Safety Requirements for Confined Spaces
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Foreword

(This Foreword is not a part of American National Standard Z117.1-2003)

This standard was developed by an American National Standards Committee, national in scope, functioning under the procedures of the American National Standards Institute with the American Society of Safety Engineers (ASSE) as Secretariat. This standard establishes minimum safety requirements for confined spaces.

It is intended that the procedures and performance requirements detailed herein will be adopted by every employer whose operations fall within the scope and purpose of the standard.

Neither the standards committee, nor the secretariat, feel that this standard is perfect or in its ultimate form. It is recognized that new developments are to be expected, and that revisions of the standard will be necessary as the art progresses and further experience is gained. It is felt, however, that uniform requirements are very much needed and that the standard in its present form provides for the minimum performance requirements necessary in developing and implementing a comprehensive confined space program for the protection of personnel.

In 1993 OSHA estimated that 238,000 establishments had permit required confined spaces. These establishments employed approximately 1.6 million workers, including contractors, who entered 4.8 million permit-required confined spaces annually. OSHA further estimated that 63 fatalities and 13,000 lost workday cases and non-lost workday cases involving confined spaces entry occurred annually.

OSHA and NIOSH data during the period 1980-1993 indicates atmospheric conditions were the leading cause of death associated with confined space entry. The data indicates that oxygen deficiency, hydrogen sulfide, methane, and inert gases ranked as the leading specific atmospheric hazardous conditions. Engulfment was found to be second in terms of occurrence. Mechanical asphyxiation from loose materials such as grain, agricultural products, sand, cement, and gravel was dominant. Evidence suggests that the cause of death associated with confined space entry has not changed appreciably during recent years.

The Z117 Committee acknowledges the critical role of design in influencing the safe entry of confined spaces. Design deficiencies often increase the risk for entrants: examples are (1) means of entry (portals, hatchways, etc.) which are too small, improperly located, or that complicate/inhibit escape; (2) spaces which are convoluted, unnecessarily obstructed, or hazardously configured; (3) internal clearances which are too tight for safe passage; (4) space penetration distances which are excessive without alternative means of access or escape; (5) absence of appropriate devices to isolate all energy sources from the space; (6) no provision for vessel mechanisms/devices to prevent loose materials from bridging, compacting, etc. (7) lack of features that would enhance space ventilation effectiveness; (8) structural weaknesses in walls, floors, ceilings, or pipes containing gases, liquids, or steam, or which increase hazard risk to entrants while working or coming in contact with stated structures in confined spaces; (9) absence of anchor points for retrieval devices.

The standard does not attempt to address these issues. It is believed they are best dealt with by the purchaser, employer, or owner during a project’s design, acquisition, or construction. However, it is recommended that designers, manufacturers, and users make confined space design issues a priority when new or modified machinery, equipment, processes or facilities are contemplated.

For existing confined spaces, which have recognized design deficiencies, it should be the responsibility of those authorizing entry to either:

- modify or correct the deficiencies when possible, or
- employ alternate means to accomplish the work without exposing personnel, or
- develop and implement specific safe entry procedures for each confined space, or
- dismantle, open, remove, etc. the equipment/process rather than enter if the risk is deemed
unacceptable.

Suggestions for improvement of this standard will be welcome. They should be sent to the American Society Safety Engineers, 1800 East Oakton Street, Des Plaines, Illinois 60018-2187.

This standard was processed and approved for submittal to ANSI by American National Standards Committee on Confined Spaces Z117. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved that standard, the Z117 Committee had the following members:

Edward V. Grund, Chairman
Terry W. Krug, Vice-Chairman
Timothy R. Fisher, Secretary
Patrick J. Arkins, Assistant Secretary

**Organizations Represented**

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Safety Management Inc.
San Diego, City of

Sellstrom
Shell Chemical
Steel Plate Fabricators Association

United Automobile Workers of America

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American National Standard Z117.1-2003 uses a two-column format to provide both specific requirements and supporting information.

The left column, designated “Standard Requirements,” is confined solely to these requirements and is printed in bold type. The right column, designated “Explanatory Information,” contains only information that is intended to clarify the standard. This column is not a part of the standard.

