Be capable of supporting the weight of at least two divers; (2) Have an open-grating platform; (3) Be available for a diver to enter or exit the water from the dive location and for in-water decompression if the diver is— (i) Wearing a heavy-weight diving outfit; or (ii) Diving outside the no-decompression limits, except when a bell is provided; and (4) Be— (i) Made of corrosion-resistant material; or (ii) Protected against and maintained free from injurious corrosion.

197.322 Surface-supplied helmets and masks. (a) Each surface-supplied helmet or mask must have— (1) A nonreturn valve at the attachment point between helmet or mask and umbilical that closes readily and positively; (2) An exhaust valve; and (3) A two-way voice communication system between the diver and the dive location or bell. (b) Each surface-supplied air helmet or mask must— (1) Ventilate at least 4.5 ACFM at any depth at which it is operated; or (2) Be able to maintain the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

197.324 Diver's safety harness. Each safety harness used in surface supplied diving must have— (a) A positive buckling device; and (b) An attachment point for the umbilical lifeline that— (1) Distributes the pulling force of the umbilical over the diver's body; and (2) Prevents strain on the mask or helmet.

197.326 Oxygen safety. (a) Equipment used with oxygen or oxygen mixtures greater than 40 percent by volume must be designed for such use. (b) Oxygen systems with pressures greater than 125 psig must have slow opening shut-off valves except pressure boundary shut-off valves, may be ball valves.

197.328 PVHO—General. (a) Each PVHO, contracted for or purchased after February 1, 1979, must be built, and stamped in accordance with ASME PVHO–1. (b) Each PVHO, contracted for or constructed before February 1, 1979, and not Coast Guard approved, must be submitted to the Coast Guard for approval prior to February 1, 1984. (c) To be approved under paragraph (b), a PVHO must be— (1) Constructed in accordance with part 54 of this chapter; or— (2) Be built in accordance with section VIII, division 1 or division 2 of the ASME Code; and— (i) Have the plans approved in accordance with § 54.01– 18 of this chapter; (ii) Pass the radiographic and other survey tests of welded joints required by section VIII, division 1 or division 2, as appropriate, of the ASME Code; and (iii) Pass— (A) The hydrostatic test described in § 54.10–10 of this chapter; or (B) The pneumatic test described in § 54.10–15 of this chapter and such additional tests as the Officer-in-Charge, Marine Inspection (OCMI) may require. (d) Each PVHO must— (1) Have a shut-off valve located within 1 foot of the pressure boundary on all piping penetrating the pressure boundary; (2) Have a check valve located within 1 foot of the pressure boundary on all piping exclusively carrying fluids into the PVHO; (3) Have the pressure relief device required by ASME PVHO–1; (4) Have a built-in breathing system with at least one mask per occupant stored inside each separately pressurized compartment; (5) Have a two-way voice communications system allowing communications between an occupant in one pressurized compartment of the PVHO and— (i) The diving supervisor at the dive location; (ii) Any divers being supported from the same PVHO; and (iii) Occupants of other separately pressurized compartments of the same PVHO; (6) If designed to mechanically couple to another PVHO, have a two-way communications system allowing communications between occupants of each PVHO when mechanically coupled; (7) Have a pressure gage in the interior of each compartment that is— (i) Designed for human occupancy; and (ii) Capable of having the compartment pressure controlled from inside the PVHO; (8) Have viewports that allow observation of occupants from the outside; (9) Have viewports that meet the requirements of ASME PVHO–1 except those PVHO's approved under paragraph (b) of this section which have non acrylic viewports; (10) Have means of illumination sufficient to allow an occupant to— (i) Read gages; and (ii) Operate the installed systems within each compartment; (11) Be designed and equipped to minimize sources of combustible materials and ignition; (12) Have a protective device on the inlet side of PVHO exhaust lines; (13) Have a means of extinguishing a fire in the interior;

(14) Have a means of maintaining the oxygen content of the interior atmosphere below 25 percent surface equivalent by volume when pressurized with air as the breathing mixture; (15) Have a means of maintaining the interior atmosphere below 2 percent surface equivalent carbon dioxide by volume; (16) Have a means of overriding and controlling from the exterior all interior breathing and pressure supply controls; (17) Have a speech unscrambler when used with mixed-gas; (18) Have interior electrical systems that are designed for the environment in which they will operate to minimize the risk of fire, electrical shock to personnel, and galvanic action of the PVHO; and (19) Be tested after every repair, modification, or alteration to the pressure boundaries as required by § 197.462.

197.330 PVHO—Closed bells. (a) Except as provided in paragraph (b) of this section, each closed bell must meet the requirements of § 197.328 and— (1) Have underwater breathing apparatus for each occupant stored inside each separately pressurized compartment; (2) Have an umbilical; (3) Have lifting equipment attached to the closed bell capable of returning the occupied closed bell when fully flooded to the dive location; (4) Be capable of recompressing on the surface to the maximum design diving depth; (5) Be constructed and equipped as required by § 197.332; (6) Have an emergency locating device designed to assist personnel on the surface in acquiring and maintaining contact with the submerged PVHO if the umbilical to the surface is severed; (7) Have a capability to remove an injured diver from the water; and (8) Have a life support capability for the intact closed bell and its occupants for— (i) Twelve hours after an accident severing the umbilical to the surface when the umbilical to the surface is the only installed means of retrieving the closed bell; or (ii) A period of time, at least equal to 1 hour plus twice the time required to retrieve the bell from its designed operating depth and attach an auxiliary life support system, after an accident severing the umbilical to the surface when the umbilical is one of the two independent installed means of retrieving the closed bell, each meeting the requirements of paragraph (a) (3) of this section. (c) A closed bell that does not meet the requirements of paragraphs (a)(3), (a)(4), and (a)(5) of this section, must be capable of attachment to another PVHO that— (1) Allows the transfer of personnel and diver's equipment under pressure from the closed bell to the PVHO; (2) Meets the requirements of paragraph (a)(3) of this section; (3) Is capable of attachment to a decompression chamber meeting the requirements of paragraphs (a)(4) and (a)(5) of this section; and (4) Allows the transfer of personnel and diver's equipment under pressure from the PVHO to the decompression chamber.

197.332 PVHO—Decompression chambers. Each decompression chamber must— (a) Meet the requirements of § 197.328; (b) Have internal dimensions sufficient to accommodate a diver lying in a horizontal position and another person tending the diver; (c) Have a capability for ingress and egress of personnel and equipment while the occupants are under pressure; (d) Have a means of operating all installed man-way locking devices, except disabled shipping dogs, from both sides of a closed hatch; (e) Have interior illumination sufficient to allow visual observation, diagnosis, and medical treatment of an occupant. (f) Have one bunk for each two occupants; (g) Have a capability that allows bunks to be seen over their entire lengths from the exterior; (h) Have a minimum pressure capability of— (1) 6 ATA, when used for diving to 300 fsw; or (2) The maximum depth of the dive, when used for diving operations deeper than 300 fsw, unless a closed bell meeting the requirements of § 197.330(a) (3), (4), and (5) is used; (i) Have a minimum pressurization rate of 2 ATA per minute to 60 fsw and at least 1 ATA per minute thereafter; (j) Have a decompression rate of 1 ATA per minute to 33 fsw; (k) Have an external pressure gage for each pressurized compartment; (l) Have a capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work; and (m) Have a sound-powered headset or telephone as a backup to the communications system required by § 197.328(c) (5) and (6), except when that communications system is a sound-powered system.

197.334 Open diving bells. Each open diving bell must— (a) Have an upper section that provides an envelope capable of maintaining a bubble of breathing mixture available to a diver standing on the lower section of the platform with his body through the open bottom and his head in the bubble; (b) Have lifting equipment capable of returning the occupied open bell to the dive location; (c) Have an umbilical; and (d) Be— (1) Made of corrosion-resisting material; or (2) Protected against and maintained free from injurious corrosion.

197.336 Pressure piping. Piping systems that are not an integral part of the vessel or facility, carrying fluids under pressures exceeding 15 psig must— (a) Meet the ANSI Code; (b) Have the point of connection to the integral piping system of the vessel or facility clearly marked; and (c) Be tested after every repair, modification, or alteration to the pressure boundaries as set forth in § 197.462.

