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| NOVA SOUTHEASTERN UNIVERSITY | ENVIRONMENTAL HEALTH AND SAFETY |
| POLICY/PROCEDURE TITLE: CONFINED SPACE | POLICY/PROCEDURE NUMBER: |

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1. INTRODUCTION

The principal objective of this comprehensive program is to implement practices and procedures that will protect employees and provide guidance to authorized contractors from hazards that may exist in confined spaces during the course of their work on NSU campuses.

2. PURPOSE

The purpose of this program is to educate employees on how to identify and protect themselves from hazards associated with confined spaces that they are required to work in and to provide guidelines for all entries into confined spaces to be accomplished in a safe and healthful manner.

Nova Southeastern University has a wide geographic distribution of facilities and diverse spaces throughout campuses thus a thorough understanding of confined space hazard identification; documentation, proper labeling and control methods are required.

This program should be used in conjunction with other NSU Environmental Health and Safety policies and programs associated with safe work practices which may include but not limited to: personal protective equipment, handling of hazardous materials and control of hazardous energy.

3. SCOPE AND APPLICATION

Many work areas contain spaces that are considered “confined” because their configurations may hinder the activities of employees who must enter, work in and exit them.

OSHA uses the term “confined space” to describe such spaces that meets all three of the following characteristics:

- limited openings for entry and exit
- unfavorable natural ventilation
- not designed for continuous worker occupancy.

“Permit-Required Confined Space” is a term used by OSHA to describe spaces that meet the definition of “confined space” with the threat of serious health and safety hazards.

This program is intended to cover three main classifications of confined spaces:

- Permit-required confined spaces (hazardous atmosphere, engulf an entrant)
- Non-permit required confined spaces (potential to contain hazardous atmosphere)
- Enclosed spaces (designed for periodic entry)

The objectives of the program are met when:

- a. A survey, inventory and evaluation of the workplaces are performed to determine if any spaces are permit-required confined spaces.
- b. The posting of appropriate signs and training provided to employees so that they recognize and will not enter permit-required confined spaces without authorization.
- c. The training of employees and authorized entrants who will be entering permit-required confined spaces.
- d. The implementation of a permit system to control and monitor entry into permit-required confined spaces.
- e. Requirements for potential rescue teams.

4. REGULATORY REQUIREMENTS

This program is designed to provide the safety requirements in accordance with the Occupational Safety and Health Administration's (OSHA) Permit-Required Confined Spaces Standard, 1910.146. As well as the following Non-permit Required Confined Spaces Standards:

- Electrical Transmission and Distribution. 29 CFR 1910.269
- Telecommunications. 29 CFR 1910.268

5. DEFINITIONS

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| Acceptable Entry Conditions: | The conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space. |
| Attendant: | An individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in this program. |
| Authorized Entrant: | A person who has been determined capable to perform work in a permit-required confined space and has appropriate training for that entry. |
| Blanking or Blinding | The absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate. |
| Confined Space: | A space that has all of the following characteristics: <ul style="list-style-type: none">▪ Is large enough and so configured that an employee can bodily enter and perform assigned work.▪ Has limited or restricted means for entry or exit (for example, manholes, tanks, vessels, storage bins, vaults, and pits are spaces that may have limited means of entry.).▪ Is not designed for continuous employee occupancy. |

Confined space can be classified into two categories:

- Low-hazard confined space
- High-hazard permit-required confined space.

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| Double Block and Bleed: | The closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves. |
| Emergency: | Any occurrence or event internal or external to the permit-required confined space that could endanger entrants or any condition not permitted on the entry permit. This includes any failures of hazard control, monitoring, communication, or lighting equipment. |
| Engulfment: | The surrounding and effective capture of a person by a liquid or finely divided solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing. |
| Entry: | The action by which a person passes through an opening into a permit-required 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. |
| Entry Permit: | The written or printed document that is provided by the employer to allow and control entry into a permit-required confined space. |
| Entry Supervisor: | <p>A qualified person from the EH&S or plant manager) is responsible for determining if acceptable entry conditions are present at a permit-required space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.</p> <p>Note: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. The duties of entry supervisor may be passed from one individual to another during the course of an entry operation.</p> |
| Hazardous Atmosphere: | <p>An atmosphere that may expose employees to a risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a permit space), injury, acute illness or delayed illness from one or more of the following causes:</p> <ul style="list-style-type: none">▪ Flammable gas, vapor, or mist in excess of 10 % of its lower |

flammable limit (LFL) that has no toxic quality other than dilution of available breathing air (e.g., methane).

- Airborne combustible dust at a concentration that meets or exceeds its LFL and obscures vision within a distance of five feet (1.52m) or less.
- Atmospheric oxygen concentration below 19.5 % or above 23.5 %.
- Atmospheric concentration of any substance for which a dose or a permissible exposure limit (PEL) is published in 29 CFR 1910 which could result in an employee's exposure in excess of its dose or permissible exposure limit.
- Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, section 1910.1200 or published information can provide guidance in establishing acceptable atmospheric conditions.

Hot Work Permit:

The employer's written authorization to perform hot work operations (for example, riveting, welding, cutting, burning, and heating) capable of Providing a source of ignition.

Immediately Dangerous to Life or Health (IDLH):

Any condition that poses an immediate or delayed threat to life and would cause irreversible adverse health effects or interfere with an Individual's ability to escape unaided from a permit space.

Note: Some materials -- hydrogen fluoride gas and cadmium vapor, for example -- may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, Possibly fatal collapse 12-72 hours after exposure. The victim "feels Normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

Inerting:

The process of filling a space with an inert non-flammable material for the purpose of displacing or diluting oxygen to remove the flammable potential of the permit-required confined space atmosphere.

Note: This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation:

The process by which a permit space is removed from service and completely protected against the release of energy and material into the space. This process includes such means as blanking or blinding, misaligning or removing sections of lines, pipes, or ducts, a double block and bleeding of systems, lockout or tagout of all energy sources, or blocking or disconnecting all mechanical linkages.

