Marine Biological Laboratory

THE UNIVERSITY OF CHICAGO

CONFINED SPACE PROGRAM

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APPROVAL:

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1 POLICY

The purpose of this program is to ensure the protection of all Marine Biological Laboratory (MBL) employees from the potential hazards associated with confined space entry by defining requirements for safe entry practices and procedures in accordance with the Occupational Safety and Health Administration's (OSHA) Confined Space Standards (29 CFR 1910.146).

All confined spaces located at the MBL shall be shall be managed, investigated, and access shall be denied until the location has been cleared for entry in accordance with this policy.

2 DEFINITIONS

Confined Space*:* A "Confined Space" is defined as a space that meets **ALL** of the following criteria:

a) An employee can bodily enter in order to perform assigned work,
b) Has limited or restricted means for entry or exit,
c) Is not intended for continuous employee occupancy.

Permit Required Confined Space: A “Permit Required Confined Space" is defined by its physical construction or use and may have **one or more** of the following characteristics:

a) Contains or has the potential to contain a hazardous atmosphere.
b) Contains materials that have the potential for engulfing an entrant.
c) Contains any other recognized serious safety or health hazards (e.g., electrical hazard).
d) Has an internal configuration with a potential for entrapment or asphyxiation.

Non-Permit Required Confined Space: A “Non-permit Required Confined Space” is defined as a space that does not contain atmospheric hazards or have the potential to contain a hazard capable of causing death or serious harm.

Alternative Entry Procedure*:* If a Permit Required Confined Space demonstrates upon completion of a Confined Space Assessment Form (Appendix A) that the only hazard

posed by the permit space is a potential hazardous atmosphere, then Alternate Entry Procedures can be considered. The following conditions must be satisfied for the application of Alternate Entry Procedures:

a) Demonstrate that the only hazard posed by the permit space is a hazardous atmosphere.
b) Demonstrated that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry.
c) Confined Space Assessment Form conclusion for Alternative Entry Procedure is agreed upon by the EH&S Manager and the POM Manager/Supervisor.
d) Manager/Supervisor must then inform each employee who enters the space of the decision to follow the Alternate Entry Procedure and provide documentation supporting the Alternate Entry Procedure.

3 AUTHORITY AND RESPONSIBILITY

For the plan to be effective, all individuals associated with confined spaces must follow requirements as outlined in this document. The responsibilities for all parties involved with the Confined Space Entry Program is defined below which include the Environmental Health and Safety (EH&S) Manager, Assistant Facilities Director (POM Manager), Authorized Confined Space Entrant, Authorized Confined Space Attendant, and any contractor/subcontractors for MBL.

3.1 Environmental Health and Safety (EH&S) Manager is responsible for:

- Investigating all known and suspected confined spaces;
- Completing a Confined Space Profile for all confined spaces;
- Designating confined spaces as permit-required confined spaces or non-permit confined spaces;
- Implementing the measures necessary to prevent unauthorized entry into a permit-required confined space by posting warning signs or other equally effective means;
- Determining if a permit-required confined space can be reclassified as a non-permit confined space;
- Developing, implementing and annually reviewing the Confined Space Program;
- Initially reviewing and approving all departmental policies for specific permit-required confined spaces prior to implementation;

- Providing entry supervisors for all permit-required confined space entry procedures;
- Providing a means of training employees involved with permit-required confined space entry; and
- Coordinating with the department supervisor and contractor's entry supervisor to ensure proper procedures are followed prior to entry, during entry operations, and after entry into permit-required confined space(s).

3.2 Plant Operations and Maintenance (POM) Manager is responsible for:

- Identify and report to the Safety Office any locations that have the potential of being confined spaces;
- Developing and implementing departmental policies specific to each identified confined space;
- Informing contractors of any permit-required confined space(s);
- Providing authorized entrants and attendants to perform assigned tasks in permit-required confined spaces;
- Ensuring that affected employees participate in training programs as prescribed by this policy;
- Providing necessary equipment to control permit-required confined space atmospheres at levels that will permit occupancy;
- Enforce all applicable safety programs and procedures including but not limited to Lockout/Tag-out, Fall Protection, Respiratory Protection, etc; and
- Notify immediately EH&S Manager in the event a Non-Permit Confined Space conditions have changed.