197.338 Compressed gas cylinders. Each compressed gas cylinder must— (a) Be stored in a ventilated area; (b) Be protected from excessive heat; (c) Be prevented from falling; (d) Be tested after any repair, modification, or alteration to the pressure boundaries as set forth in § 197.462; and (e) Meet the requirements of— (1) Part 54 of this chapter; or (2) 49 CFR 173.34 and 49 CFR part 178, subpart C.

197.340 Breathing gas supply. (a) A primary breathing gas supply for surface-supplied diving must be sufficient to support the following for the duration of the planned dive: (1) The diver. (2) The standby diver. (3) The decompression chamber, when required by §197.432(e)(2) or by § 197.434(a) for the duration of the dive and for one hour after completion of the planned dive. (4) A decompression chamber when provided but not required by this subpart. (5) A closed bell when provided or required by § 197.434(d). (6) An open bell when provided or required by § 197.432(e) (4) or by § 197.434(c). (b) A secondary breathing gas supply for surface-supplied diving must be sufficient to support the following: (1) The diver while returning to the surface. (2) The diver during decompression. (3) The standby diver. (4) The decompression chamber when required by §197.432(e)(2) or by § 197.434(a) for the duration of the dive and one hour after the completion of the planned dive. (5) The closed bell while returning the diver to the surface. (6) The open bell while returning the diver to the surface. (c) A diver-carried reserve breathing gas supply for surface supplied diving must be sufficient to allow the diver to— (1) Reach the surface. (2) Reach another source of breathing gas; or 11.10 International Consensus Standards For Commercial Diving And Underwater Operations 309 (3) Be reached by a standby diver equipped with another source of breathing gas for the diver. (d) A primary breathing gas supply for SCUBA diving must be sufficient to support the diver for the duration of the planned dive through his return to the dive location or planned pickup point. (e) A diver-carried reserve breathing gas supply for SCUBA diving must be sufficient to allow the diver to return to the dive location or planned pick-up point from the greatest depth of the planned dive. (f) Oxygen used for breathing mixtures must— (1) Meet the requirements of Federal Specification BB0–925a; and (2) Be type 1 (gaseous) grade A or B. (g) Nitrogen used for breathing mixtures must— (1) Meet the requirements of Federal Specification BBN–411c; (2) Be type 1 (gaseous); (3) Be class 1 (oil free); and (4) Be grade A, B, or C. (h) Helium used for breathing mixtures must be grades A, B, or C produced by the Federal Government, or equivalent. (i) Compressed air used for breathing mixtures must— (1) Be 20 to 22 percent oxygen by volume; (2) Have no objectionable odor; and (3) Have no more than— (i) 1,000 parts per million of carbon dioxide; (ii) 20 parts per million carbon monoxide; (iii) 5 milligrams per cubic meter of solid and liquid particulates including oil; and (iv) 25 parts per million of hydrocarbons (includes methane and all other hydrocarbons expressed as methane).

197.342 Buoyancy-changing devices. (a) A dry suit or other buoyancy changing device not directly connected to the exhaust valve of the helmet or mask must have an independent exhaust valve. (b) When used for SCUBA diving, a buoyancy-changing device must have an inflation source separate from the breathing gas supply.

197.344 Inflatable floatation devices. An inflatable floatation device for SCUBA diving must— (a) Be capable of maintaining the diver at the surface in a faceup position; (b) Have a manually activated inflation device; (c) Have an oral inflation device; (d) Have an over-pressure relief device; and (e) Have a manually operated exhaust valve.

197.346 Diver's equipment. (a) Each diver using SCUBA must have— (1) Self-contained underwater breathing equipment including— (i) A primary breathing gas supply with a cylinder pressure gage readable by the diver during the dive; and (ii) A diver-carried reserve breathing gas supply provided by— (A) A manual reserve (J valve); or (B) An independent reserve cylinder connected and ready for use; (2) A face mask; (3) An inflatable floatation device; (4) A weight belt capable of quick release; (5) A knife; (6) Swim fins or shoes; (7) A diving wristwatch; and (8) A depth gage. (b) Each diver using a heavyweight diving outfit must— (1) Have a helmet group consisting of helmet, breastplate, and associated valves and connections; (2) Have a diving dress group consisting of a basic dress that encloses the body (except for head and hands) in a tough, waterproof cover, gloves, shoes, weight assembly, and knife; 3) Have a hose group consisting of the breathing gas hose and fittings, the control valve, the lifeline, communications cable, and a pneumofathometer; and (4) Be provided with a helmet cushion and weighted shoes. (c) Each surface-supplied dive operation using a heavyweight diving outfit must have an extra breathing gas hose with attaching tools available to the standby diver. (d) Each diver using a lightweight diving outfit must have— (1) A safety harness; (2) A weight assembly capable of quick release; (3) A mask group consisting of a lightweight mask and associated valves and connections; (4) A diving dress group consisting of wet or dry diving dress, gloves, shoes or fins, and knife; and (5) A hose group consisting of the breathing gas hose and fittings, the control valve, the lifeline, communications cable, and a pneumofathometer (if the breaking strength of the communications cable is at least equal to that required for the lifeline, the communications cable can serve as the lifeline). (e) Each surface-supplied air dive operation within the no decompression limits and to depths of 130 fsw or less must have a primary breathing gas supply at the dive location. (f) Each surface-supplied dive operation outside the no compression limits, deeper than 130 fsw, or using mixed-gas as a breathing mixture must have at the dive location— (1) A primary breathing gas supply; and (2) A secondary breathing gas supply. (g) Each diver diving outside the no decompression limits, deeper than 130 fsw, or using mixed-gas must have a diver carried reserve breathing gas supply except when using a heavyweight diving outfit or when diving in a physically confining area.

OPERATIONS

197.400 Applicability. Diving operations may only be conducted from a vessel or facility subject to the subpart if the regulations in this subpart are met.

197.402 Responsibilities of the person-in-charge. (a) The person-in-charge shall— (1) Be fully cognizant of the provisions of this subpart; (2) Prior to permitting any commercial diving operation to commence, have— (i) The designation of the diving supervisor for each diving operation as required by § 197.210; (ii) A report on— (A) The nature and planned times of the planned diving operation; and (B) The planned involvement of the vessel or facility, its equipment, and its personnel in the diving operation. (b) Prior to permitting any commercial diving operation involving liveboating to commence, the person in charge shall insure that— (1) A means of rapid communications with the diving supervisor while the diver is entering, in, or leaving the water is established; and (2) A boat and crew for diver pickup in the event of an emergency is provided. (c) The person-in-charge shall insure that a boat and crew for SCUBA diver pickup is provided when SCUBA divers are not line-tended from the dive location. (d) The person-in-charge shall coordinate the activities on and of the vessel or facility with the diving supervisor. (e) The person-in-charge shall insure that the vessel or facility equipment and personnel are kept clear of the dive location except after coordinating with the diving supervisor.

197.404 Responsibilities of the diving supervisor. (a) The diving supervisor shall— (1) Be fully cognizant of the provisions of this subpart; (2) Be fully cognizant of the provisions of the operations manual required by § 197.420; (3) Insure that diving operations conducted from a vessel or facility subject to this subpart meet the regulations in this subpart; (4) Prior to the commencement of any commercial diving operation, provide the report required by § 197.402 to the person-in-charge; (5) Coordinate with the person-in charge any changes that are made to the report required by § 197.402; and (6) Promptly notify the person-in charge of any diving related casualty, accident, or injury. (b) The diving supervisor is in charge of the planning and execution of the diving operation including the responsibility for the safety and health of the dive team.