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| Line Breaking: | The intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury. |
| Non-Permit Confined Space: | A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm. |
| Oxygen Deficient Atmosphere: | An atmosphere containing less than 19.5 % oxygen by volume. When the oxygen content is below 19.5%, an air-purifying respirator cannot be worn and a supplied air respirator must be used for entry (SCBA) |
| Oxygen Enriched Atmosphere: | An atmosphere containing more than 23.5 % oxygen by volume. |
| Permit-Required Confined Space: | A confined space that has a high hazard potential with one or more of the following characteristics: <ul style="list-style-type: none">▪ Contains or has a potential to contain a hazardous atmosphere.▪ Contains a material that has the potential for engulfing an entrant.▪ Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.▪ Contains any other recognized serious safety or health hazard. |
| Permit-Required Confined Space Program: | The employer's overall program for controlling, and, where appropriate, protecting associates from permit space hazards and for regulating employee entry into permit spaces. |
| Permit System: | The written procedure for obtaining, preparing, issuing and retrieving permits for entry into permit-required confined spaces and returning the permit space to service following termination of entry. |
| Prohibited Condition: | Any condition in a permit space that is not allowed by the permit during the period when entry is authorized. |
| Rescue Service: | The personnel designated to rescue employees from permit-required confined spaces. |
| Retrieval System: | System for conducting non-entry rescue of persons from permit-required confined spaces. This system includes retrieval or extraction devices (retrieval line, davit, wristlets, if appropriate, and a lifting device or anchor) and a full body harness. |
| Testing: | The process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space. |

Ventilation: A process used to control the atmospheric hazards of permit-required confined spaces by replacing unsafe air with clean, breathable air.

6. ROLES AND RESPONSIBILITIES

The specific responsibilities outlined in this section must be followed by all persons entering confined spaces due to the potential hazards associated with confined space entry procedures.

6.1 Environmental Health and Safety Department (EH&S)

- Oversee and manage the implementation of this program and any situations that may arise that are not directly addressed by this program.
- Evaluate and update the Confined Space written procedures on an annual basis or as procedures change.
- Designate confined spaces as permit-required confined spaces or non-permit confined spaces. Perform and coordinate an annual review of the Confined Space Inventory with supervisors and facilities manager and determine if a permit-required confined space can be reclassified as a non-permit confined space.
- Perform training as necessary.
- Perform annual field audits with a written report to ensure the effectiveness of the program and compliance with applicable standards.
- Provide safety expertise and regulatory guidance to Authorized Entrants.
- Provide technical expertise or industrial hygiene sampling (consultant) and assist with air monitoring.
- Approve all safety and PPE equipment.

6.2 Physical Plant Operations

- Identify all campus locations that fit the definition of a confined space.
- Provide and maintain equipment required to work and ventilate a confined space.
- Notify EH&S of employees who are required to wear and use respirators.
- Post signage at confined spaces where appropriate and prevent unauthorized entry.
- Ensure that means for summoning the rescue services and the local Fire Department are operable.
- Ensure all permits are obtained for entry into permit-required confined spaces and recorded with EH&S.
- Obtain all the required sampling and safety equipment.
- Provide information on all hazards for a particular permit-required confined space that a contractor might be required to enter.

6.3 Employees and Authorized Entrants

- Employees shall follow all safe work procedures while working in confined spaces and wear Personal Protective Equipment as required.
- Employees and authorized entrants must have completed training.

- Know and understand the potential entry hazards and be aware of signs and symptoms of exposure to hazardous atmospheric conditions.
- Report to the supervisor or EH&S, any unsafe conditions concerning confined spaces.
- Ensure that appropriate control measures are followed (lock-out/tag-out procedures, ventilation, etc.).
- Ensure that any permit-required confined space entry is coordinated with all appropriate parties (EH&S, Facilities Management and Physical Plant) sufficiently ahead of time so that all safety equipment and monitoring devices can be prepared, calibrated and reviewed for proper function.
- Evacuate the space if there is an alarm condition, the monitoring equipment malfunctions or upon notification by the entry supervisor or attendant.
- Clean up work areas when work is finished.
- Participate in any post-entry debriefings.

6.4 Supervisor and Entry Attendant

- Be knowledgeable of the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure.
- Be aware of possible behavioral effects of hazard exposure in authorized entrants.
- Ensure all persons involved in a confined space entry are properly trained, physically fit to perform the required tasks and follow the procedures as outlined in this program.
- Ensure the entry permit form is properly completed and that all pre-entry requirements of the permit have been met prior to endorsing the permit and allowing entry.
- Ensure that entry and air monitoring equipment is maintained in working order according to manufacturer's specifications.
- Confirm that rescue resources are available and verify that the means for contacting Facilities Management or Physical Plant are operable.
- Ensure all current and canceled permits are properly filed with EH&S.
- The supervisor is responsible for verifying the safety of the space before entry and knowledgeable of the hazards in the space.
- The entry attendant is to monitor the pedestrian barriers / railings (if necessary) to protect entrant(s) from external hazards such as foreign objects entering the confined space. The barriers/ railings will prevent anyone from accidentally falling into the opening of the space.
- An entry attendant or supervisor is to remain outside the space during entry operations at all times or until relieved. Activities that may interfere with the attendant's duties shall not be performed.
- The entry attendant must have radio or telephone access to be able to call for an emergency rescue.
- The attendant is to continuously monitor the hazards both inside and outside of the space and ensure the following conditions are met:
 - i. Oxygen (O₂) Level is greater than 19.5% and less than 23.5%
 - ii. Combustible gas is less than 10% of the LEL
 - iii. Carbon Monoxide (CO) concentration is less than 35ppm
 - iv. Hydrogen Sulfide (H₂S) concentration is less than 10ppm

- Maintain communication with the employees and entrants to be aware of any problems that may occur, and to order an immediate evacuation if a situation develops that could endanger the employees and entrants.
- Maintain a continuous and accurate count of all entrants in the permit space (sign-in, sign-out log) thus ensuring a means to accurately identify authorized entrants.

6.5 Emergency Procedures and Rescue Team

- In an emergency, the attendant must call for help by two-way radio or telephone to summon the Fire Department and Rescue Team.
- If possible perform a non-entry rescue, do not enter the space for any reason.
- Attendant shall remain at the location and at a safe distance.
- Rescue team is to respond in a timely manner and consist of trained persons in Confined Space Emergency Response (C.S.E.R). Rescue team members are to be certified in first-aid and CPR as well as HAZWOPER training in the event of exposure to hazardous materials.