3.3 Authorized Confined Space Entrant is responsible for the following:

- Comply with the confined space entry program contained herein and with those procedures stipulated by the manager or supervisor;
- Understand the hazards that may be faced during entry;
- Recognize the signs and symptoms of exposure to a potentially hazardous atmosphere;
- Understand the use and limitations of personal protective equipment and other safety equipment that is provided. Report any deficiencies or malfunction of equipment to site Manager or Supervisor;
- Maintain constant communication with the confined space attendant; and
- Exit the confined space quickly when required.

3.4 Authorized Confined Space Attendant is responsible for the following:

- Comply with the confined space entry Program contained herein and with those procedures stipulated by the manager or supervisor;
- Recognize the signs and symptoms of exposure to a potentially hazardous atmosphere;
- Maintain constant communication with confined space entrant;
- Remain outside the permit space at all times with no conflicting duties;
- Prevent unauthorized entry;
- Perform non-entry rescue; and
- Clearly understand that under no circumstance may an Authorized Attendant or anybody else enter a confined space that is suspect of having a hazardous atmosphere, without appropriate respiratory protection, even to rescue a fellow employee.

3.5 Contractors/Subcontractors is responsible for the following:

- Utilizing any available information from MBL regarding the permit-required confined space hazards and entry operations prior to entry;
- Informing the MBL of the permit-required confined space program to be followed by the contractor during the aforementioned initial meeting;
- Providing an entry supervisor when sole entry into a permit-required confined space consists of their employees;
- Provide Confined Space and Respiratory Protection training and proper entry equipment to their personnel;
- Communicate to MBL on any equipment being taken out of service in the confined space, any unique restrictions, and any changes to the environment which will impact the confined space; and
- Contact MBL manager or supervisor upon completion of projected work and request an official release of the confined space entry permit.

4.0 ASSESSMENT OF HAZARDS

4.1 Atmospheric Hazards:

The most common hazardous atmospheric conditions that constitute a potential health and safety hazard in confined spaces are:

a) An oxygen deficient atmosphere with a concentration of less than 19.5% by volume. Normal oxygen levels typically contain 20.9% by volume.
b) Combustible gases or vapors which pool in the atmosphere within a confined space above their respective lower explosive limits, thus having the potential to explode or ignite if an ignition source is inadvertently introduced.
c) The off-gassing of a toxic residue or chemicals which have the ability to deplete oxygen levels or in themselves create a toxic atmosphere. (e.g., Carbon monoxide).

4.2 Confined Space Assessment:

Prior to the entry of any new or existing potential confined spaces, the Safety Office in cooperation with the POM Manager and/or Supervisor shall conduct an assessment of the location utilizing MBL's Confined Space Assessment form (Appendix A). In accordance with the Occupational Safety and Health Administration guidelines, this form will identify whether the potential confined space is Permit-required or a Non-permit required confined space or Alternative Entry Procedures; and define the potential hazards associated with that space.

The following hazards shall be evaluated for all confined spaces prior to entry:

- Atmospheric hazards
- Entry conditions (ladder)
- Electrical hazards
- Temperature hazards
- Engulfment hazards
- Flammable atmosphere
- Chemical hazards
- Mechanical hazards
- Noise hazards
- Physical hazards (fall, debris, slipping hazards)

For evaluation of the atmospheric conditions, a MSA Sirius Multi-gas Detector is used by the EH&S Department. The MSA Sirius unit will determine % Oxygen, Combustible % LEL, Carbon Monoxide PPM, Hydrogen Sulfide PPM and Other Gases (PPM). See Appendix C for instructions on use of detector.

The final determination from this form will dictate the personal protective equipment requirements, requirement for completion of the MBL Confined

Space Permit Entry (Appendix B) and the extent of personnel monitoring surveillance.