197.410 Dive procedures. (a) The diving supervisor shall insure that— (1) Before commencing diving operations, dive team members are briefed on— (i) The tasks to be undertaken; (ii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and (iii) Any modifications to the operations manual or procedures including safety procedures necessitated by the specific diving operation; (2) The breathing gas supply systems, masks, helmets, thermal protection, when provided, and bell lifting equipment, when a bell is provided or required, are inspected prior to each diving operation; (3) Each diver is instructed to report any physical problems or physiological effects including aches, pains, current illnesses, or symptoms of decompression sickness prior to each dive; (4) A depth, bottom time profile, including any breathing mixture changes, is maintained at the dive location for each diver during the dive, except that SCUBA divers shall maintain their own profiles; (5) A two-way voice communication system is used between— (i) Each surface-supplied diver and a dive team member at the dive location or bell (when provided); and (ii) The bell (when provided) and the dive location; (6) A two-way communication system is available at the dive location to obtain emergency assistance; (7) After the completion of each dive— (i) The physical condition of the diver is checked by— (A) Visual observation; and (B) Questioning the diver about his physical wellbeing; (ii) The diver is instructed to report any physical problems or adverse physiological effects including aches, pains, current illnesses, or symptoms of decompression sickness or gas embolism; (iii) The diver is advised of the location of an operational decompression chamber; and (iv) The diver is alerted to the potential hazards of flying after diving; (8) For any dive outside the no-decompression limits, deeper than 130 fsw, or using mixed-gas as a breathing mixture— (i) A depth, time, decompression profile including breathing mixture changes is maintained for each diver at the dive location; (ii) The diver is instructed to remain awake and in the vicinity of the dive location decompression chamber for at least one hour after the completion of a dive, decompression, or treatment; and (iii) A dive team member, other than the diver, is trained and available to operate the decompression chamber; and (9) When decompression sickness or gas embolism is suspected or symptoms are evident, a report is completed containing— (i) The investigation for each incident including— (A) The dive and decompression profiles; (B) The composition, depth, and time of breathing mixture changes; (C) A description of the symptoms including depth and time of onset; and (D) A description and results of the treatment; (ii) The evaluation for each incident based on— (A) The investigation; (B) Consideration of the past performance of the decompression table used; and (C) Individual susceptibility; and (iii) The corrective action taken, if necessary, to reduce the probability of recurrence. (b) The diving supervisor shall ensure that the working interval of a dive is terminated when he so directs or when— (1) A diver requests termination; (2) A diver fails to respond correctly to communications or signals from a dive team member; (3) Communications are lost and can not be quickly reestablished between— (i) The diver and a dive team member at the dive location; or (ii) The person-in-charge and the diving supervisor during liveboating operations; or (4) A diver begins to use his diver carried reserve breathing gas supply.

197.420 Operations manual. (a) The diving supervisor shall— (1) Provide an operations manual to the person-in-charge prior to commencement of any diving operation; and (2) Make an operations manual available at the dive location to all members of the dive team. (b) The operations manual must be modified in writing when adaptation is required because of— (1) The configuration or operation of the vessel or facility; or (2) The specific diving operation as planned. (c) The operations manual must provide for the safety and health of the divers. (d) The operations manual must contain the following: (1) Safety procedures and checklists for each diving mode used. (2) Assignments and responsibilities of each dive team member for each diving mode used. (3) Equipment procedures and checklists for each diving mode used. (4) Emergency procedures for— (i) Fire; (ii) Equipment failure; (iii) Adverse environmental conditions including, but not limited to, weather and sea state; (iv) Medical illness; and (v) Treatment of injury. (5) Procedures dealing with the use of— (i) Hand-held power tools; (ii) Welding and burning equipment; and (iii) Explosives.

SPECIFIC DIVING MODE PROCEDURES

197.430 SCUBA diving. The diving supervisor shall insure that— (a) SCUBA diving is not conducted— (1) Outside the no-decompression limits; (2) At depths greater than 130 fsw; (3) Against currents greater than one (1) knot unless line tended; and (4) If a diver cannot directly ascend to the surface unless line-tended; (b) The SCUBA diver has the equipment required by § 197.346(a); (c) A standby diver is available while a diver is in the water; (d) A diver is line-tended from the surface or accompanied by another diver in the water in continuous visual contact during the diving operation; (e) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line tending the diver; and (f) A boat is available for diver pickup when the divers are not line-tended from the dive location.

197.432 Surface-supplied air diving. The diving supervisor shall insure that— (a) Surface-supplied air diving is conducted at depths less than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw; (b) Each diving operation has a primary breathing gas supply; (c) Each diver is continuously tended while in the water; (d) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line-tending the diver; (e) For dives deeper than 130 fsw or outside the no decompression limits— (1) Each diving operation has a secondary breathing gas supply; (2) A decompression chamber is ready for use at the dive location; (3) A diving stage is used except when a bell is provided; (4) A bell is used for dives with an in water decompression time greater than 120 minutes, except when the diver is using a heavy-weight diving outfit or is diving in a physically confining space; (5) A separate dive team member tends each diver in the water; (6) A standby diver is available while a diver is in the water; and (7) Each diver has a diver-carried reserve breathing gas supply except when using a heavy-weight diving outfit or when diving in a physically confining space; and (f) The surface-supplied air diver has the equipment required by § 197.346 (b) or (d).

197.434 Surface-supplied mixed-gas diving. The diving supervisor shall insure that— (a) When mixed-gas diving is conducted, a decompression chamber or a closed bell meeting the requirements of § 197.332 is ready for use at the dive location; (b) A diving stage is used except when a bell is provided; (c) A bell is used for dives deeper than 220 fsw or when the dive involves in-water decompression times greater than 120 minutes, except when the diver is using a heavy-weight diving outfit or is diving in a physically confining space; (d) A closed bell is used for dives at depths greater than 300 fsw, except when diving is conducted in a physically confining space; (e) A separate dive team member tends each diver in the water; (f) A standby diver is available during all non-saturation dives; (g) When saturation diving is conducted— (1) A standby diver is available when the closed bell leaves the dive location until the divers are in saturation; and (2) A member of the dive team at the dive location is a diver able to assist in the recovery of the closed bell or its occupants, if required; (h) When closed bell operations are conducted, a diver is available in the closed bell to assist a diver in the water; (i) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line tending the diver; (j) Each diving operation has a primary and secondary breathing gas supply meeting the requirements of § 197.340; and (k) The surface-supplied mixed-gas diver has the equipment required by § 197.346 (b) or (d).

197.436 Liveboating. (a) During liveboating operations, the person-in-charge shall insure that— (1) Diving is not conducted in seas that impede station keeping ability of the vessel; (2) Liveboating operations are not conducted— (i) From 1 hour after sunset to 1 hour before sunrise; or (ii) During periods of restricted visibility; (3) The propellers of the vessel are stopped before the diver enters or exits the water; and (4) A boat is ready to be launched with crew in the event of an emergency. (b) As used in paragraph (a)(2)(ii) of this section, restricted visibility means any condition in which vessel navigational visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes. (c) During liveboating operations, the diving supervisor shall insure that— (1) Diving is not conducted at depths greater than 220 fsw; (2) Diving is not conducted in seas that impede diver mobility or work function; (3) A means is used to prevent the diver's hose from entangling in the propellers of the vessel; (4) Each diver carries a reserve breathing gas supply; (5) A standby diver is available while a diver is in the water; (6) Diving is not conducted with inwater decompression times greater than 120 minutes; and (7) The person-in-charge is notified before a diver enters or exits the water.

PERIODIC TESTS AND INSPECTIONS OF DIVING EQUIPMENT

197.450 Breathing gas tests. The diving supervisor shall insure that— (a) The output of each air compressor is tested and meets the requirements of § 197.340 for quality and quantity by means of samples taken at the connection point to the distribution system—(1) Every 6 months; and (2) After every repair or modification. (b) Purchased supplies of breathing mixtures supplied to a diver are checked before being placed on line for— (1) Certification that the supply meets the requirements of § 197.340; and (2) Noxious or offensive odor and oxygen percentage; (c) Each breathing supply system is checked, prior to commencement of diving operations, at the umbilical or underwater breathing apparatus connection point for the diver, for noxious or offensive odor and presence of oil mist; and (d) Each breathing supply system, supplying mixed-gas to a diver, is checked, prior to commencement of diving operations, at the umbilical or underwater breathing apparatus connection point for the diver, for percentage of oxygen.

197.452 Oxygen cleaning. The diving supervisor shall ensure that equipment used with oxygen or oxygen mixtures greater than 40 percent by volume is cleaned of flammable materials— (a) Before being placed into service; and (b) After any repair, alteration, modification, or suspected contamination.

197.454 First aid and treatment equipment. The diving supervisor shall ensure that medical kits are checked monthly to insure that all required supplies are present.