7. PROCEDURES AND GENERAL REQUIREMENTS

7.1 Identifying Confined Spaces and Permit-Required Confined Spaces

The confined space program requires that workplaces on NSU campuses be identified then evaluated to determine if any are confined spaces. To classify as a confined space, it must meet all of the following criteria:

1. The space must be large enough and configured so that an employee can bodily enter and perform assigned work.
2. The area has limited or restricted means for entry or exit.
3. The area is not designed for continuous employee occupancy.

If the space meets all of the above criteria it is deemed a confined space. The next step is to determine if it meets the definition of a **permit-required** confined space. Review Appendix A – Flow chart to determine a Permit-Required Confined Space.

In addition to classifying confined spaces, the hazard potential of a confined space must be determined. Hence, a permit-required confined space can be classified as such if it meets one or more of the following characteristics:

1. The area has the potential or contains a hazardous atmosphere.
2. The space contains a material that is flammable and has the potential to engulf an entrant.
3. The space has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.
4. The space contains any other recognized serious health or safety hazard including, but not limited to the following:
 - Airborne dust
 - Grinding/mulching

- Agitators
- Steam
- Falling/tripping hazards
- Rodents/snakes/spiders or
- Wind/weather

If the space meets any of the above criteria, it has “high hazard potential” and is a permit-required confined space. A permit system must be implemented according to OSHA standard 29 CFR 1910.146.

A workplace risk assessment shall be performed by the supervisor and EH&S to identify confined spaces, record what the hazards are and the potential for hazards to develop in or around the spaces. Reference, Appendix C – Confined Space Hazard Assessment Form.

Hazards to be identified can be any of the following:

Atmospheric Hazards

- Asphyxiating
- Flammable/Explosive
- Toxic

Physical Hazards

- Moving machinery
- Engulfment
- Falls
- Electrocution
- Hazardous material
- Noise
- Burns
- Heat stress
- Any other hazard

7.2 Entry Requirements

For the three classifications of confined spaces, there are certain entry requirements and procedures. See Appendix B – Confined Space Requirements, for a summary of requirements.

7.3 Signage

Confined spaces that are designated as permit-required confined spaces must be posted with warning/danger signs which read:

DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER

In addition, permit-required confined spaces should be secured in a manner such as a lock, fence or an enclosure to prevent unauthorized persons from entering the spaces.

Non-permit confined spaces are not regulated, but a sign in those spaces would be a reminder to all entrants that although the space does not require a permit in its current condition, the introduction of hazards into the space could change the status of the space and require a permit for entry.

CAUTION
NON-PERMIT REQUIRED CONFINED SPACE

DO NOT BRING HAZARDS INTO THE AREA

7.4 Non-permit Confined Space Procedures

A non-permit required confined space, by definition, poses no hazard to an entrant 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 into this confined space should still be made with caution.

Entry is not regulated and can be accomplished without a permit, but the following conditions shall be met before entry:

1. Employees and entrants are to enter the space only under the direction of a supervisor.
2. Determine if there have been any changes in the use or configuration of the space that could change its classification.
3. Determine if any activities in the area could cause a hazardous atmosphere to build up in the space.
4. Review the work to determine if personal protective equipment is required.
5. Establish traffic control barriers or railings at the entry point, if applicable.
6. Ensure a safe means of communication is available.
7. Ensure appropriate lighting and/or equipment for safe entry and exit by the entrants is available.
8. Ensure no employee/entrant works alone.
9. Use continuous forced air ventilation for spaces that are below ground.
10. Air monitoring is not required unless additional hazards are introduced as part of the work to be performed.

7.5 Permit-Required Confined Space Procedures

Entry into a designated permit-required confined space is regulated because of the physical or atmospheric hazards that exist. EH&S shall be contacted at least 48 hours prior to the anticipated entry into a permit-required confined space so that the area and space can be evaluated. In addition, a communication system must be established and the rescue team notified of the entry.

The following conditions shall be met prior and during entry:

1. A supervisor from EH&S or Facilities Management shall perform a visual inspection of the permit-required confined space and document the general purpose of entry and the nature of hazards on the entry permit.
2. If possible eliminate the physical hazards before entry by one of the following means therein changing the space status:
 - *Locking out* –electrical sources at switches that are remote to the space.
 - *Blanking & bleeding* – pneumatic and hydraulic lines.
 - *Disconnecting* – mechanical linkages and belt or chain drives.
 - *Securing* – mechanically moving parts with chains, blocks, or other devices.

- *Plugging* – pipe inlets.

If all the physical hazards can be eliminated, the space can be entered as either an Alternate Procedure or a Non-Permit Confined Space, this will depend on the condition of the atmosphere.

3. EH&S will conduct a pre-entry monitoring of the space to evaluate the hazardous atmosphere and document all results on the entry permit. Appendix D – Confined Space Permit.
4. If EH&S determines the permit-required confined space is safe for entry, a permit will be issued.
5. If the entry permit is awarded, the permit will be posted at the entrance post.
6. Only authorized and trained employees and entrants may enter a permit-required confined space or act as an entry attendant.
7. No smoking is permitted in a confined space or the area surrounding the entrance/exit.
8. An entry attendant must be present at all times and maintain a constant visual or voice communication with the entrants in the confined space.
9. Erect barriers or railings around the opening and provide traffic control if necessary.
10. Only assigned tasks or activities identified on the permit shall be conducted. All entry team members are to be assigned a specific role to serve with detailed instructions.
11. Determine the method of communication between employees, entrants and the entry attendant.
12. The atmosphere in the confined space must be tested prior to entry. Air and oxygen monitoring is required and the internal atmosphere must be tested with calibrated direct-reading instruments for the conditions in the following order:
 - Oxygen content – levels must be between 19.5 and 23.5%.
 - Flammable gases and vapors – entry prohibited if explosive gas is detected above levels of 10% of the Lower Flammable Limit (LFL).
 - Potential toxic air contaminants – measure less than the recognized ACGIH exposure limits, OSHA PEL's or NIOSH REL's.
13. Ventilate the confined space for a minimum of five minutes prior to entering the space.
14. Identify the equipment and personal protective equipment required for entry.
15. Set-up the non-entry rescue equipment.
16. All entrants must put on a body harness with a line attached.
17. The body harness must be connected to the line from the tripod.
18. Enter the confined space and check for hazards that may not have been detected.
19. Forced air ventilation should be maintained during the occupancy and until the entrants have left the space.
20. Monitor the atmosphere throughout entry and record results every 30 minutes.
21. **Exit the space immediately if any of the following occurs:**
 - A hazardous atmosphere is detected.
 - If any health or safety hazards are detected.
 - If entrants start to show signs of exposure to atmospheric hazards
22. When the work has been completed, the confined space must be left in a proper condition with the opening secured.
23. Note any problems encountered on the permit.