Operating rules (safe practices) are not included in either column, unless they are of such a nature as to be vital safety requirements, equal in weight to other requirements, or guides to assist in compliance with the standard.

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American National Standard
Safety Requirements for Confined Spaces

1. Scope, Purpose, and Application

1.1 Scope. This standard provides minimum safety requirements to be followed while entering, exiting and working in confined spaces at normal atmospheric pressure.

Exception. This standard does not pertain to underground mining, tunneling, caisson work, intentionally inert confined spaces, or other similar tasks that have established national consensus standards.

1.2 Purpose. The purpose of this standard is to establish minimum requirements and procedures for the safety and health of employees who work in, and in connection with, confined spaces.

1.3 Application. This standard is designed for voluntary application immediately upon approval as an American National Standard.

2. Definitions

ATTENDANT. A person who is assigned to monitor a confined space process or operation and provide support or react as required to provide for the safety of the entrants and entry team.

BIOLOGICAL HAZARDS. Microbial agents presenting a risk or potential risk to the well-being of humans through inhalation, ingestion, skin absorption, or injection.

BLINDING/BLANKING. Inserting a solid barrier across the open end of a pipe, or in between two flanges, leading into or out of the confined space, and securing the barrier in such a way to prevent leakage of material.

Explanation: Microorganisms may cause toxic release or an oxygen deficient atmosphere. Bio hazards may include, but are not limited to: Infectious or parasitic agents; microorganisms such as some fungi, mold, yeasts and algae; plants and plant products, and animals and animal products, which cause occupational disease.

A blank is designed as a bolted flat plate, which can be used to terminate a pipe line (ASME B31.3 Paragraph 304.5.2b).
CONFINED SPACE. An enclosed area that is large enough and so configured that an employee can bodily enter and has the following characteristics:

- its primary function is something other than human occupancy.
- has restricted entry and exit. (Restricted entry and exit is a physical configuration, which requires the use of the hands or contortion of the body to enter into or exit from a confined space.)

DOUBLE BLOCK AND BLEED. A method used to isolate a confined space from a line, duct or pipe by physically closing two main valves on a piping system, and opening a “vented-to-atmosphere” valve between them.

EMERGENCY. Any occurrence inside or outside of the confined space that could endanger the entry team.

ENGULFMENT. The surrounding and effective capture of a person by a liquid or flowable solid substance.

ENTRANT. A person who enters a confined space to perform an assigned task.

ENTRY. Ingress by persons into a confined space, which occurs upon breaking the plane of the confined space portal with any part of the body. Entry includes all periods of time in which the confined space is occupied.

ENTRY SUPERVISOR/LEADER. An individual who has been assigned the responsibility for directing all aspects of the confined space entry.

EVACUATION. An unaided emergency exit out of a confined space. This action may result from the entrant’s own decision or by a command from outside the space.

HAZARD. A condition or changing set of circumstances that presents a potential for injury, illness, or property damage. The potential or inherent characteristics of an activity, condition, or circumstance, which can produce adverse or harmful consequences.

HAZARDOUS ATMOSPHERE. An atmosphere that may be, or is injurious to occupants by reason of: oxygen deficiency or enrichment; flammability or explosivity; or toxicity.

When a blind is required, use the geometry specified in ASME/ANSI B16.5.

Explanation: Examples of confined spaces include but are not limited to tanks, silos, vessels, pits, sewers, pipelines, boilers, septic tanks, utility vaults, tank cars and other mobile containers.

Temporary structures may meet the criteria of this definition.

Tanks and other structures being constructed may or may not be considered confined spaces until completely closed.

Explanation: Bleed means the contents will flow from the bleed point in the event of valve failure or leakage. The bleed point should be appropriately sized to accomplish its relief function and prevent any flow into the confined space.

This is referred to in OSHA Regulation 29 CFR 1910.146 as self-rescue.

Examples are materials that cause oxygen deficiency/enrichment flammability, toxicity, corrosivity, stored product, chemical and mechanical energy.
Explanation: NFPA 325-1994 defines these as follows:
In the cases of gases or vapors which form flammable mix-
tures with air or oxygen, there is a minimum concentra-
tion of vapor-in-air or vapor-in-oxygen below which propagation
of flame does not occur on contact with a source of ignition.
There is also a maximum proportion of vapor or gas in air
above which flame propagation does not occur. These
boundary-line mixtures of vapor or gas with air, which if
ignited will just propagate flame are known as the ‘lower
and upper flammable or explosive limits’, and are usually
expressed in terms of percentage by volume of gas or vapor
in air. No attempt is made to differentiate between the terms
‘flammable’ and ‘explosive’ as applied to the lower and
upper limits of flammability.