197.456 Breathing supply hoses. (a) The diving supervisor shall insure that— (1) Each breathing supply hose is pressure tested prior to being placed into initial service and every 24 months thereafter to 1.5 times its maximum working pressure; (2) Each breathing supply hose assembly, prior to being placed into initial service and after any repair, modification, or alteration, is tensile tested by— (i) Subjecting each hose-to-fitting connection to a 200 pound axial load; and (ii) Passing a visual examination for evidence of separation, slippage, or other damage to the assembly; (3) Each breathing supply hose is periodically checked for— (i) Damage which is likely to affect pressure integrity; and (ii) Contamination which is likely to affect the purity of the breathing mixture delivered to the diver; and (4) The open ends of each breathing supply hose are taped, capped, or plugged when not in use. (b) To meet the requirements of paragraph (a)(3) of this section, each breathing supply hose must be— (1) Carefully inspected before being shipped to the dive location; (2) Visually checked during daily operation; and (3) Checked for noxious or offensive odor before each diving operation.

197.458 Gages and timekeeping devices. The diving supervisor shall insure that— (a) Each depth gage and timekeeping device is tested or calibrated against a master reference gage or time-keeping device every 6 months; (b) A depth gage is tested when a discrepancy exists in a depth gage reading greater than 2 percent of full scale between any two gages of similar range and calibration; (c) A timekeeping device is tested when a discrepancy exists in a timekeeping device reading greater than one-quarter of a minute in a 4-hour period between any two timekeeping devices; and (d) Each depth gage and timekeeping device is inspected before diving operations are begun.

197.460 Diving equipment. The diving supervisor shall insure that the diving equipment designated for use in a dive under § 197.346 is inspected before each dive.

197.462 Pressure vessels and pressure piping. (a) The diving supervisor shall ensure that each pressure vessel, including each volume tank, cylinder and PVHO, and each pressure piping system is examined and tested as required by this section and after any repair, modification or alteration to determine that they are in satisfactory condition and fit for the service intended. (b) Pressure vessels and pressure piping shall be examined annually for mechanical damage or deterioration. Any defect that may impair the safety of the pressure vessel or piping shall be repaired and pressure tested to the satisfaction of the Officer in Charge, Marine Inspection. (c) The following tests shall be conducted at least every three years: (1) All piping permanently installed on a PVHO shall be pressure tested. (2) PVHOs subject to internal pressure shall be leak tested at the maximum allowable working pressure using the breathing mixture normally used in service. (3) Equivalent nondestructive testing may be conducted in lieu of pressure testing. Proposals to use nondestructive testing in lieu of pressure testing shall be submitted to the Officer in Charge, Marine Inspection. (d) Unless otherwise noted, pressure tests conducted in accordance with this section shall be either hydrostatic tests or pneumatic tests. (1) When a hydrostatic test is conducted on a pressure vessel, the test pressure shall be no less than 1.25 times the maximum allowable working pressure. (2) When a pneumatic test is conducted on a pressure vessel, the test pressure shall be the maximum allowable working pressure stamped on the nameplate. (3) When a pneumatic test is conducted on piping, the test pressure shall be no less than 90 percent of the setting of the relief device. (4) Pressure tests shall be conducted only after suitable precautions are taken to protect personnel and equipment. (5) When pressure tests are conducted on pressure vessels or pressure piping, the test pressure shall be maintained for a period of time sufficient to allow examination of all joints, connections and high stress areas. [CGD 95–028, 62 FR 51220, Sept. 30, 1997]

RECORDS

197.480 Logbooks. (a) The person-in-charge of a vessel or facility, that is required by 46 U.S.C. 11301 to have an official logbook, shall maintain the logbook on form CG–706. (b) The person-in-charge of a vessel or facility not required by 46 U.S.C. 11301 to have an official logbook, shall maintain, on board, a logbook for making the entries required by this subpart. (c) The diving supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart. [CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 95–028, 62 FR 51220, Sept. 30, 1997]

197.482 Logbook entries. (a) The person-in-charge shall insure that the following information is recorded in the logbook for each commercial diving operation: (1) Date, time, and location at the start and completion of dive operations. (2) Approximate underwater and surface conditions (weather, visibility, temperatures, and currents). (3) Name of the diving supervisor. (4) General nature of work performed. (b) The diving supervisor shall insure that the following information is recorded in the logbook for each commercial diving operation: (1) Date, time, and location at the start and completion of each dive operation. (2) Approximate underwater and surface conditions (weather, visibility, temperatures, and currents). (3) Names of dive team members including diving supervisor. (4) General nature of work performed. (5) Repetitive dive designation or elapsed time since last hyperbaric exposure if less than 24 hours for each diver. (6) Diving modes used. (7) Maximum depth and bottom time for each diver. (8) Name of person-in-charge. (9) For each dive outside the no-decompression limits, deeper than 130 fsw, or using mixed-gas, the breathing gases and decompression table designations used. (10) When decompression sickness or gas embolism is suspected or symptoms are evident— (i) The name of the diver; and (ii) A description and results of treatment. (11) For each fatality or any diving related injury or illness that results in incapacitation of more than 72 hours or requires any dive team member to be hospitalized for more than 24 hours— (i) The date; (ii) Time; (iii) Circumstances; and (iv) Extent of any injury or illness. (c) The diving supervisor shall insure that the following is recorded in the logbook for each diving operation deviating from the requirements of this subpart: (1) A description of the circumstances leading to the situation. (2) The deviations made. (3) The corrective action taken, if appropriate, to reduce the possibility of recurrence. (d) The diving supervisor shall insure that a record of the following is maintained: (1) The date and results of each check of the medical kits. (2) The date and results of each test of the air compressor. (3) The date and results of each check of breathing mixtures. (4) The date and results of each check of each breathing supply system. (5) The date, equipment cleaned, general cleaning procedure, and names of persons cleaning the diving equipment for oxygen service. (6) The date and results of each test of the breathing supply hoses and system. (7) The date and results of each inspection of the breathing gas supply system. (8) The date and results of each test of depth gages and timekeeping devices. (9) The date and results of each test and inspection of each PVHO. (10) The date and results of each inspection of the diving equipment. (11) The date and results of each test and inspection of pressure piping. (12) The date and results of each test and inspection of volume tanks and cylinders. (e) The diving supervisor shall insure that a notation concerning the location of the information required under paragraph (d) is made in the logbook. NOTE: 46 U.S.C. 11301 requires that certain entries be made in an official logbook in addition to the entries required by this section; and 46 U.S.C. 11302 prescribes the manner of making those entries. [CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by USCG–1999–6216, 64 FR 53229, Oct. 1, 1999

197.484 Notice of casualty. (a) In addition to the requirements of subpart 4.05 of this chapter and 33 CFR 146.30, the person-in-charge shall notify the Officer-in-Charge, Marine Inspection, as soon as possible after a diving casualty occurs, if the casualty involves any of the following: (1) Loss of life. (2) Diving-related injury to any person causing incapacitation for more than 72 hours. (3) Diving-related injury to any person requiring hospitalization for more than 24 hours. (b) The notice required by this section must contain the following: (1) Name and official number (if applicable) of the vessel or facility. (2) Name of the owner or agent of the vessel or facility. (3) Name of the person-in-charge. (4) Name of the diving supervisor. (5) Description of the casualty including presumed cause. (6) Nature and extent of the injury to persons. (c) The notice required by this section is not required if the written report required by § 197.486 is submitted within 5 days of the casualty. [CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 95–072, 60 FR 50469, Sept. 29, 1995]

197.486 Written report of casualty. The person-in-charge of a vessel or facility for which a notice of casualty was made under § 197.484 shall submit a report to the Officer-in-Charge, Marine Inspection, as soon as possible after the casualty occurs, as follows: (a) On Form CG–2692, when the diving installation is on a vessel. (b) Using a written report, in narrative form, when the diving installation is on a facility. The written report must contain the information required by § 197.484. (c) The report required by this section must be accompanied by a copy of the report required by § 197.410(a)(9) when decompression sickness is involved. (d) The report required by this section must include information relating to alcohol or drug involvement as required by § 4.05–12 of this chapter. (The reporting requirement in paragraph (a) was approved by OMB under control number 1625–0001) [CGD 76–009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 82–023, 47 FR 35748, Aug. 16, 1982; 48 FR 43328, Sept. 23, 1983; CGD 84–099, 52 FR

47536, Dec. 14, 1987; USCG–2006–25697, 71 FR 55747, Sept. 25, 2006]

197.488 Retention of records after casualty. (a) The owner, agent, or person-in charge of a vessel or facility for which a report of casualty is made under § 197.484 shall retain all records onboard that are maintained on the vessel or facility and those records required by this subpart for 6 months after the report of a casualty is made or until advised by the Officer-in-Charge, Marine Inspection, that records need not be retained onboard. (b) The records required by paragraph (a) of this section to be retained on board include, but are not limited to, the following: (1) All logbooks required by § 197.480. (2) All reports required by §197.402(a)(2)(ii), §197.404(a)(4), § 197.410(a)(9). (c) The owner, agent, person-in charge, or diving supervisor shall, upon request, make the records described in this section available for examination by any Coast Guard official authorized to investigate the casualty.