24. Return the entry permit to the supervisor or EH&S.

7.6 Alternate Entry Procedures

Alternate entry procedures can only be used when the only hazard is an actual or potential atmospheric hazard that can be controlled through continuous forced air ventilation that will be sufficient to maintain safe entry conditions. The control of the atmospheric hazards by forcing air ventilation does not eliminate the hazards, therefore the space cannot be considered a non-permit confined space. The atmosphere must be continuously monitored to verify that acceptable entry conditions are present.

It is important to follow the procedures below when using the alternate entry procedure:

1. Demonstrate that the only hazard posed by the confined space is an actual or potential hazardous atmosphere, therefore any hazards involving high noise levels, lockout-tagout, drowning, excessive heat or cold, slips, trips, falls or other hazards have been eliminated.
2. If necessary, the opening shall be guarded by a railing or barrier that will prevent an accidental fall through the opening and will protect entrants working in the confined space from foreign objects entering the space.
3. The atmosphere shall be tested before entry into the confined space.
4. The internal atmosphere shall be tested for oxygen content, flammable gases and vapors and potential toxic air contaminants to ensure the space does not contain a hazardous atmosphere.
5. An adequate ventilation supply must be set-up and the authorities are to ensure that the supply air is taken from a clean source.
6. Prior to entering the confined space, it must be ventilated for a minimum of five minutes. If ventilation ceases to operate, all employees and entrants must leave the space immediately.
7. The atmosphere must be monitored throughout the entry and the results recorded every 30 minutes.
8. **The entrants shall evacuate the space immediately if any of the following occur:**
 - A hazardous atmosphere is detected.
 - Any health or safety hazard is detected.
 - If an employee or entrant start to show signs of exposure to atmospheric hazards.Reevaluate the confined space and modify the entry procedure before reentering.
9. Upon completion of the work, return the confined space to its proper condition and secure the opening.
10. Document any problems encountered on the permit and return to the supervisor EH&S.

7.7 Basic Equipment and PPE

The minimum PPE requirements for all confined space entries should include:

- safety shoes
- safety glasses
- hard hats
- gloves

- ear plugs
- respirators / self contained air packs (if required)
- traffic vest

Basic equipment required at all confined space sites are:

- manhole hooks
- manhole barricades
- traffic cones
- “Men working” signs
- multi-gas monitor
- ventilating fan and power source
- ingress and egress equipment such as ladder
- lights
- fire extinguisher
- first aid kit

Permit-required confined space sites require for the entries the following additional PPE:

- body harness
- safety ropes
- non-entry rescue equipment (tri-pod and host)
- communication equipment
 - for entrants and attendants
 - to summon rescue services
- entry permit and procedures
- testing and monitoring equipment
- ventilating equipment

7.8 Entry Permit

The entry permit is a vital part of the confined space program that documents the required measures taken to ensure employee and entrant safety. All pertinent safety requirements must be documented on the permit including isolation, ventilation, tests and monitoring, personal protective equipment, rescue and other equipment necessary for entrant safety.

The following requirements must be recorded on the entry permit. Appendix D – Confined Space Entry Permit.

- Identification of the confined space
- Purpose and description of the work to be performed
- Date and authorized duration of the entry permit
- The names of the authorized employees and entrants
- Means of identifying entrants inside the confined space at any point in time – log in sheet or tracking system.
- Names of the authorized attendants and the entry supervisor
- Hazards of the space as determined by the hazard assessment form

- Measures taken to isolate the space and eliminate or control the space hazards before entry (barriers needed to protect entrants from external hazards)
- Acceptable entry conditions
- Results of the initial and periodic tests with the names of the testers and the date and time when each test was/is performed
- Rescue and emergency services notified and how to contact them
- Communication methods and how to be maintained during entry between the attendants and entrants
- Personal protective equipment and other equipment to be used
- Any other pertinent information necessary to ensure the safety of entrants
- Requirements for additional permits such as hot work.

The completed permit must be made available to all permit confined space entrants at the site. The duration of the permit should not exceed the time required to accomplish the task. *The permit must be retained for at least one year to facilitate the annual standard review.* Comments concerning problems with the entry operations should be noted on the permit so that the entry procedure can be evaluated and revised if necessary.

8. RESCUE AND EMERGENCY SERVICES

When working in any confined space, hazards may arise quickly or unexpectedly that authorized entrants would be unable to exit or escape from the space without assistance. In some cases, it may be possible for properly trained attendants to use the extraction or rescue retrieval equipment for a non-entry rescue. Under no circumstances shall unauthorized personnel enter a confined space to attempt a rescue; this should only be attempted by professionals and the Fire Department who are certified for confined space rescue.

The local fire department shall be provided with access to NSU's Confined Space inventory to ensure the safety of rescue personnel and expedite the rescue process.

If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

8.1 Non-entry Rescue

The following procedure of retrieval has been developed for attendants and entrants to use when the retrieval equipment does not increase the overall risk of entry or egress.

- Authorized entrants shall use a chest or full body harness with a retrieval line attached at the center of the entrant's back near shoulder level or above the entrant's head.
- Wristlets are only be used in lieu of the full body harness when it has been demonstrated that use of the full body harness is infeasible or creates a greater hazard.
- Retrieval lines will be attached to a mechanical lifting device (winch) or a fixed point outside of the permit space in such a manner that rescue can begin immediately the attendant /rescuer/entrant becomes aware that rescue is necessary.

- A mechanical retrieval device must be deployed to retrieve entrants from vertical type permit spaces more than 5 feet deep.

- Rescue retrieval devices should not be used when:
 - a) A horizontal entry is required
 - b) There is no safe/stable surface for a retrieval system
 - c) Entrances are too large for a tripod
 - d) The passageway meanders in a manner that could cause the retrieval line to become entangled
 - e) Protruding objects or dangerous obstacles are present risking entanglement of the retrieval line.

8.2 Emergency Rescue

In the event of an emergency rescue for an entrant(s) in a confined space, the rescue must be immediate and emergency services called by dialing 911 either by phone or radio plant operations declaring an emergency.