4.3 Posting Confined Spaces

To effectively warn personnel of the potential hazards posed by Confined Spaces, warning signs will be posted at each confined space identified by the EH&S Department in conjunction with the POM Department.

4.3.1 Signage used by MBL employees should read as follows for a Permit Required Confined Space:

"**DANGER - CONFINED SPACE, ENTER BY PERMIT ONLY"**

The following areas have been identified as Permit Required Confined Spaces:

- Two Manholes on Quad side of Rowe with High Voltage Contractor Access Only
- Two Manholes Loeb Parking, Communication and Electrical Contractor Access Only

4.3.2 Signage used by MBL employees should read as follows for a Non-permit Required Confined Space:

"DANGER-CONFINED SPACE,
AUTHORIZED PERSONNEL ONLY"

The following areas have been identified as Non–Permit Required Confined Spaces:

- Loeb Building, Room G2 (rear right corner, floor access)
  Sump pump,
  Room dimensions - 11'8"by 18'7" and 7' height

- Lillie Building, Pipe Chaser (front left corner of building)
  Underground pipes bring seawater to roof
  Room dimensions - 8' by 18' and 7' height

- Lillie Building, Roof, 9 Fiberglass Water Tanks
  Tank dimension - 10' across by 9' deep

5.0 CONFINED SPACE PROCEDURES

5.1 Non-Permit Required Confined Space Entry Procedures

A Non-permit Required Confined Space, by definition, poses no hazard to an employee more serious than its restricted means of entry and exit. Therefore, provided that the work to be performed lacks any potential to create a prohibited or unacceptable condition, entry to a non-permit-required confined space may proceed as described below:

- Review the work to see if personal protective equipment is needed;
- Establish traffic control barriers at the entry point, if applicable;
- Eliminate any condition that would make removal of the confined space entry cover unsafe;
- Once the entry cover is removed, promptly guard the entry point with a temporary barrier to prevent an accidental fall through the opening and protect employees working in the space from foreign objects entering the space;
- Visually verify conditions of the confined space have not changed, such as standing water.
- Ensure a safe means of communication is available; and
- Ensure appropriate lighting and/or equipment (e.g., ladders) for safe entry and exit by entrants is available.

EXCEPTION: The confined space – Lillie Water Tanks – will maintain a Confined Space Attendant to be assigned on the upper platform in full view of the entrants for the duration of the project.

Note: Activities involving chemical processes (PVC cement, painting) or hot work (welding) can result in a change in the atmosphere of a confined space. If these activities are to be performed within a confined space designated as a non-permit confined space, EH&S Manager shall be contacted prior to entry.

5.2 Permit Required Confined Space Entry Procedures

EH&S Manager shall be contacted at 508-289-7424 at least 24 hours in advance to the anticipated entry into a Permit Required Confined Space so that the appropriate visual evaluation and atmospheric monitoring of the space can be performed.

EXCEPTION: EH&S Manager shall be notified immediately during an emergency situation involving the anticipated entry into a Permit Required Confined Space to perform the appropriate evaluations of the space.

The following conditions shall be met prior to entry into a Permit Required Confined Space:

- The POM Manager/Supervisor and EH&S Manager shall perform a visual inspection of the Permit Required Confined Space and document the general purpose of entry and nature of hazards on the Confined Space Entry Permit (Appendix B);
- EH&S Manager shall conduct pre-entry monitoring to determine if the space contains a hazardous atmosphere and document all results on the Confined Space Entry Permit;
- If the Permit Required Confined Space is determined by EH&S Manager as safe for entry, then a permit will be issued. If a permit is denied, the EH&S Manager will identify the measures to be taken in order for a permit to be awarded. Entry shall be prohibited until EH&S Manager deems the space safe for entry and issues a permit;
- If an Confined Space Entry Permit is awarded, EH&S Manager shall complete and post the entry permit or provide the permit to the supervisor to post at the entry portal of the Permit Required Confined Space;
- The Authorized Entrant shall wear a Multi-gas Detector meter provided by EH&S Department for continuous air monitoring of the atmosphere in the Permit Required Confined Space. When work is complete, the Authorized Entrant shall return meter to EH&S Department;
- Only the assigned tasks or activities identified on the permit shall be conducted within the Permit Required Space and the duration of the permit may not exceed the time required to complete those assigned tasks or activities. If the assigned work goes beyond the planned time period or work tasks/activities other than those identified on the permit become necessary, the Authorized Entrant shall leave the space and inform the supervisor of the expiration of the permit or of the newly proposed work tasks or activities. The POM Manager/Supervisor shall contact EH&S Manager immediately for a re-evaluation of the space in regard to the proposed work task or activity;