PERSPECTIVE OF INDEXES

Note: Care should be exercised when using dated PEL criteria.

29CFR 1910, Subpart Z, the Occupational Safety and Health
Administration “Toxic and Hazardous Substances”.

HORIZONTAL RESCUE. Methodology to move the
entrant to safety while the entrant’s weight is support-
ed by the surface of the space’s floor or other horizon-
tal level within the space.

HOT WORK. Work within a confined space that pro-
duces arcs, sparks, flames, heat, or other sources of
ignition.

ISOLATION. A process of physically interrupting, or
disconnecting, or both, pipes, lines and energy sources
from the confined space.

LEL/LFL and UEL/UFL. Abbreviation for “lower
explosive limit”?/”lower flammable limit” and “upper
explosive limit”?/”upper flammable limit”.

LOCKOUT/TAGOUT. The placement of a lock/tag on
the energy isolating device in accordance with an
established procedure, indicating that energy isolating
device shall not be operated until removal of the
lock/tag in accordance with an established procedure.
(The term “lockout/tagout” allows the use of a lockout
device, a tag, or a combination of both.)

NON-PERMIT CONFINED SPACE (NPCS). A space,
which, by configuration, meets the definition of a con-
fined space but which after evaluation is unlikely to
have potential hazards or has the hazards eliminated
by engineering controls.

OXYGEN DEFICIENT ATMOSPHERE. An atmos-
phere containing less than 19.5% oxygen by volume.

OXYGEN ENRICHED ATMOSPHERE. An atmos-
phere containing more than 23.5% oxygen by volume.

PEL. Abbreviation for “Permissible Exposure Limit”.
PELs are the allowable air contaminant level estab-
lished by the U.S. Department of Labor, Occupational
Safety and Health Administration.

PERMIT REQUIRED CONFINED SPACE (PRCS).
A confined space, which after evaluation, is found to
contain actual or potential hazards. Because of the hazards, the confined space requires written authorization for entry.

PERMIT SYSTEM. A written procedure for preparing and issuing permits for entry and for returning the permit required confined space (PRCS) to service following termination of entry.

QUALIFIED PERSON. A person who by reason of training, education and experience is knowledgeable in the operation to be performed and is competent to judge the hazards involved and specify controls and/or protective measures.

RESCUE. Aided assistance in exiting the confined space requiring entry by the rescuer(s).

RETRIEVAL. Aided assistance in exiting the confined space not requiring entry.

SHALL. Denotes a mandatory requirement.

SHOULD. A recommendation that is a sound safety and health practice; it does not denote a mandatory requirement.

TLV®. Abbreviation for Threshold Limit Value.

Explanation: “Threshold Limit Values” TLVs® are the recommended worker exposure levels of chemical and physical agents recommended by the ACGIH (American Conference of Governmental Industrial Hygienists). This is a registered trademark of the American Conference of Governmental Industrial Hygienists.

TOXIC ATMOSPHERE. An atmosphere containing a concentration of a substance above the published or otherwise known safe levels.

Explanation: Sources of published or otherwise presumed known acceptable levels of air contaminants include, but are not limited to the most current editions of:

The American Conference of Governmental Industrial Hygienists “Threshold Limit Values and Biological Indices”.

In-House standards and vendor material safety data sheets (MSDS).

VERTICAL RESCUE. Methodology to move the entrant to safety while all or a portion of the entrant’s weight is supported by life-safety rope or wire. This methodology would include Diagonal Rescue where a portion of the entrant’s weight is supported by a surface within the space.
3. Identification and Evaluation

General Requirements

3.1 Confined Space Survey. A qualified person shall conduct an initial survey of the premises or operations, or both to identify confined spaces as defined by this standard. A process shall be established to identify the addition or deletion of confined spaces to keep the documented inventory current.