- Sufficient and adequate emergency rescue equipment must be made available
- The nearest available Fire Department will respond to the call.
- Notify the hospital's emergency rescue unit
- If NSU employees are involved in the rescue, they must have received training and practice within the last 12 months and at least one member of the rescue team must have CPR and First Aid training.

9. CONTRACTORS

If an outside contractor and other non-employees are hired to perform work within a permit-required confined space at NSU, they must comply with this confined space program and the OSHA 29 CFR 1910.146 standard.

The following requirements and procedures are to be followed by contractors, their employees and others:

- Inform the contractor that the area in question is a permit-required confined space.
- Inform the contractor of the elements including the hazards identified within the space and any past experience with the space.
- Apprise the contractor of the precautions or procedures that have been implemented for the protection of employees in or near the permit space where contractor personnel will be working.
- Debrief the contractor at the end of the work/entry to identify any hazards confronted or created in the permit-required confined space during entry operations.
- All contractors performing work and entering permit-required spaces are required to:
 - a) Obtain and use the available information provided;
 - b) Coordinate entry operations with others working in or near the space;
 - c) Inform EH&S of permit space program the contractor will follow; and

- d) Provide verification that their employees have received Confined Space training.

10. HAZARD CONTROL

Air monitoring and ventilation is required before entry into a permit-required confined space can begin and to evaluate the potential for atmospheric hazards and to determine that acceptable entry conditions exist. The atmosphere must be tested to determine whether dangerous air contamination and/or oxygen deficiency or enrichment exists.

Under certain circumstances, the accuracy of testing and monitoring equipment may be significantly affected by humidity, pressure, temperature or by the presence of interfering chemicals. The proper selection of equipment is important and should be operated by well-trained employees who are trained in calibration and maintenance of the equipment.

10.1 Atmospheric Testing

Atmospheric testing is necessary for two purposes: to evaluate airborne hazards that may be present in permit-required spaces, and to verify that acceptable entry conditions into that space exist.

Evaluation:

EH&S should perform the initial evaluation of the atmosphere of a confined space with an approved instrument that is of sufficient sensitivity and specificity to identify and evaluate any hazardous atmosphere that may exist or arise.

The results of the initial atmospheric testing will have a direct impact on:

- the development of the entry procedure,
- the selection of the PPE to be used,
- the duration of worker/employee exposure or
- whether entry into the confined space will be made at all.

Verification:

A permit-required confined space that may contain a hazardous atmosphere shall be tested for residues of all contaminants prior to entry. Verification testing is done to ensure the chemical hazards that may be present are below the levels necessary for safe entry, and meet the conditions of the permit. Results of the testing shall be recorded on the entry permit and compared to the initial and acceptable entry conditions.

The atmosphere is to be tested in the following order:

- a. oxygen,
- b. combustible gases,
- c. toxic gases and vapors.

If testing reveals oxygen deficiency or the presence of toxic gases or vapors, the space must be ventilated or purged before entry. The atmosphere must be tested continuously during entry operations.

Measurement duration:

The measurement of each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.

Stratified atmospheres:

The density of the gases and vapors will cause them to be:

- a. heavier than air and it will settle to the bottom of the space such as hydrogen sulfide
- b. lighter than air and concentrate at the top of the space such as methane
- c. the same density as air, and accumulate in the center such as carbon monoxide.

When entering or monitoring an area that descends into an atmosphere that may be stratified,, the atmospheric envelope should be tested at a distance of approximately 4 feet in the direction of travel. ~~the direction of travel and to the side.~~ The entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

Equipment calibration:

The atmospheric testing equipment is to be calibrated to ensure it is functioning properly and not used until the following operations have been performed:

- inspection
- calibration
- function test

Testing procedure:

The employee who will act as the air monitor is required to complete confined space training as well as training on how to use the monitoring equipment. Prior to conducting the testing process, the instrument to be use must be calilbrated and inspected. When inspecting the instrument, check the physical condition and review the instructions.

1. In a clean atmosphere – perform the function test of the sensors to be used.
 - To test the oxygen sensor: breath into the sampling device to reduce the oxygen level to below 19.5%, the oxygen alarm should sound.
 - To test the combustible gas sensor: expose the sensor the an open container of solvent magic marker until the instrument reached a reading of 10%, the combustiblegas sensor should sound.
2. Conduct a “pre-test” of the confined space
 - In fresh clean air- zero the instrument.

- Open the entry port to the confined space and start sampling every 4 feet in the direction of travel and from side to side.
 - Test the atmospheric parameters in the following order:
 - i. Oxygen
 - ii. Flammability
 - iii. Toxicity
3. Compare the pre-entry sampling results to the following acceptable entry conditions:
- | | |
|-------------------------------------|--|
| Oxygen (O ₂) | > 19.5% and < 23.5% |
| Flammability | < 10% of Lowe Flammable Limit (LFL) |
| Carbon Monoxide (CO) | < 35ppm |
| Hydrogen Sulfide (H ₂ S) | <10ppm |
| Other substances | Less than Permissible Exposure Limit (PEL) |
4. Record the results on the permit form.
5. Monitoring of the space is to occur throughout the process:
- i. Before ventilation
 - ii. After ventilation
 - iii. Initial entry survey and
 - iv. Monitored continuously thereafter – record readings every 30 minutes.
6. **Exit the space immediately if any of the alarms sound.**

10.2 Ventilation

Ventilation is one of the most effective means of controlling an atmospheric hazard that can be achieved by replacing the unsafe air with continuously moving clean breathable air. Ventilation dilutes and displaces air contaminants, assuring an adequate oxygen air supply are maintained during entry, and exhausts contaminants created by entry activities such as welding.

For most confined spaces, fans or other air-moving equipment can provide adequate ventilation. Two common types of mechanical ventilation are local exhaust and general ventilation systems.

Local exhaust ventilation captures contaminants and removes them at their point of origin, this method is ideal for flammable and toxic materials when produced at a single point. The exhaust intake should be close to the working site when using this type of ventilation system. For atmospheric hazards that are widely dispersed or confined spaces that make local exhaust ventilation difficult to operate, use the general ventilation system.

General ventilation flushes the atmosphere by supplying and exhausting large volumes of air. This system of ventilation is not recommended for highly toxic atmospheres as it does not reduce the amount of contaminants released but it is ideal for providing oxygen and controlling low concentrations of materials that are not highly toxic. Ventilation should produce approximately 10 air exchanges per hour.