- The POM Manager/Supervisor shall supervise the entry team's implementation of the means, procedures and practices necessary for safe entry operations which may include, but are not limited to, the following:

    1. Isolating the permit space by blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; using a double block and bleed system; using lockout or tagout procedures; or blocking or disconnecting all mechanical linkages;
    2. Purging, inerting, flushing, or ventilating the Permit Required Confined Space as necessary to eliminate or control atmospheric hazards;
    3. Providing pedestrian, vehicle, or other barriers to protect entrants from external hazards whenever a Permit Required Confined Space is entered; and
    4. Follow all non-permit required confined space prior to entry procedures.

5.3 Reclassifying Permit to Non-Permit Required Confined Spaces

Under certain conditions, the POM Manager/Supervisor may temporarily reclassify a Permit Required Confined Space to Non-permit Required Confined Space. This action can facilitate entry into the space by reducing the entry requirements. The specific conditions necessary to allow this temporary reclassification are as follows:

- All hazards within the permit space are eliminated prior to entry through isolation techniques (e.g., lockout/tagout, line blocking, purging) which must be accomplished without having to enter the space; and
- The space poses no atmospheric hazard (actual or potential) during entry. Any atmospheric hazard eliminated shall remain eliminated throughout the duration of the entry operation. Note: The use of continuous forced air ventilation to control an atmospheric hazard does not "eliminate" the hazard and thus does not constitute compliance with this condition.

EH&S Manager shall document this reclassification on the Confined Space Entry Permit and that all hazards in the space have been eliminated. The

Confined Space Entry Permit is then made available to all employees entering the space by posting of the permit at the entry point to the space.

The reclassification remains valid only for as long as the hazards remain eliminated. All Non-permit Required Confined Spaces procedure prior to entry shall be followed. If a hazard is detected during entry, all employees will immediately evacuate the space and the POM Manager/Supervisor will evaluate the space to determine how the prohibited conditions developed and implement measures to eliminate the prohibited conditions and prevent its recurrences before any subsequent re-entry.

5.4 Alternate Entry Procedures for Permit Required Confined Spaces

Alternate Entry Procedures can only be used when the only hazard present in a confined space is an actual or potential atmospheric hazard that can be controlled through ventilation alone. In short, this means that a permit is not required before entry, rescue arrangements do not have to be made, and no Authorized Attendant is required. It is extremely important to follow the procedures below when using the Alternate Entry Procedure:

- Demonstrate that the only hazard posed by the space is an actual or potential hazardous atmosphere, which means that any hazard involving high noise levels, lockout-tagout, engulfment, excessive heat or cold, fall or and other hazards shall be eliminated;
- Demonstrate that continuous forced air ventilation alone is sufficient for safe entry;
- Develop monitoring and inspection data to support the above. If initial entry into the space is necessary to collect such data, the Authorized Entrant shall follow the complete permit program; and
- Make available to each employee who enters the space, the data collected to prove that the space qualifies for Alternate Entry Procedures.

Even with Alternate Entry Procedures, the following requirements shall be met prior to entry:

- The internal atmosphere shall be tested for oxygen content, flammable gases and vapors, and potential toxic air contaminants to ensure there is no hazardous atmosphere in the space;

- Forced air ventilation shall be provided in the area where the employee will be present in order to control any hazardous atmosphere;
- Authorized Entrant shall wear a Multi-gas detector meter for the duration of the work being performed in the space; and
- All Alternate Entry Procedure requirements have been met and documented on the Confined Space Entry Permit.