3.2 Hazard Identification. Confined spaces shall be considered hazardous until determined to be otherwise. Hazards shall be identified for each confined space. The hazard identification process shall include, but not be limited to, a review of the following:

3.2.1 The past and current uses of the confined space which may adversely affect the atmosphere of the confined space;

3.2.2 The physical characteristics, configuration, and location of the confined space;

3.2.3 Existing or potential atmospheric hazards, such as:

1) Oxygen deficient or enriched atmosphere
2) Flammable/explosive atmosphere
3) Toxic atmosphere;

3.2.4 Biological hazards;

3.2.5 Mechanical hazards.

3.2.6 Physical hazards.

3.3 Hazard Evaluation. Hazards identified shall be evaluated by a qualified person. Each hazard shall be examined with respect to:

3.3.1 Scope of hazard exposure;

3.3.2 Magnitude of the hazard;

3.3.3 Likelihood of hazard occurrence:

E3.1 The purpose of the survey is to develop an inventory of those locations or equipment, or both, which meet the definition of a confined space so that personnel may be made aware of them and appropriate procedures developed for each prior to entry.

E3.2 Confined spaces can become unsafe as a result of: 1) possible atmospheric contamination by toxic or flammable vapors, or oxygen deficiency or excess; 2) possible physical hazards; 3) the possibility of liquids, gases, or solids being introduced to the space during occupancy; 4) the isolation of occupants from rescue personnel; 5) presence of radiation sources.

E.3.2.1: Review MSDS(s) to determine compatibility of current and previous contents. Be aware of protective coatings, which could trap materials or residue that may decompose or react with cleaning agents or heat (from welding or burning); and/or exhaust gases from engine powered equipment in or positioned outside the confined space.

E3.2.2 The means of entry and exit, and the hazards posed by adjacent spaces and operations should be reviewed.

E.3.2.3 The current edition of the ACGIH Threshold Limit Values, 29CFR1910, Subpart Z, and Material Safety Data Sheets are examples of reference sources, which should be consulted to determine the exposure limits for toxic materials.

E3.2.6 Electrical, thermal, radiological, noise, or engulfment
E3.3.4 Consideration should be given to the most likely outcome if the hazard occurs, i.e. space explosion, death by asphyxiation, etc.

E3.3.5: Examples of changes in conditions / activities are; introduction of hot work or cleaning agents into the confined space that were not previously identified. The filling / emptying of an adjacent compartment / tank is an example of changes in adjacent spaces. Weather changes, such as thunder storms, (drop in barometric pressure, lightening etc.) heat of the day increasing vaporization and affecting personnel (heat exhaustions) are examples of changes in the environment which can cause problems in confined spaces. The hazard introduced by portable hand or power tools should also be considered. Introduction of exhaust contaminants from internal combustion engines in or near the space.

E3.3.6 Hazards should be eliminated or controlled to the extent that an acceptable level of risk is attained prior to conducting confined space entries. The following hierarchy of control should be followed:
- Eliminate the hazard;
- Substitute (material procedure, etc.) with a less hazardous replacement
- Isolate the hazard;
- Use engineering controls;
- Use administrative controls;
- Use PPE

E3.3.7 Physical conditions that could hinder emergency rescue may include: manway or manhole size, scaffolding or pipe structures, or other obstructions. These special needs should be addressed in assessment for emergency response.

3.4 Confined Space Classification. Based on the evaluation of the hazards, a qualified person shall classify the confined space as either a permit-required confined space (PRCS) or non-permit confined space (NPCS). All confined spaces shall be treated as permit spaces until determined to be otherwise.

3.5 Hazard Re-evaluation. A qualified person(s) shall determine the need for periodic identification and reevaluation of the hazards based on possible changes in activities in the space, or other physical or environmental conditions, or both, which could adversely affect the space. When the need is determined, a qualified person(s) shall conduct the identification and reevaluation process.

3.6 Written Program. If the employer determines that employees will enter confined spaces, the employer shall develop and implement a written confined space entry program. The program shall contain a requirement for a periodic written performance assessment of

E3.6 The written entry program should include how the key items of this standard will be implemented and who is responsible for their execution. Since employers are ultimately responsible for implementation of this standard, management should use the method identified for correcting
the requirements of this standard. An established method, with action steps and assigned responsibility, shall be specified for correcting deficiencies identified by the performance assessment.