Testing procedure:

1. Select a fan with enough capacity to quickly replace the volume of air in the confined space. The fan's limitations of capacity are pasted on the housing.
2. Use only fans in excellent working condition and with no frayed wires.
3. Use reliable, grounded electrical power.
4. Position fan where it will take in clean fresh air.
5. Eliminate any hazardous atmosphere by exhausting toxic and flammable air by positioning the exhaust duct inlet next to source of contaminants.
6. Use a flexible duct to deliver air into all areas of the confined space.
7. Ventilate the space a minimum of 5 minutes before verifying acceptable entry conditions are present.
8. Continue to ventilate with a constant circulation of fresh air for as long as the space is occupied.
9. Monitor the air to ensure ventilation is keeping the air safe to breath.

11. TRAINING

All entry supervisors, attendants and entrants shall be properly trained initially; when the duties and/or space hazards change; or whenever an evaluation determines the employee's knowledge is inadequate. The training or if required, a refresher course, shall provide employees with the understanding, knowledge and skills necessary to assure the safe performance of all confined space operations.

Training frequency:

1. Before the employee is first assigned duties in a permit-required confined space.
2. Before an employee is expected to perform duties for a confined space operation that he has not received prior training for.
3. When the operations of a confined space presents with a new hazard that is unknown to the employee.
4. When there is reason to believe the employee's knowledge may be insufficient or there has been a deviation from the entry procedures.

Training topics to be covered:

1. Confined space definition and requirements
2. Duties and responsibilities of all authorized entrants including supervisors, attendants and emergency personnel
3. Hazard controls
4. Personal Protective Equipment
5. Communication procedures and equipment
6. Emergency response

The training program shall establish employee proficiency in the required duties for confined spaces. Training programs and records shall be maintained by EH&S for three years subsequent to the period of initial training. A training certificate or documentation will be kept on file and

available for inspection, the documentation will contain the employee's name, type of training received, dates of training and signature of the trainer. **Only medical records have to be retained for 30 years not training records**

12. RECORDKEEPING

All documentation for the Confined Space Program at NSU will be maintained EH&S. This will include the following:

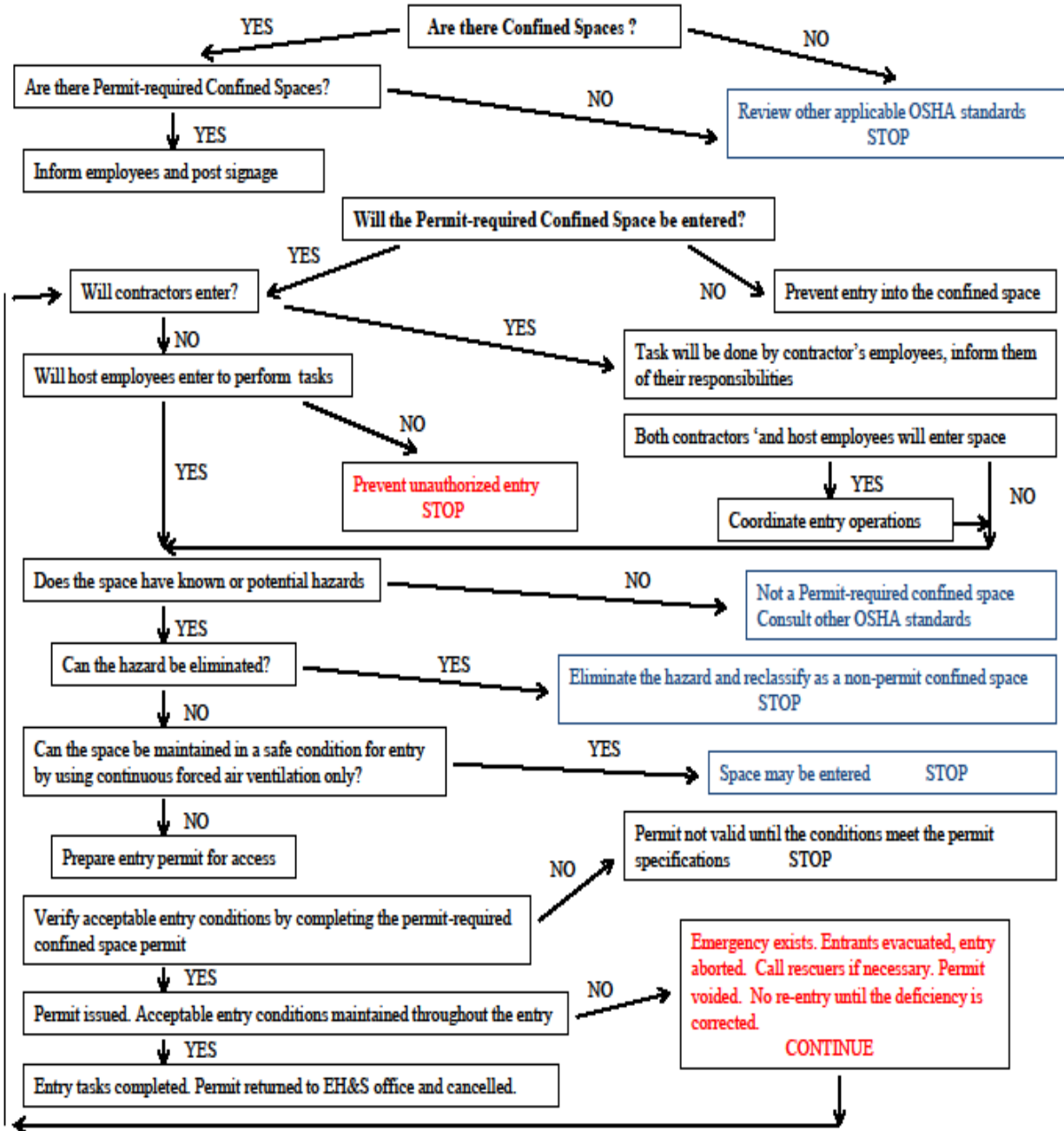
- A comprehensive list of all permit-required confined spaces and non-permit required confined spaces at all NSU facilities.
- A Confined Space Hazard Assessment form for each confined space identified.
- Confined Space Entry Permits for all permit-required confined spaces.
- Documentation of all training for all employees.
- Confined Space Hazard Assessment form for each entry into a confined space.