ADDENDUM # 13 – OSHA 1910 SUBPART T - COMMERCIAL DIVING OPERATIONS

Title 29 - Labor
Subtitle B - Regulations Relating to Labor
Chapter XVII - Occupational Safety and Health Administration, Department of Labor
Part 1910 - Occupational Safety and Health Standards

Source: 39 FR 23502, June 27, 1974, unless otherwise noted.

Subpart T - Commercial Diving Operations

Authority: 29 U.S.C. 653, 655, 657; 40 U.S.C. 333; 33 U.S.C. 941; Secretary of Labor's Order No. 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31160), or 4–2010 (75 FR 55355) as applicable, and 29 CFR 1911.

Source: 42 FR 37668, July 22, 1977, unless otherwise noted.

GENERAL

§ 1910.401 Scope and application.

(a) *Scope.*

(1) This subpart (standard) applies to every place of employment within the waters of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, Wake Island, Johnston Island, the Canal Zone, or within the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462, 43 U.S.C. 1331), where diving and related support operations are performed.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(ii) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(iii) Governed by 45 CFR part 46 (Protection of Human Subjects, U.S. Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(iv) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(B) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) *Alternative requirements for recreational diving instructors and diving guides.* Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by paragraphs (b)(2) and (c)(3)(iii) of § 1910.423 and paragraph (b)(1) of § 1910.426 when they meet all of the following conditions:

(i) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(ii) The instructor or guide is diving within the no-decompression limits in these operations;

(iii) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(iv) The instructor or guide is using an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(v) The employer of the instructor or guide is complying with all requirements of appendix C of this subpart.

(b) *Application in emergencies.* An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(1) Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(2) Upon request from the Area Director, submits such information in writing.

(c) *Employer obligation.* The employer shall be responsible for compliance with:

(1) All provisions of this standard of general applicability; and

(2) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 58 FR 35310, June 30, 1993; 69 FR 7363, Feb. 17, 2004]

§ 1910.402 Definitions.

As used in this standard, the listed terms are defined as follows:

Acfm: Actual cubic feet per minute.

ASME Code or equivalent: ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA: Atmosphere absolute.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

Bottom time: The total elasped time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

Bursting pressure: The pressure at which a pressure containment device would fail structurally.

Cylinder: A pressure vessel for the storage of gases.

Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

Decompression table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive-guiding operations means leading groups of sports divers, who use an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, to local undersea diving locations for recreational purposes.

Dive location: A surface or vessel from which a diving operation is conducted.

Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

Dive team: Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver: An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-carried reserve breathing gas: A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.

Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Fsw: Feet of seawater (or equivalent static pressure head).

Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.

Hyperbaric conditions: Pressure conditions in excess of surface pressure.

Inwater stage: A suspended underwater platform which supports a diver in the water.

Liveboating: The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

Mixed-gas diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No-decompression limits: The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives", U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Psi(g): Pounds per square inch (gauge).

Recreational diving instruction means training diving students in the use of recreational diving procedures and the safe operation of diving equipment, including an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, during dives.

Scientific diving means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA diving: A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby diver: A diver at the dive location available to assist a diver in the water.

Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

Treatment table: A depth-time and breathing gas profile designed to treat decompression sickness.

Umbilical: The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 69 FR 7363, Feb. 17, 2004]

PERSONNEL REQUIREMENTS

§ 1910.410 Qualifications of dive team.

(a) *General.*

(1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(2) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode: and

(iii) Diving operations and emergency procedures.

(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(4) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(b) *Assignments.*

(1) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(2) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(3) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(c) *Designated person-in-charge.*

(1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

GENERAL OPERATIONS PROCEDURES

§ 1910.420 Safe practices manual.

(a) *General.* The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(b) *Contents.*

(1) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(2) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

(a) *General.* The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(b) *Emergency aid.* A list shall be kept at the dive location of the telephone or call numbers of the following:

(1) An operational decompression chamber (if not at the dive location);

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

(5) The nearest U.S. Coast Guard Rescue Coordination Center.

(c) *First aid supplies.*

(1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions.

(3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(d) *Planning and assessment.* Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(1) Diving mode;

(2) Surface and underwater conditions and hazards;

(3) Breathing gas supply (including reserves);

(4) Thermal protection;

(5) Diving equipment and systems;

(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

(7) Repetitive dive designation or residual inert gas status of dive team members;

(8) Decompression and treatment procedures (including altitude corrections); and

(9) Emergency procedures.

(e) *Hazardous activities.* To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(f) *Employee briefing.*

(1) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(2) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(g) *Equipment inspection.* The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(h) *Warning signal.* When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982; 54 FR 24334, June 7, 1989]

§ 1910.422 Procedures during dive.

(a) *General.* The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(b) *Water entry and exit.*

(1) A means capable of supporting the diver shall be provided for entering and exiting the water.

(2) The means provided for exiting the water shall extend below the water surface.

(3) A means shall be provided to assist an injured diver from the water or into a bell.

(c) *Communications.*

(1) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(d) *Decompression tables.* Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(e) *Dive profiles.* A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(f) *Hand-held power tools and equipment.*

(1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(g) *Welding and burning.*

(1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(2) The welding machine frame shall be grounded.

(3) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(4) Insulated gloves shall be provided to divers performing welding and burning operations.

(5) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

(h) *Explosives.*

(1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of §§ 1910.109 and 1926.912 of Title 29 of the Code of Federal Regulations.

(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(3) Explosives shall not be detonated while the diver is in the water.

(i) *Termination of dive.* The working interval of a dive shall be terminated when:

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly re-established between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or

(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423 Post-dive procedures.

(a) *General.* The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(b) *Precautions.*

(1) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(c) *Recompression capability.*

(1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(3) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within 5 minutes of the dive location.

(4) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(6) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(d) *Record of dive.*

(1) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(e) *Decompression procedure assessment.* The employer shall:

(1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

SPECIFIC OPERATIONS PROCEDURES

§ 1910.424 SCUBA diving.

(a) *General.* Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* SCUBA diving shall not be conducted:

(1) At depths deeper than 130 fsw;

(2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(3) Against currents exceeding one (1) knot unless line-tended; or

(4) In enclosed or physically confining spaces unless line-tended.

(c) *Procedures.*

(1) A standby diver shall be available while a diver is in the water.

(2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(5) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

§ 1910.425 Surface-supplied air diving.

(a) *General.* Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.*

(1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(3) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(c) *Procedures.*

(1) Each diver shall be continuously tended while in the water.

(2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(3) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(4) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(5) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving.

(a) *General.* Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* Mixed-gas diving shall be conducted only when:

(1) A decompression chamber is ready for use at the dive location; and

(i) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(c) *Procedures.*

(1) A separate dive team member shall tend each diver in the water.

(2) A standby diver shall be available while a diver is in the water.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(5) Each diving operation shall have a dive-location reserve breathing gas supply.

(6) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(7) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(8) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

§ 1910.427 Liveboating.

(a) *General.* Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(b) *Limits.* Diving operations involving liveboating shall not be conducted:

(1) With an inwater decompression time of greater than 120 minutes;

(2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(3) Using mixed gas at depths greater than 220 fsw;

(4) In rough seas which significantly inpede diver mobility or work function; or

(5) In other than daylight hours.

(c) *Procedures.*

(1) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(2) A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

(3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(4) A standby diver shall be available while a diver is in the water.