3.6.1 The written program shall include a requirement to develop specific entry procedures for permitable spaces identified during the survey. Procedures shall identify known hazards as well as the actions required to eliminate or control those hazards. Where spaces are identical with respect to hazards and required control actions a single procedure to cover these like spaces is acceptable.

4. Non Permit Confined Spaces (NPCS)

4.1 Controls. The employer shall specify what conditions and precautions must be in place to allow for safe entry and what would constitute a change in conditions, which would require a re-evaluation of the confined space. Sections 7 through 17 of this standard shall be considered for NPCS entries to determine their relevance for safe entry.

4.2 Training. Training shall be conducted as needed to maintain competence in entry procedures and precautions.

4.3 Re-evaluation. NPCS’s shall be periodically reevaluated to assure proper classification.

4.3.1 Any change of conditions in the space which introduces new hazards to the space, shall require an immediate re-evaluation of the space before entry.

4.4 Atmospheric Testing. A qualified person shall determine whether atmospheric testing is required. If testing indicates atmospheric levels are not within acceptable limits the entry shall not proceed.

5. Permit Required Confined Spaces (PRCS)

5.1 Entry Permits. A permit shall be established for all PRCS entries. This document shall include:

5.1.1 The date of entry, the location of entry, the names or identification of entrants and type of work which will be conducted in the confined space;

5.1.2 The hazards to be controlled or eliminated prior to proceeding with the entry;

deficiencies identified during the performance assessments as a fundamental tool for enforcing the requirements of this standard. Frequency of performance assessment should be governed by the identified need for improvement.

E3.6.1 Procedures that are intended to assist in the evaluation of the space are not a substitute for pre-entry evaluation.


E4.3.1 Any change in conditions such as, but not limited to, atmospheric conditions while in the space may trigger evacuation or removal of personnel and re-evaluation of the space.

E4.4 If atmospheric test results are not within acceptable limits, this should indicate that the engineering controls are not adequate or the potential for generation of hazards is not as minimal as was initially determined. Consequently, the confined space would no longer be an NPCS.

E5. This section provides the elements of a permit system.

E5.1 The intent of the permit system is to provide a systematic review for hazards, communicate this information to all those involved and provide an approval process for confined space entry.

E5.1.1 Under certain conditions, it may be necessary to document the entry and exiting of personnel and/or termination of entry.
5.1.3 Safety equipment required to perform the job;

5.1.4 Safety precautions required to perform the job;

5.1.5 The type of atmospheric tests required and the results of those tests;

5.1.6 The type of equipment which will be necessary for a rescue and how aid will be summoned in the event of an emergency;

5.1.7 A duration for the permit;

5.1.8 Space for approval authority.

5.2 Permit Implementation. Before each entry, an entry permit as defined above will be completed and signed by a qualified person and the contents communicated to the entrants, or posted, or both.

5.3 Duration of Permits. For a permit to remain in effect, the following must be done before each re-entry into the confined space:

5.3.1 Atmospheric test results shall be within acceptable limits per Section 6.0 of this standard. If atmospheric test results are not within acceptable limits, precautions to protect entrants against the hazards shall be addressed on the permit.

5.3.2 A qualified person shall verify that all precautions and other measures called for on the permit are still in effect;

5.3.3 Only operations or work originally approved on the permit shall be conducted in the confined space.

5.4 Revoking Permits. When conditions or work activity are outside the limits than those specified on the Permit, or could introduce a new hazard to the confined space, then the permit shall be immediately revoked.

5.5 Changing Work Conditions. A new permit shall be issued or the original permit re-issued whenever changing work conditions or work activity introduce new hazards into the confined space.

6. Atmospheric Testing

6.1 Requirements. Before entry into a confined space,
necessary testing shall be conducted for hazardous atmospheres by a qualified person. If there is no potential for a hazardous atmosphere, the atmospheric testing may be waived. A qualified person shall possess the knowledge and skills to understand the test instrument’s use, calibration procedures, limitations, and have the ability to interpret results.

6.1.1 Testing equipment and accessories used in hazardous classified areas shall be listed, approved, or certified for use in such areas. This listing, approval, or certification shall be from nationally recognized testing laboratories.