13. AUDITS

The Confined Space Program shall be reviewed annually for effectiveness. All canceled permits will be reviewed annually to ensure that all employees were protected from permit-required space hazards. A confined space self-inspection shall be performed annually to evaluate all confined spaces, reclassify a confined space if necessary, ensure the proper signage is posted for confined spaces and all personal protective equipment and rescue equipment are in excellent working condition.

APPENDIX A

Permit-Required Confined Space Decision Flow Chart – OSHA 1910.146



APPENDIX B

Confined Space Requirements

| Classification | Permit-Required | Non-Permit Required | Enclosed Space |
|--|------------------------|----------------------------|-----------------------|
| Hazard Assessment | X | X | X |
| Hazard Evaluation and Control | X | * | X |
| Entry Permit | X | | |
| Attendant | X | X | X |
| Notify - Supervisor and Plant Operations | X | X | X |
| Rescue Retrieval Devices | ** | ** | ** |
| Two-way radios or phones | X | X | X |
| PPE | X | X | X |
| Training | X | X | X |

* Air monitoring not required

** Rescue retrieval system consists of a full body harness, tripod and mechanical lifting device are required in all confined spaces when vertical depth exceed 5 feet as long as this equipment does not increase the overall risk of entry.

| 5. HAZARD IDENTIFICATION | | | | |
|---------------------------------|-------------|--------------------|---------------------------|-------------------------------|
| Hazards | Source/Type | Quantity & Quality | Severity (Rate 1 to 5) | Hazard Abatement Method |
| Explosive Atmosphere | | ___ LFL | | |
| Oxygen Levels | | ___ % | | |
| Combustible Material | | | | |
| Electrical Circuits | | | | |
| Toxic Gases | | ___ PEL | | |
| Toxic Material | | | | |
| Thermal Hazards | | ___ °F | | |
| Machinery | | | | |
| Slip / Fall Hazards | | | | |
| Engulfment Hazards | | | | |
| Entrapment Hazards | | | | |

| | |
|---|--|
| <p><u>Configuration Hazards</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Interior shape or slope <input type="checkbox"/> Low overhead clearance <input type="checkbox"/> Drop offs <input type="checkbox"/> Complex layout <input type="checkbox"/> Structural integrity <input type="checkbox"/> Compartmentalized <input type="checkbox"/> Elevated work surfaces <input type="checkbox"/> Sharp surfaces <input type="checkbox"/> Inwardly converging walls <input type="checkbox"/> Maneuverability <input type="checkbox"/> Structural integrity <p><u>Potential Energy Sources</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Electrical <input type="checkbox"/> Hydraulic <input type="checkbox"/> Pneumatic <input type="checkbox"/> Mechanical <input type="checkbox"/> Steam <input type="checkbox"/> Piping systems <input type="checkbox"/> Spring actuated <input type="checkbox"/> Gravity <input type="checkbox"/> Others: _____ _____ _____ | <p><u>Content Hazards</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Decomposing organic matter <input type="checkbox"/> Shifting content <input type="checkbox"/> Content fill or removal <input type="checkbox"/> Dust <input type="checkbox"/> Inerting agents (Nitrogen, Argon, Carbon Dioxide) <p><u>Environmental Hazards</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Damp / wet conditions <input type="checkbox"/> Snakes / rodents / insects <input type="checkbox"/> Falling objects / suspended loads <input type="checkbox"/> Fire suppression systems <input type="checkbox"/> Poor illumination/visibility <input type="checkbox"/> Asbestos <input type="checkbox"/> Others: _____ <p><u>External Hazards</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Traffic <input type="checkbox"/> Work in neighboring compartments <input type="checkbox"/> Terrain <input type="checkbox"/> Weather <input type="checkbox"/> Processes <input type="checkbox"/> Others: _____ |
|---|--|

| 6. VENTILATION REQUIREMENTS | |
|------------------------------------|--|
| | Confined space - volume in cubic feet |
| | Natural circulation - additional ventilation may be required for worker comfort, hot work, grinding or other operations that would produce airborne fumes, mist or dust. |
| | Mechanical ventilation required for venting hazardous atmospheric contaminants |

| 6. VENTILATION REQUIREMENTS | | | | | | |
|--|--------------------------|--|-------------------|---|------------------------------|--|
| Supply | | Exhaust | | Local | | |
| Volume | CUFT per Min | Volume | CUFT per Min | Volume | CUFT per Min | |
| Ventilation Formulas & Requirements | | | | | | |
| 20 Air Changes Per Hour (ACH) required for duration of entry 20 ACH = Space volume X 20 | | Adequate Blower Capacity (ABC) $ABC = \frac{\text{Space Volume} \times 20 \text{ ACH}}{60 \text{ Minutes}}$ | | Initial Purge Time $\frac{7.5 \times \text{Space volume}}{\text{Effective Blower Capacity}}$ | | |
| 7. RESCUE & SAFETY EQUIPMENT | | | | | | |
| | Body harness | | Life line | | Winch | |
| | Tripod | | Blower | | Vent trunks | |
| | Ladder | | Portable lighting | | Manhole hooks | |
| | Emergency retrieval line | | First aid kit | | Fire extinguisher | |
| | Traffic cones | | Vent saddle | | Emergency escape respirators | |
| 8. COMMUNICATION | | | | | | |
| _____ Wireless Radio | | _____ Line Radios | | _____ Verbal from access | | |
| 9. RESCUE PROCEDURES | | | | | | |
| _____ Self Rescue | | _____ Non-entry Rescue | | _____ Rescue team entry | | |
| 10. SPECIAL HAZARDS / REQUIREMENTS / NOTES | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| EVALUATORS | | | | | | |
| NAME: print legibly _____ | | TITLE _____ | | DATE: dd/mm/yy _____ | | |
| NAME: print legibly _____ | | TITLE _____ | | DATE: dd/mm/yy _____ | | |
| NAME: print legibly _____ | | TITLE _____ | | DATE: dd/mm/yy _____ | | |