5.5 Termination of Work

Individual departments shall contact the POM Manager/Supervisor to terminate entry and cancel the permit when the work covered by the entry permit has been completed and/or a condition that is not allowed under the entry permit arises in or near the space.

5.6 Contractors

If an outside contractor is hired to perform work within a Permit Required Confined Space at the MBL, the POM Manager/Supervisor shall contact EH&S Manager 3 days prior to beginning the work.

The POM Manager/Supervisor from EH&S Manager shall coordinate entry operations with the entry supervisor of the outside contractor when employees from the MBL and the Contractor will be working together in or near a Permit Required Confined Space.
The POM Manager/Supervisor from EH&S Manager shall be responsible for the following:

1. Informing the contractor that the area in question is a Permit Required Confined Space;
2. Reviewing the Permit Required Confined Space program with the contractor;
3. Informing the contractor of the hazards identified within the space and any past experience with the space;
4. Informing the contractor of any precautions or procedures that have been implemented for the protection of employees in the Permit Required Confined Space where contractor personnel will be working;
5. Contractor must sign off on compliance with Entry Permit; and

6. Debriefing the contractor at the end of the work as needed, to identify hazards discovered or created in the Permit Required Confined Space during operations.

5.7 Rescue and Emergency Services

If an Authorized Attendant becomes aware that an Authorized Entrant needs assistance in escaping from the space, the attendant shall immediately contact MBL Security at **x7911** from a campus phone or **508-289-7911** from an off campus phone. Authorized Attendants shall never enter the space to attempt a rescue and always remain outside the Permit Required Confined Space during entry operations until relieved by another Authorized Attendant.

Security will notify the Falmouth Fire Department of the emergency and provide your location. The POM Manager/Supervisor shall inform the Falmouth Fire Department of the hazards they may confront when called upon to perform a Permit Required Confined Space rescue.

6.0 TRAINING

The MBL Safety Office shall provide training so that all employees whose work in areas of confined spaces acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned.

Only trained Authorized Attendants, Authorized Entrants, POM Manager/Supervisor shall be authorized to work in and around a space defined as “Permit Required Confined Space” or a “Non-permit Required Confined Space”. Training shall be provided to all employees identified by the POM Manager/Supervisor as having the potential to work in or around confined spaces. Training shall be conducted:

- Before an employee is assigned to a duty involving entry into a confined space;
- Before there is a change in assigned duties (e.g., attendant becomes an entrant);
- Whenever there is a change in a permit space which an employee has not previously been trained; or
- Whenever the EH&S Department has reason to believe either that there are deviations from the permit space entry procedures required by 29 CFR 1910.146 or that there are inadequacies in the employee’s knowledge or use of these procedures.

Training will include, but is not limited to, the following:

- A discussion of the requirements of this program;
- Identification of common safety hazards, sources and the signs and symptoms of potential hazardous environmental conditions;
- Interpretation and use of the Confined Space Entry Permit;
- Use, maintenance, and limitation of personal protective equipment, monitoring instruments and retrieval/fall protection safety equipment if required;
- Rescue and emergency response procedure; and
- Atmospheric testing.

EH&S Department shall document the required training was performed. A copy of the certification shall be available for inspection by employees and their authorized representatives.

Appendix A
Confined Space Assessment Form

Location of Space: _____

Type of Space: _____ **Dimensions of Space:** _____

Date of Assessment: _____ **Assessor Name:** _____

A. Confined Space Determination

1. Area was **NOT** designed for continuous human occupancy. □ YES □ NO
2. Area can be bodily entered and assigned work performed. □ YES □ NO
3. Area has limited and or/restricted means of access and egress. □ YES □ NO

If you answered yes to **ALL** of the above then the space has met the criteria for a confined space. Please move on to the next section.