6.1.2 Initial testing of atmospheric conditions shall be done with the ventilation systems shut down.

6.1.3 Further testing shall be conducted with ventilation systems turned on to ensure that the contaminants are removed and that the ventilation system is not a source of contamination.

6.1.4 If the confined space is vacated for any significant period of time, the atmosphere of the confined space shall be retested before re-entry is permitted.

6.1.5 Atmospheric testing may be waived for non-permit confined spaces where it has been established through a formal hazard identification and evaluation study that no atmospheric hazards exist.

6.1.6 Instrument reliability verification: Calibration of direct reading portable atmospheric testing instruments shall be conducted according to the manufacturer’s recommendations, or more often if necessary because of the instruments usage to ensure accuracy is maintained. At a minimum, a function check (e.g., bump test) shall be done prior to each day’s use.

bustible and toxic atmospheres. It is recommended on a vertical entry that remote probes be used to test at various levels of the confined space. Note: Atmospheric tests will normally be conducted using direct reading real-time equipment. The user should ensure that the electronic test instrument indicates the appropriate response in clean air, and the order of the testing should be as follows unless all are conducted simultaneously:

1. Oxygen
2. Flammability/combustibility
3. Toxicity

E6.1.2 Testing with the ventilation off would closely represent the ambient atmosphere inside a confined space in the event of a ventilation system failure.

E6.1.3 Testing with the ventilation on can reveal problems such as the suction of engine exhaust gases into the confined space or where pneumatically powered blowers or tools may bring contaminated air or other gases into the confined space.

E6.1.4 Defining when re-testing may be needed should be determined by a qualified person as part of the permit system.

E6.1.5 A documented hazard identification and evaluation study meeting the requirements contained in Section 3.2 Hazard Identification and Section 3.3 Hazard Evaluation could be used to establish there are no atmospheric hazards resulting from conditions or work activities performed inside the space.

E6.1.6 Various types of instrument verification methods include the following:

a) Function check (bump test) – this involves the passing of a challenge gas source across the sensor to produce a response so the user knows all sensors are functioning. This is conducted as often as necessary throughout the testing period. If the instrument has comparable sensor self-testing features it meets the requirements of section 6.1.6 as a function check (bump test).

b) Point Source Calibration (calibration check) – A means of verifying calibration by using a known traceable concentration of a test gas to demonstrate that an instrument response to the test gas is within the instru-
6.1.6.1 An instrument maintenance record shall be maintained.

6.2 Testing Considerations. Testing of confined spaces shall be conducted in a manner that represents the atmosphere throughout the confined space.

6.2.1 Where personnel must enter the confined space to complete atmospheric testing, the space shall be treated as PRCS.

6.3 Acceptable Limits.

6.3.1 The atmosphere of the confined spaces shall be considered within acceptable limits whenever the following conditions are maintained:

6.3.1.1 Oxygen - 19.5% to 23.5%;

6.3.1.2 Flammability less than or equal to 10% of the Lower Explosive Limit (LEL) or Lower Flammable Limit (LFL);

6.3.1.3 Toxicity - less than recognized exposure limits.

E6.1.6.1 The record should include date of purchase, sensor change schedule, maintenance/repair, history, data logging, and battery life.

E6.2 Atmospheric testing for the confined space should be based on the configuration and design of the space, and physical, and chemical characteristics of suspected contaminants that may be encountered. Continuous monitoring should be considered in situations where a worker is present in a space where atmospheric conditions have the potential to change. Examples include broken or leaking pipe or vessels, disturbance of existing materials, the potential for adjacent work activities that can create a hazardous environment or any space that is not capable of being isolated.

E6.2.1 Proper engineering controls, work practices, and personal protective equipment (PPE) may be needed to address the conditions that may be encountered during testing.

E6.3.1.1 Any variation from normal atmospheric oxygen conditions inside the confined space as compared to outside the confined space should be investigated.

E6.3.1.2 Any level above zero should be investigated.