(5) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

EQUIPMENT PROCEDURES AND REQUIREMENTS

§ 1910.430 Equipment.

(a) *General.*

(1) All employers shall comply with the following requirements, unless otherwise specified.

(2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(b) *Air compressor system.*

(1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

(3) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (CO_2) greater than 1,000 p/m;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

(c) *Breathing gas supply hoses.*

(1) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(2) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(3) Umbilicals shall:

(i) Be marked in 10-ft. increments to 100 feet beginning at the diver's end, and in 50 ft. increments thereafter;

(ii) Be made of kink-resistant materials; and

(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(d) *Buoyancy control.*

(1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(e) *Compressed gas cylinders.* Compressed gas cylinders shall:

(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.

(2) Be stored in a ventilated area and protected from excessive heat;

(3) Be secured from falling; and

(4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(f) *Decompression chambers.*

(1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(3) Each decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(g) *Gauges and timekeeping devices.*

(1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(2) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.

(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(4) A timekeeping device shall be available at each dive location.

(h) *Masks and helmets.*

(1) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) *Oxygen safety.*

(1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) *Weights and harnesses.*

(1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.

[39 FR 23502, June 27, 1974, as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]

RECORDKEEPING

§ 1910.440 Recordkeeping requirements.

(a)

(1) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(b) *Availability of records.*

(1) Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)–(e) and (g)–(i). Safe practices manuals (§ 1910.420), depth-time profiles (§ 1910.422), recordings of dives (§ 1910.423), decompression procedure assessment evaluations (§ 1910.423), and records of hospitalizations (§ 1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (§ 1910.430) shall also be provided upon request to employees and their designated representatives.

(3) Records and documents required by this standard shall be retained by the employer for the following period:

(i) [Reserved]

(ii) Safe practices manual (§ 1910.420)—current document only;

(iii) Depth-time profile (§ 1910.422)—until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording of dive (§ 1910.423)—1 year, except 5 years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (§ 1910.423)—5 years;

(vi) Equipment inspections and testing records (§ 1910.430)—current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§ 1910.440)—5 years.

(4) The employer shall comply with any additional requirements set forth at 29 CFR 1910.1020,

(5) [Reserved]

[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986; 61 FR 9242, Mar. 7, 1996; 71 FR 16672, Apr. 3, 2006; 76 FR 33607, June 8, 2011; 76 FR 80740, Dec. 27, 2011]

Appendix A to Subpart T of Part 1910 - Examples of Conditions Which May Restrict or Limit Exposure to Hyperbaric Conditions

The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

History of seizure disorder other than early febrile convulsions.

Malignancies (active) unless treated and without recurrence for 5 yrs.

Chronic inability to equalize sinus and/or middle ear pressure.

Cystic or cavitary disease of the lungs.

Impaired organ function caused by alcohol or drug use.

Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, moodaltering drugs, or insulin).

Meniere's disease.

Hemoglobinopathies.

Obstructive or restrictive lung disease.

Vestibular end organ destruction.

Pneumothorax.

Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).

Juxta-articular osteonecrosis.

Appendix B to Subpart T of Part 1910 - Guidelines for Scientific Diving

This appendix contains guidelines that will be used in conjunction with § 1910.401(a)(2)(iv) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.
2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[50 FR 1050, Jan. 9, 1985]

Appendix C to Subpart T of Part 1910 - Alternative Conditions Under § 1910.401(a)(3) for Recreational Diving Instructors and Diving Guides (Mandatory)

Paragraph (a)(3) of § 1910.401 specifies that an employer of recreational diving instructors and diving guides (hereafter, "divers" or "employees") who complies with all of the conditions of this appendix need not provide a decompression chamber for these divers as required under §§ 1910.423(b)(2) or (c)(3) or 1910.426(b)(1).

1. Equipment Requirements for Rebreathers

(a) The employer must ensure that each employee operates the rebreather (*i.e.*, semi-closed-circuit and closed-circuit self-contained underwater breathing apparatuses (hereafter, "SCUBAs")) according to the rebreather manufacturer's instructions.

(b) The employer must ensure that each rebreather has a counterlung that supplies a sufficient volume of breathing gas to their divers to sustain the divers' respiration rates, and contains a baffle system and/or other moisture separating system that keeps moisture from entering the scrubber.

(c) The employer must place a moisture trap in the breathing loop of the rebreather, and ensure that:

(i) The rebreather manufacturer approves both the moisture trap and its location in the breathing loop; and

(ii) Each employee uses the moisture trap according to the rebreather manufacturer's instructions.

(d) The employer must ensure that each rebreather has a continuously functioning moisture sensor, and that:

(i) The moisture sensor connects to a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) alarm that is readily detectable by the diver under the diving conditions in which the diver operates, and warns the diver of moisture in the breathing loop in sufficient time to terminate the dive and return safely to the surface; and

(ii) Each diver uses the moisture sensor according to the rebreather manufacturer's instructions.

(e) The employer must ensure that each rebreather contains a continuously functioning CO_2 sensor in the breathing loop, and that:

(i) The rebreather manufacturer approves the location of the CO_2 sensor in the breathing loop;

(ii) The CO_2 sensor is integrated with an alarm that operates in a visual (*e.g.,* digital, graphic, analog) or auditory (*e.g.,* voice, pure tone) mode that is readily detectable by each diver under the diving conditions in which the diver operates; and

(iii) The CO_2 alarm remains continuously activated when the inhaled CO_2 level reaches and exceeds 0.005 atmospheres absolute (ATA).

(f) Before each day's diving operations, and more often when necessary, the employer must calibrate the CO_2 sensor according to the sensor manufacturer's instructions, and ensure that:

(i) The equipment and procedures used to perform this calibration are accurate to within 10% of a CO_2 concentration of 0.005 ATA or less;

(ii) The equipment and procedures maintain this accuracy as required by the sensor manufacturer's instructions; and

(iii) The calibration of the CO_2 sensor is accurate to within 10% of a CO_2 concentration of 0.005 ATA or less.

(g) The employer must replace the CO_2 sensor when it fails to meet the accuracy requirements specified in paragraph 1(f)(iii) of this appendix, and ensure that the replacement CO_2 sensor meets the accuracy requirements specified in paragraph 1(f)(iii) of this appendix before placing the rebreather in operation.

(h) As an alternative to using a continuously functioning CO_2 sensor, the employer may use a schedule for replacing CO_2-sorbent material provided by the rebreather manufacturer. The employer may use such a schedule only when the rebreather manufacturer has developed it according to the canister-testing protocol specified below in Condition 11, and must use the canister within the temperature range for which the manufacturer conducted its scrubber canister tests following that protocol. Variations above or below the range are acceptable only after the manufacturer adds that lower or higher temperature to the protocol.

(i) When using CO_2-sorbent replacement schedules, the employer must ensure that each rebreather uses a manufactured (*i.e.,* commercially pre-packed), disposable scrubber cartridge containing a CO_2-sorbent material that:

(i) Is approved by the rebreather manufacturer;

(ii) Removes CO_2 from the diver's exhaled gas; and

(iii) Maintains the CO_2 level in the breathable gas (*i.e.,* the gas that a diver inhales directly from the regulator) below a partial pressure of 0.01 ATA.

(j) As an alternative to manufactured, disposable scrubber cartridges, the employer may fill CO_2 scrubber cartridges manually with CO_2-sorbent material when:

(i) The rebreather manufacturer permits manual filling of scrubber cartridges;

(ii) The employer fills the scrubber cartridges according to the rebreather manufacturer's instructions;

(iii) The employer replaces the CO_2-sorbent material using a replacement schedule developed under paragraph 1(h) of this appendix; and

(iv) The employer demonstrates that manual filling meets the requirements specified in paragraph 1(i) of this appendix.

(k) The employer must ensure that each rebreather has an information module that provides:

(i) A visual (*e.g.,* digital, graphic, analog) or auditory (*e.g.,* voice, pure tone) display that effectively warns the diver of solenoid failure (when the rebreather uses solenoids) and other electrical weaknesses or failures (*e.g.,* low battery voltage);

(ii) For a semi-closed circuit rebreather, a visual display for the partial pressure of CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA; and

(iii) For a closed-circuit rebreather, a visual display for: partial pressures of O_2 and CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA and a preset O_2 partial pressure of 1.40 ATA or lower; gas temperature in the breathing loop; and water temperature.