B. Permit-Required Confined Space Determination

1. Does the space have or have the potential for a hazardous atmosphere? □ YES □ NO

Location	% Oxygen	Comb % LEL	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Other Gases PPM
Top					
Bottom					

If a hazardous atmosphere was detected, please mark the hazard(s) below:

□ Oxygen Deficiency □ Oxygen Enrichment □ Explosive Gas/Vapor □ Explosive Dust
□ Hydrogen Sulfide □ Carbon Monoxide □ Other: _____

2. Does the space have the potential to engulf the entrant? □ YES □ NO
   Please mark below if the hazard poses a potential for engulfment:
   □ Water □Sand □Soil □Gravel/Loose Rock □ Sewage □Oil □Other: _____

3. Does the space have the potential to entrap the entrant? □ YES □ NO

4. Is there a potential for any other serious safety and health hazard? □ YES □ NO
   If yes, please mark below:
   □ Electrical □ Moving Parts □ Heat □ Cold □ Skin or Eye Irritants
   □ Noise □ Chemicals □ Other: _____

5. How is the space entered?
□ Fixed Ladder (circle one: good condition or needs repair) □ Stairs □ Portable Ladder
   □ Lowering Winch (separate from non-entry rescue equipment)

6. Will ventilation be required for the space? □ YES □ NO
   If YES: (check all that apply) □ Natural □Forced Positive □Forced Negative

C. Alternate Entry Procedure Determination

Only applicable if Section B is **YES** to question 1 and also **NO** to questions 2, 3 and 4.

Is the only hazard an actual or potential hazardous atmosphere? □ YES □ NO

If yes, will ventilation alone maintain safe conditions? □ YES □ NO

If yes has been marked for both questions, the space may use alternate entry procedures. If at any time the space changes and other hazards are present, it is automatically a permit-required space again.

FINAL DETERMINATION:

□ Non-Permit Confined Space □ Permit-Required Confined Space □ Alternate Entry Procedures

COMMENTS:

APPENDIX B: MBL CONFINED SPACE ENTRY PERMIT

Location/Description: _____ Date: _____

Purpose of Entry**:**

Time In: _____ **Permit Canceled Time:** _____

Time Out:_____ **Reason Permit Canceled:** _____

Manager/Supervisor: _____

Hazards of Confined Space	Yes	No	Special Requirements	Yes	No
Oxygen deficiency			Hot Work Permit Required		
Combustible gas/vapor			Lockout/Tagout		
Combustible dust			Lines broken, capped, or blanked		
Carbon Monoxide			Purge-flush and vent		
Hydrogen Sulfide			Secure Area-Post and Flag		
Toxic gas/vapor			Ventilation		
Toxic fumes			Other- List:		
Skin- chemical hazards			**Special Equipment**		
Electrical hazard			Breathing apparatus- respirator		
Mechanical hazard			Escape harness required		
Engulfment hazard			Tripod emergency escape unit		
Entrapment hazard			Lifelines		
Thermal hazard			Lighting (explosive proof/low voltage)		
Slip or fall hazard			PPE- goggles, gloves, clothing, etc.		
			Fire Extinguisher		

Communication Procedures:

Do not exceed if permissible entry levels are exceeded		Test Start Time:	Test Stop Time:
	Permissible Level		
% of Oxygen	19.5% to 23.5%		
% of LEL	Less than 10%		
Carbon Monoxide	35 PPM (8 hr)		
Hydrogen Sulfide	10 PPM (8 hr)		
Other			

Name of Person testing: _____

Test Instrument (Name, Model, Serial Number): _____

Authorized Entrants	Authorized Attendants
_____	_____
_____	_____
_____	_____
_____	_____

PERMIT AUTHORIZATION

I certify that all actions and conditions necessary for safe entry have been performed.

Print Name: _____

Signature:_____ Date/Time: _____

CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

PERMIT REQUIRED CONFINED SPACE ENTRY

Marine Biological Laboratory

CONTRACTOR/ SUB-CONTRACTOR CERTIFICATION

I certify that:

All work performed in confined spaces will be performed in compliance with the requirements of all applicable OSHA standards.

If MBL personnel and our personnel will be working in or near permit spaces, we will coordinate entry operations with MBL personnel.

We have and/or will provided to the MBL copies of our confined space permit program.