E6.3.1.3 Any level above zero should be investigated. To determine excessive toxic levels, standards such as the most current American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values document should be referenced, Material Safety Data Sheets (MSDS), 29CFR1910, Subpart Z, or other pertinent information which may apply to the toxic material. Consideration should
6.3.2 Whenever testing of the atmosphere indicates that levels of oxygen, flammability, or toxicity are not within acceptable limits, entry shall be prohibited until appropriate controls are implemented or appropriate personal protective equipment is provided.

6.3.2.1 If the source of the contaminant cannot be determined, precautions shall be adequate to deal with the worst possible condition, which the contaminant could present in the confined space.

6.3.2.2 If there is the possibility that the confined space atmosphere can become unacceptable while the work is in progress, procedures and equipment shall be provided to allow the employee to safely exit the confined space.

7. Entry Team

7.1 Attendant.

7.1.1 Location. The attendant shall be stationed immediately outside the point of entry/exit of the confined space to observe the permit required confined space (PRCS) and be able to communicate with the occupants throughout the entry.

7.1.2 Personnel Requirements. The number of attendants needed shall be determined by a qualified person who shall consider the manpower necessary to carry out the duties.

7.1.3 Duties. Attendants shall have the following duties:

7.1.3.1 Provide standby assistance to entrants entering the confined space.

7.1.3.2 Direct entrants to exit the confined space when any irregularities are observed.

be given to the use of continuous monitoring equipment. Applicable exposure limits should not be exceeded even instantaneously.

E6.3.2 The recommended method of entering confined spaces requires that an unacceptable atmosphere be corrected and controlled prior to entry. In some situations, this is not possible or practical and the entrants must be protected by the use of personal protective equipment that is appropriate for the actual conditions. These atmospheric conditions need to be considered when developing the specific work plan and rescue procedures. Entry under these conditions must be part of the entry permit or a new permit issued.

E7.1.1 This may be supplemented visually or verbally through remote means such as radio, hardwire, video, camera, etc… Communication equipment should be safe for the intended use.

E7.1.2 The number of attendants should be determined by considering the manpower it will take to carry out duties assigned to the attendant for the entry(ies). If several entry points are within a few feet of each other, one attendant may be able to monitor more than one entry directly, or more than one entry may be monitored using remote technology, such as multiple radios and/or video monitors. This would be dependent upon the attendant’s ability to communicate with the entrants and summon aid in the event of an emergency.

E7.1.3.1 “Standby Assistance” may include checking breathing air cylinders, or any ancillary duties that do not require the attendant to enter the confined space or leave his/her position, or distract them from monitoring the entrant(s) in the space(s).

E7.1.3.2 Irregularities include: (A) Whenever unanticipated hazards or other conditions or operation not allowed by the permit arise; (B) Whenever entrants exhibit symptoms of exposure to contaminants potentially in the space; (C)
Whenever surrounding operations or conditions create hazards for entrants, including entry of the space by unauthorized personnel.

E7.1.3.3 Attendants should summon the rescue team as soon as the attendant recognizes there may be a problem.

Explanation: Hazards that may not be detectable include structural weakness, biological agents, dangerous insects/animals, engulfment potential, and low volatility hydrocarbons, (e.g. diesel fuels), or any materials for which direct reading instrumentation is not available.

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7.1.3.3 Initiate evacuation and emergency procedures.

7.1.3.4 Monitor for any conditions or changes that could adversely affect the entry.

7.1.3.5 Remain at the entry point unless relieved by another attendant or until the entry is completed or terminated.

7.2 Entrant.
7.2.1 Duties

7.2.1.1 An entrant shall:

1) Recognize potential hazards that may be encountered during the entry and proper use and limitations of equipment for control of these hazards. Inspect for hazards not identified by atmospheric monitoring during entry activities.
2) Respond to emergencies, which includes method(s) for self-rescue.
3) Recognize symptoms and warning signs of exposure to potential hazards or prohibited conditions.
4) Notify the attendant of any emergency or unacceptable condition in the confined space.
5) Exit the confined space immediately if symptoms, warning signs, or unacceptable conditions occur or if directed by the attendant or entry supervisory leader.
6) Inspect for hazards during entry activities.