APPENDIX D

Confined Space Entry Permit

| NSU CONFINED SPACE ENTRY PERMIT | | | | | | | |
|---|--|-----------|--|-------|---|-------|--|
| GENERAL INFORMATION | | | | | | | |
| Space to be Entered: _____ | | | Purpose of Entry: _____ | | | | |
| Confined Space Number: _____ | | | Supervisor: _____ | | | | |
| Location/Area: _____ | | | Authorized Duration of Permit: Date: _____ | | Time: _____ | | |
| | | | Until Date: _____ | | Time: _____ | | |
| POTENTIAL HAZARDS (Check All That Apply) | | | EQUIPMENT REQUIRED FOR ENTRY AND WORK | | | | |
| <input type="checkbox"/> Oxygen deficiency (less than 19.5%) <input type="checkbox"/> Oxygen enrichment (greater than 23.5%) <input type="checkbox"/> Flammable gases/vapors (greater than 10% of LFL) <input type="checkbox"/> Airborne combustible dust (vision obscured @ : 5 ft meets or exceeds the LFL) <input type="checkbox"/> Toxic gases or vapors (greater than PEL) <input type="checkbox"/> Mechanical hazards <input type="checkbox"/> Electrical shock <input type="checkbox"/> Materials harmful to skin <input type="checkbox"/> Engulfment <input type="checkbox"/> Inflow <input type="checkbox"/> Heat <input type="checkbox"/> Noise <input type="checkbox"/> Working Aloft <input type="checkbox"/> Stored Energy <input type="checkbox"/> Other: _____ | | | PPE: <input type="checkbox"/> N/A Respiratory Protection: <input type="checkbox"/> N/A | | | | |
| | | | Ventilation: <input type="checkbox"/> 2000 CFM / Welder | | Illumination: _____ | | |
| | | | Atmospheric Testing/Monitoring (Check all that apply): <input type="checkbox"/> _____ Monitor / Meter Calibration Date: _____ <input type="checkbox"/> Other (Identify): _____ | | | | |
| | | | Communication Method & Equipment: <input type="checkbox"/> Verbal / Visual <input type="checkbox"/> Equipment (List): _____ | | | | |
| PREPARATION FOR ENTRY (Check after steps taken) <input type="checkbox"/> Notification of affected personnel of service interruption <input type="checkbox"/> Isolation Methods: <input type="checkbox"/> Lockout <input type="checkbox"/> Blank/blind <input type="checkbox"/> Purge/clean <input type="checkbox"/> Other: _____ <input type="checkbox"/> Personnel Awareness: <input type="checkbox"/> Pre-entry briefing on specific hazards & control <input type="checkbox"/> Notify contractors of permit & hazardous conditions <input type="checkbox"/> Other: _____ <input type="checkbox"/> Atmospheric Testing <input type="checkbox"/> Hotwork Permit (Ventilation and Continuous Monitoring Required) | | | Non-Entry Rescue Equipment (Check all that apply): <input type="checkbox"/> Harness <input type="checkbox"/> Lanyard <input type="checkbox"/> Tripod <input type="checkbox"/> Wristlet <input type="checkbox"/> Other (List): _____ | | | | |
| EMERGENCY INFO / NUMBERS / CONTACTS Emergencies and Rescue – 911 EH&S: _____ Fire Department _____ | | | ATTENDANT(S) | | ENTRANTS | | |
| | | | _____ _____ _____ _____ _____ | | _____ _____ _____ _____ _____ | | |
| TESTING RECORD <i>Required</i> | | | PERIODIC MONITORING RESULTS | | | | |
| | | | PRE-ENTRY | | | | |
| | | | 1- Results 2- Results 3- Results 4- Results 5- Results | | | | |
| Oxygen >19.5% <23.5% | | | _____ | | | | |
| Flammability <10%LEL/LFL | | | _____ | | | | |
| H ₂ S <10 ppm | | | _____ | | | | |
| CO <35 ppm | | | _____ | | | | |
| <i>Other (If Potential Exists)</i> | | | _____ | | | | |
| Other: | | | _____ | | | | |
| Time | | | _____ | | | | |
| Tester Initials | | | _____ | | | | |
| AUTHORIZATION BY ENTRY SUPERVISOR I certify that all required precautions have been taken and necessary equipment is provided for safe entry and work in this confined space. | | | | | | | |
| Printed Name | | Signature | | Date | | Time | |
| _____ | | _____ | | _____ | | _____ | |
| THIS PERMIT MUST BE POSTED AT THE CONFINED SPACE ENTRY POINT Return to the EH&S office upon completion of the job. | | | | | | | |

APPENDIX E

Confined Space Audit Checklist

CONFINED SPACE ENTRY AUDIT CHECKLIST

Building: _____

Date: _____

Supervisor: _____

Audit Performed by: _____

| | Y | N | N/A | COMMENTS |
|--|---|---|-----|----------|
| A. Confined Space Entry Program | | | | |
| 1. Workplace been evaluated to determine if any spaces are permit-required confined spaces? [OSHA 1910.146(c)(1)] | | | | |
| 2. Is the written confined space program complete? [OSHA 1910.146(c)(4)] | | | | |
| 3. Is the program reviewed and updated regularly by qualified staff? | | | | |
| 4. The training of employees and entrants complete and documented? | | | | |
| 5. Has a periodic survey of canceled permits been performed and documented? | | | | |
| B. Confined Space Entry Procedures | | | | |
| 1. Has the evaluation of confined spaces been completed? | | | | |
| 2. Has effective measures been taken to prevent employees from entering the permit spaces? [OSHA 1910.146(c)(3)] | | | | |
| 3. Has entry procedures been established and documented for: <ul style="list-style-type: none"> a. permit-required confined spaces (permit spaces) b. alternate procedures for permit spaces c. non-permit confined spaces? | | | | |
| 4. Have signs been posted at confined spaces? | | | | |
| 5. Have confined space hazards been identified, evaluated and documented? | | | | |
| 6. Have appropriate atmospheric tests been performed prior to confined space entry? | | | | |
| 7. Are confined spaces thoroughly emptied and rinsed of corrosive and hazardous substances before entry? | | | | |
| 8. Are all lines to a confined space containing hazardous materials locked and tagged out before entry? | | | | |
| 9. Have the protective equipment and materials been provided and maintained? | | | | |
| 10. Has adequate ventilation been provided prior to and during confined space entry? | | | | |
| 11. Is the Rescue and Emergency Services provided for? | | | | |
| 12. Are accurate facility maps, descriptions and locations readily available to emergency personnel if needed? | | | | |
| 13. Procedures established for work performed by contractors in confined spaces? | | | | |
| 14. Are entry permits reviewed prior to work being performed by qualified personnel and posted at the site? | | | | |