We agree to participate in project debriefings during and at the conclusion of the contract as deemed necessary by the MBL.

_____	_____	_____
Contractor's Name	Contractor's Signature	Date

Entry Procedure Checklist

Complete the following steps before, during, and after a confined space entry:

Step 1
Obtain a Permit-Confined Space Entry Form from POM Manager/Supervisor.

Step 2
Notify Supervisor before the **Confined Space Entry.**

Step 3
Verify Confined Space Meter has been calibrated and is in working order.

Step 4
Complete the top portion of the Permit-Confined Space Entry Form.

Step 5
Ensure all rescue equipment (e.g. tripod, body-belt, lanyard) is in place prior to entry.

Step 6
Monitor the confined space with the MSA 4-Gas Detector prior to entry. The entrant and attendant should sign the permit authorization section on the bottom of the permit to ensure all actions and conditions necessary for safe entry have been performed.

Step 7
Employee entering the confined space should wear the 4-Gas Detector after the pre-atmosphere test. The employee should also have a full body harness and lanyard attached to the rescue tripod. Employee shall have a radio and any other necessary personal protective equipment.

Step 8
Employee can enter the confined space once Step 7 is completed. The entrant and attendant should complete the Hazards of Confined Spaces and Special Requirements Section of the Permit-Confined Space Entry Form once the employee is within the confined space. The entrant should also gather the % Oxygen, % Explosive Gases, Carbon Monoxide, and Hydrogen Sulfide readings and communicate them to the attendant to place on the Permit Form.

Step 9
The attendant should maintain constant communication with the entrant until the entrant has exited the confined space.

Step 10
The attendant should contact POM Manager/Supervisor once the entrant has exited the confined space.

Step 11

The Permit-Confined Space Entry Form should be given to POM Manager/Supervisor, to file in the Confined Space Records.

Appendix C

MSA Multi-Gas Detector Monitoring

Evaluation Testing

Air quality testing is necessary for the evaluation of the hazards of the permit space and verification that acceptable entry conditions for entry into that space exist. The air quality of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate entry procedures can be developed and accepted entry conditions stipulated for that space.

The following tests are performed to identify the quality of the air in confined spaces:

- Oxygen Content
- Flammability
- Carbon Monoxide
- Hydrogen Sulfide
- Other Gases

Verification Testing

The air quality of a Permit-required Confined Space, which may contain potentially hazardous contaminants, should also be tested for all residues of those contaminants identified. Upon notification, the EH&S Department shall assist in identifying and characterize the residual concentrations through subsequent testing. They will also determine the applicable monitoring requirements and define the air quality range of acceptable entry conditions.

Testing Stratified Atmospheres

To monitor for entries involving a descent into a confined space note that the atmosphere may be stratified. Consequently, the testing envelope should be from a distance no less than four (4) feet in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress shall be slowed to accommodate the instrument sampling speed and detector response.

Equipment Calibration

To ensure that the testing equipment is functioning properly, all direct reading instrumentation should be periodically inspected, calibrated and tested functionally in accordance with the specifications identified by the manufacturer.

Using the MS Sirius Multi-Gas Detector

1. Calibrate the MSA Sirius Multi-Gas Meter in accordance with the manufacturer's instruction.

2. Perform a Fresh Air function test

   - Always perform the fresh air function test in a clean environment.
   - Never perform a function test in the suspected atmosphere.

3. Pre-Test the Confining Space:

   - A sampling of the atmosphere inside of the Permit Required Confined Space should be done for at least 2-minutes, preferably 5-minutes prior to entry.
   - With a pre-calibrated gas meter (MSA Sirius) test the entire workspace, top to bottom, every four (4) feet in the direction of travel. For the following tests:
     a) Oxygen
     b) Flammability
     c) Carbon Monoxide
     d) Hydrogen Sulfide
     e) Other – Suspected Residues

4. Monitor the Confined Space

   - The atmosphere inside of the confined space must be continuously tested to ensure the air quality levels within the potentially hazardous atmosphere.
   - Position the MSA Sirius system near or on the workers for accurate readings.