(l) Before each day's diving operations, and more often when necessary, the employer must ensure that the electrical power supply and electrical and electronic circuits in each rebreather are operating as required by the rebreather manufacturer's instructions.

2. Special Requirements for Closed-Circuit Rebreathers

(a) The employer must ensure that each closed-circuit rebreather uses supply-pressure sensors for the O_2 and diluent (*i.e.,* air or nitrogen) gases and continuously functioning sensors for detecting temperature in the inhalation side of the gas-loop and the ambient water.

(b) The employer must ensure that:

(i) At least two O_2 sensors are located in the inhalation side of the breathing loop; and

(ii) The O_2 sensors are: functioning continuously; temperature compensated; and approved by the rebreather manufacturer.

(c) Before each day's diving operations, and more often when necessary, the employer must calibrate O_2 sensors as required by the sensor manufacturer's instructions. In doing so, the employer must:

(i) Ensure that the equipment and procedures used to perform the calibration are accurate to within 1% of the O_2 fraction by volume;

(ii) Maintain this accuracy as required by the manufacturer of the calibration equipment;

(iii) Ensure that the sensors are accurate to within 1% of the O_2 fraction by volume;

(iv) Replace O_2 sensors when they fail to meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix; and

(v) Ensure that the replacement O_2 sensors meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix before placing a rebreather in operation.

(d) The employer must ensure that each closed-circuit rebreather has:

(i) A gas-controller package with electrically operated solenoid O_2-supply valves;

(ii) A pressure-activated regulator with a second-stage diluent-gas addition valve;

(iii) A manually operated gas-supply bypass valve to add O_2 or diluent gas to the breathing loop; and

(iv) Separate O_2 and diluent-gas cylinders to supply the breathing-gas mixture.

3. O_2 Concentration in the Breathing Gas

The employer must ensure that the fraction of O_2 in the nitrox breathing-gas mixture:

(a) Is greater than the fraction of O_2 in compressed air (*i.e.*, exceeds 22% by volume);

(b) For open-circuit SCUBA, never exceeds a maximum fraction of breathable O_2 of 40% by volume or a maximum O_2 partial pressure of 1.40 ATA, whichever exposes divers to less O_2; and

(c) For a rebreather, never exceeds a maximum O_2 partial pressure of 1.40 ATA.

4. Regulating O_2 Exposures and Diving Depth

(a) Regarding O_2 exposure, the employer must:

(i) Ensure that the exposure of each diver to partial pressures of O_2 between 0.60 and 1.40 ATA does not exceed the 24-hour single-exposure time limits specified either by the 2001 National Oceanic and Atmospheric Administration Diving Manual (the "2001 NOAA Diving Manual"), or by the report entitled "Enriched Air Operations and Resource Guide" published in 1995 by the Professional Association of Diving Instructors (known commonly as the "1995 DSAT Oxygen Exposure Table"); and

(ii) Determine a diver's O_2-exposure duration using the diver's maximum O_2 exposure (partial pressure of O_2) during the dive and the total dive time (*i.e.*, from the time the diver leaves the surface until the diver returns to the surface).

(b) Regardless of the diving equipment used, the employer must ensure that no diver exceeds a depth of 130 feet of sea water ("fsw") or a maximum O_2 partial pressure of 1.40 ATA, whichever exposes the diver to less O_2.

5. Use of No-Decompression Limits

(a) For diving conducted while using nitrox breathing-gas mixtures, the employer must ensure that each diver remains within the no-decompression limits specified for single and repetitive air diving and published in the 2001 NOAA Diving Manual or the report entitled "Development and Validation of No-Stop Decompression Procedures for Recreational Diving: The DSAT Recreational Dive Planner," published in 1994 by Hamilton Research Ltd. (known commonly as the "1994 DSAT No-Decompression Tables").

(b) An employer may permit a diver to use a dive-decompression computer designed to regulate decompression when the dive-decompression computer uses the no-decompression limits specified in paragraph 5(a) of this appendix, and provides output that reliably represents those limits.

6. Mixing and Analyzing the Breathing Gas

(a) The employer must ensure that:

(i) Properly trained personnel mix nitrox-breathing gases, and that nitrogen is the only inert gas used in the breathing-gas mixture; and

(ii) When mixing nitrox-breathing gases, they mix the appropriate breathing gas before delivering the mixture to the breathing-gas cylinders, using the continuous-flow or partial-pressure mixing techniques specified in the 2001 NOAA Diving Manual, or using a filter-membrane system.

(b) Before the start of each day's diving operations, the employer must determine the O_2 fraction of the breathing-gas mixture using an O_2 analyzer. In doing so, the employer must:

(i) Ensure that the O_2 analyzer is accurate to within 1% of the O_2 fraction by volume.

(ii) Maintain this accuracy as required by the manufacturer of the analyzer.

(c) When the breathing gas is a commercially supplied nitrox breathing-gas mixture, the employer must ensure that the O_2 meets the medical USP specifications (Type I, Quality Verification Level A) or aviator's breathing-oxygen specifications (Type I, Quality Verification Level E) of CGA G–4.3–2000 ("Commodity Specification for Oxygen"). In addition, the commercial supplier must:

(i) Determine the O_2 fraction in the breathing-gas mixture using an analytic method that is accurate to within 1% of the O_2 fraction by volume;

(ii) Make this determination when the mixture is in the charged tank and after disconnecting the charged tank from the charging apparatus;

(iii) Include documentation of the O_2-analysis procedures and the O_2 fraction when delivering the charged tanks to the employer.

(d) Before producing nitrox breathing-gas mixtures using a compressor in which the gas pressure in any system component exceeds 125 pounds per square inch (psi), the:

(i) Compressor manufacturer must provide the employer with documentation that the compressor is suitable for mixing high-pressure air with the highest O_2 fraction used in the nitrox breathing-gas mixture when operated according to the manufacturer's operating and maintenance specifications;

(ii) Employer must comply with paragraph 6(e) of this appendix, unless the compressor is rated for O_2 service and is oil-less or oil-free; and

(iii) Employer must ensure that the compressor meets the requirements specified in paragraphs (i)(1) and (i)(2) of § 1910.430 whenever the highest O_2 fraction used in the mixing process exceeds 40%.

(e) Before producing nitrox breathing-gas mixtures using an oil-lubricated compressor to mix high-pressure air with O_2, and regardless of the gas pressure in any system component, the:

(i) Employer must use only uncontaminated air (*i.e.*, air containing no hydrocarbon particulates) for the nitrox breathing-gas mixture;

(ii) Compressor manufacturer must provide the employer with documentation that the compressor is suitable for mixing the high-pressure air with the highest O_2 fraction used in the nitrox breathing-gas mixture when operated according to the manufacturer's operating and maintenance specifications;

(iii) Employer must filter the high-pressure air to produce O_2-compatible air;

(iv) The filter-system manufacturer must provide the employer with documentation that the filter system used for this purpose is suitable for producing O_2-compatible air when operated according to the manufacturer's operating and maintenance specifications; and

(v) Employer must continuously monitor the air downstream from the filter for hydrocarbon contamination.

(f) The employer must ensure that diving equipment using nitrox breathing-gas mixtures or pure O_2 under high pressure (*i.e.,* exceeding 125 psi) conforms to the O_2-service requirements specified in paragraphs (i)(1) and (i)(2) of § 1910.430.

7. Emergency Egress

(a) Regardless of the type of diving equipment used by a diver (*i.e.,* open-circuit SCUBA or rebreathers), the employer must ensure that the equipment contains (or incorporates) an open-circuit emergency-egress system (a "bail-out" system) in which the second stage of the regulator connects to a separate supply of emergency breathing gas, and the emergency breathing gas consists of air or the same nitrox breathing-gas mixture used during the dive.

(b) As an alternative to the "bail-out" system specified in paragraph 7(a) of this appendix, the employer may use:

(i) For open-circuit SCUBA, an emergency-egress system as specified in § 1910.424(c)(4); or

(ii) For a semi-closed-circuit and closed-circuit rebreather, a system configured so that the second stage of the regulator connects to a reserve supply of emergency breathing gas.