   Note: If the MSA Sirius alarm sounds during a confined space entry without respiratory protection in use, exit the confined space immediately then identify the cause of the alarm. Determine whether a high sensor detection, low battery or sensor failure caused the alarm. Do not re-enter space until meter is corrected or atmospheric conditions are understood and requirements of the Confined Spaced Program are followed.

5. If when utilizing ventilation techniques the MSA Sirius system indicates high sensor detection, then increase ventilation within the confining space then re-monitor. If the atmospheric hazard cannot be reduced below the permissible exposure limits, **do not re-enter** the confining space and notify the EH&S Department for guidance regarding respiratory protection.

ATMOSPHERIC MONITORING LOG

Location: _____

Date: _____

Tested by: _____

Instructions:

1. Test for Oxygen, Combustible gases, Carbon Monoxide and Hydrogen sulfide.
2. Initial readings should be taken for at least 2 minutes prior to entry.
3. If ventilation is required inside of the confined space, it must be in use for at least 10-15 minutes prior to pre-entry air monitoring.
4. The atmosphere inside of the space must be tested every 10-15 minutes while entry operations are taking place.

Time	**% Oxygen**	**Comb. % LEL**	**Carbon monoxide (PPM)**	**Hydrogen sulfide (PPM)**	**Other Gases (PPM)**

Appendix D

Ventilation of Confined Spaces

Ventilation

Ventilation is one of the most effective means of controlling air quality in confined spaces by replacing contaminated air by natural or forced (mechanical) ventilation.

When ventilating a confined space, the following factors must be taken into consideration:

- Volume of air: This determines the capacity of the blower or ejector.
- Type of space: This will determine the type of blower or ejector used and the length of time needed to ventilate until it is safe for people to enter the space.
- Access to space: This determines how to get the ventilating air into and out of the space.
- Power requirements and availability: This will influence the power source and fan motor size. A portable generator may be required as a source of power.
- Cost, efficiency and maintenance: This may have an effect on the type of device that is selected and what is necessary to keep it working properly.
- Shape of space: This will affect the type of directional device needed and the amount of air pressure required to provide sufficient ventilation.
- Source of clean air: This is necessary to ensure adequate ventilation.
- Length of time ventilation is needed: This will be determined by the type of work performed and the contaminants potentially generated in the space.
- Type of work to be done: This determines whether local exhaust ventilation or general ventilation is required.

Ventilation Instructions

1. The use of blower fans will eliminate any hazardous atmosphere, exhaust toxic and flammable concentrations, and supply “fresh air” in a potentially oxygen-deficient atmosphere.
2. Select a blower fan with a capacity to quickly replace the air in the space. Limitations should be listed on the fan housing. It is preferable to use intrinsically safe fans. Intrinsically safe means the fan is protected from itself should an electrical spark be inadvertently created.
3. Use reliable, grounded electrical power.
4. Arrange ductwork to ensure safety:

- Locate supply fan intake away from flammable or toxic air.
- Position exhaust fan outlet to avoid re-circulation of bad air or endangering others outside the space. To direct clean “fresh-air” external of the space into and throughout the space.
- Position exhaust duct inlet next to the source of contaminants
- Keep ducts short and straight.
- Make sure air circulates through entire space and does not short-circuit around obstacles.

5. General Procedure:
    - Eliminate all sources, if possible, of suspected air quality contamination (for example: carbon monoxide from nearby truck or gas-powered generator).
    - Ventilate the space by pushing “fresh air” into the space until the air within the space has been changed over several times. (Minimally ventilate for period of 15 to 30 minutes).
    - Verify the result of the forced ventilation, by re-testing the air quality.
    - Continually ventilate the space by pushing air so that a positive pressure changes the air over several times every hour.
    - During operation direct the clean air toward the worker.
6. Please note:
    - Contaminants generated during hot work or cleaning with solvents in a confined space will require additional ventilation to dissipate and/or remove the fumes and vapors generated.
    - Pure oxygen is NOT “fresh air.” Never use bottled oxygen for ventilation.