(c) The employer must obtain from the rebreather manufacturer sufficient information to ensure that the bail-out system performs reliably and has sufficient capacity to enable the diver to terminate the dive and return safely to the surface.

8. Treating Diving-Related Medical Emergencies

(a) Before each day's diving operations, the employer must:

(i) Verify that a hospital, qualified health-care professionals, and the nearest Coast Guard Coordination Center (or an equivalent rescue service operated by a state, county, or municipal agency) are available to treat diving-related medical emergencies;

(ii) Ensure that each dive site has a means to alert these treatment resources in a timely manner when a diving-related medical emergency occurs; and

(iii) Ensure that transportation to a suitable decompression chamber is readily available when no decompression chamber is at the dive site, and that this transportation can deliver the injured diver to the decompression chamber within four (4) hours travel time from the dive site.

(b) The employer must ensure that portable O_2 equipment is available at the dive site to treat injured divers. In doing so, the employer must ensure that:

(i) The equipment delivers medical-grade O_2 that meets the requirements for medical USP oxygen (Type I, Quality Verification Level A) of CGA G–4.3–2000 ("Commodity Specification for Oxygen");

(ii) The equipment delivers this O_2 to a transparent mask that covers the injured diver's nose and mouth; and

(iii) Sufficient O_2 is available for administration to the injured diver from the time the employer recognizes the symptoms of a diving-related medical emergency until the injured diver reaches a decompression chamber for treatment.

(c) Before each day's diving operations, the employer must:

(i) Ensure that at least two attendants, either employees or non-employees, qualified in first-aid and administering O_2 treatment, are available at the dive site to treat diving-related medical emergencies; and

(ii) Verify their qualifications for this task.

9. Diving Logs and No-Decompression Tables

(a) Before starting each day's diving operations, the employer must:

(i) Designate an employee or a non-employee to make entries in a diving log; and

(ii) Verify that this designee understands the diving and medical terminology, and proper procedures, for making correct entries in the diving log.

(b) The employer must:

(i) Ensure that the diving log conforms to the requirements specified by paragraph (d) ("Record of dive") of § 1910.423; and

(ii) Maintain a record of the dive according to § 1910.440 ("Recordkeeping requirements").

(c) The employer must ensure that a hard-copy of the no-decompression tables used for the dives (as specified in paragraph 6(a) of this appendix) is readily available at the dive site, whether or not the divers use dive-decompression computers.

10. Diver Training

The employer must ensure that each diver receives training that enables the diver to perform work safely and effectively while using open-circuit SCUBAs or rebreathers supplied with nitrox breathing-gas mixtures. Accordingly, each diver must be able to demonstrate the ability to perform critical tasks safely and effectively, including, but not limited to: recognizing the effects of breathing excessive CO_2 and O_2; taking appropriate action after detecting excessive levels of CO_2 and O_2; and properly evaluating, operating, and maintaining their diving equipment under the diving conditions they encounter.

11. Testing Protocol for Determining the CO_2 Limits of Rebreather Canisters

(a) The employer must ensure that the rebreather manufacturer has used the following procedures for determining that the CO_2-sorbent material meets the specifications of the sorbent material's manufacturer:

(i) The North Atlantic Treating Organization CO_2 absorbent-activity test;

(ii) The RoTap shaker and nested-sieves test;

(iii) The Navy Experimental Diving Unit ("NEDU")-derived Schlegel test; and

(iv) The NEDU MeshFit software.

(b) The employer must ensure that the rebreather manufacturer has applied the following canister-testing materials, methods, procedures, and statistical analyses:

(i) Use of a nitrox breathing-gas mixture that has an O_2 fraction maintained at 0.28 (equivalent to 1.4 ATA of O_2 at 130 fsw, the maximum O_2 concentration permitted at this depth);

(ii) While operating the rebreather at a maximum depth of 130 fsw, use of a breathing machine to continuously ventilate the rebreather with breathing gas that is at 100% humidity and warmed to a temperature of 98.6 degrees F (37 degrees C) in the heating-humidification chamber;

(iii) Measurement of the O_2 concentration of the inhalation breathing gas delivered to the mouthpiece;

(iv) Testing of the canisters using the three ventilation rates listed in Table I below (with the required breathing-machine tidal volumes and frequencies, and CO_2-injection rates, provided for each ventilation rate):

Table I—Canister Testing Parameters

Ventilation rates (Lpm, ATPS[1])	Breathing machine tidal volumes (L)	Breathing machine frequencies (breaths per min.)	CO_2 injection rates (Lpm, STPD[2])
22.5	1.5	15	0.90
40.0	2.0	20	1.35
62.5	2.5	25	2.25

[1] ATPS means ambient temperature and pressure, saturated with water.

[2] STPD means standard temperature and pressure, dry; the standard temperature is 32 degrees F (0 degrees C).

(v) When using a work rate (*i.e.*, breathing-machine tidal volume and frequency) other than the work rates listed in the table above, addition of the appropriate combinations of ventilation rates and CO_2-injection rates;

(vi) Performance of the CO_2 injection at a constant (steady) and continuous rate during each testing trial;

(vii) Determination of canister duration using a minimum of four (4) water temperatures, including 40, 50, 70, and 90 degrees F (4.4, 10.0, 21.1, and 32.2 degrees C, respectively);

(viii) Monitoring of the breathing-gas temperature at the rebreather mouthpiece (at the "chrome T" connector), and ensuring that this temperature conforms to the temperature of a diver's exhaled breath at the water temperature and ventilation rate used during the testing trial;[1]

(ix) Implementation of at least eight (8) testing trials for each combination of temperature and ventilation-CO_2-injection rates (for example, eight testing trials at 40 degrees F using a ventilation rate of 22.5 Lpm at a CO_2-injection rate of 0.90 Lpm);

(x) Allowing the water temperature to vary no more than ±2.0 degrees F (±1.0 degree C) *between* each of the eight testing trials, and no more than ±1.0 degree F (±0.5 degree C) *within* each testing trial;

(xi) Use of the average temperature for each set of eight testing trials in the statistical analysis of the testing-trial results, with the testing-trial results being the time taken for the inhaled breathing gas to reach 0.005 ATA of CO_2 (*i.e.*, the canister-duration results);

(xii) Analysis of the canister-duration results using the repeated-measures statistics described in NEDU Report 2–99;

(xiii) Specification of the replacement schedule for the CO_2-sorbent materials in terms of the lower prediction line (or limit) of the 95% confidence interval; and

(xiv) Derivation of replacement schedules only by interpolating among, but not by extrapolating beyond, the depth, water temperatures, and exercise levels used during canister testing.

[69 FR 7363, Feb. 17, 2004]

[1] NEDU can provide the manufacturer with information on the temperature of a diver's exhaled breath at various water temperatures and ventilation rates, as well as techniques and procedures used to maintain these temperatures during the testing trials.

ADDENDUM # 14 – JOB SAFETY ANALYSIS WORKSHEET

JOB SAFETY ANALYSIS WORKSHEET-ACTIVITY HAZARD ANALYSIS

COMPANY:	LOCATION:	DATE:	PAGE:	NEW ■ REVISED ☐
JOB OR TASK:				
TASK COMPLETED BY:	SUPERVISOR	ANALYSIS BY:		
REVIEWED BY :	APPROVED BY:			

REQUIRED PERSONAL PROTECTIVE AND EMERGENCY EQUIPMENT	DIVERS BAILOUT CALCULATED FOR 4-MINUTE MINIMUM AT DEPTH 50cu. Ft.		
5 MAN DIVE TEAM, HARD HATS, LIFE JACKETS, GLOVES, STEEL TOE BOOTS, SAFETY GLASSES	DEPTH/ 25fsw	PRESSURE/ 3000psi	AIR TIME/17.95min

SEQUENCE OF JOB STEPS	POTENTIAL HAZARDS	CONTROLS/PREVENTION MEASURES	RESPONSIBILITY
Environmental hazards			
Equipment hazards			
CREW SIGNATURES:			COMPANY REP SIGNATURE

COMPANY:	LOCATION:	DATE:	NEW ■ REVISED □
SEQUENCE OF JOB STEPS	POTENTIAL HAZARDS	CONTROLS/PREVENTION MEASURES	RESPONSIBILITY

CREW NAME	CREW SIGNATURE		