7.3 Attendant(s)/Entrant(s) Communication. Attendant(s) and Entrant(s) shall be able to maintain two-way communication.

7.4 Entry Supervisor/Leader.

7.4.1 Duties

7.4.1.1 The Entry Supervisor/Leader shall:

1) Know the requirements of the confined space entry program, including proper execution of duties of entrants, attendants and rescue per-
2) Verify that all required actions have been taken prior to endorsing the permit and allowing entry to begin, and ensure that acceptable conditions are maintained for the duration of the entry.

3) Verify that rescue services are available prior to and throughout the entry and that the means for summoning them are operable.

4) Communicate the status and requirements of the entry to other Entry Supervisor/Leader(s) whenever the Entry Supervisor/Leader is changed.

5) Terminate entry, assure removal of personnel and equipment, and revoke or cancel the permit when required.

8. Isolation and Lockout/Tagout

8.1 General. All energy sources which are potentially hazardous to confined space entrants shall be secured, relieved, disconnected and/or restrained before personnel are permitted to enter the confined space.

8.2 Isolation. Methods and means shall be selected and used to prevent flammable, toxic, irritating, or oxygen displacing gases and vapors from entering the space. All hazardous material, high pressure, high temperature and other piping that could be reasonably expected to introduce a hazard shall be isolated by utilizing blinding, disconnection, removal, or double block and bleed as needed to prevent entry of material(s) and hazardous contaminant(s).

A confined space shall be isolated to prevent entry of material(s) and hazardous contaminant(s) using one or more of the following methods:

- Inserting a blank sized for the proper pressure in piping nearest to the confined space.

- Depressurizing and disconnecting contaminant supply line(s) and providing a blank or blind on piping leading into the confined space.

- Misaligning pipe(s) at connections closest to the confined space and capping, blinding, and plugging ends.

- Utilizing two (2) blocking valves with an open vent or bleed valve between the blocking valves. If the...
E8.2.1 Pipelines between the confined space and the first valve, blank or associated equipment may contain material or hazardous contaminants. A qualified person should ensure that such piping has been flushed, cleaned or purged. If this is not possible, i.e., a clogged line, special precautions and procedures necessary to protect occupants and control the hazards should be in place.

E8.2.2 A qualified person should assess the impact of other equipment in isolating a confined space. Inter-connected equipment, vessels or machinery may affect the isolation method(s) chosen.

E8.2.3 A decision to enter these or other similar spaces should be based upon assessing the potential for hazardous contaminants being present and either devising a plan for protecting personnel entering the space or suspending entry until adequate hazard control and protection of occupants can be assured. Use of methods such as ventilation or PPE should be considered.

E8.2.4 Distillation vessels, boilers, cargo tanks, adjoining voids on ships and barges, and similar type equipment may contain cracks or leaks that may produce a hazardous environment inside the confined space.

E8.3.1 Where there is a need to test, position or activate equipment by temporarily removing the lock or tag or both, a procedure shall be developed and implemented to control hazards to the occupants.

E8.3.2 Any removal of locks, tags, or other protective measures shall be done in accordance with ANSI Z244.1-1982 (R1993) Lockout/Tagout of Energy Sources.

E8.3.3 Lockout, or tagout, or both, of equipment, systems and processes shall be verified prior to permitting entry into the confined space.

E8.3.3 Confirming adequate lockout, or tagout, or both, of potentially hazardous stored or residual energy should be included as part of confined space entry permit review.

E9.1 Consideration should be given to the volume of the space to be ventilated, the output capacity of the ventilating device, and the distribution of air within the confined space. In addition, the air movers should meet the specifications as
be done in accordance with Section 6.

9.1.1 Blowers or other means of introducing air into the space shall be placed in such a manner to minimize the possibility of introducing air contaminants, which may create unacceptable limits (e.g., carbon monoxide).

9.1.2 Ventilation shall be maintained during the entry if there is a potential for the atmospheric conditions in the confined space to become unacceptable.

9.1.3 When ventilation is not possible or feasible for complete elimination of atmospheric hazards, other protective measures or methods to control air contaminants and protect entrants shall be determined by the qualified person prior to authorizing entry.

10. Cleaning/Decontamination

10.1 Confined spaces shall be cleaned and decontaminated of hazardous materials as the preferred method of eliminating or reducing exposure. Cleaning and decontamination shall be done to the extent feasible before entry.

10.2 Entry team members and equipment shall be decontaminated and cleaned as necessary during or after the confined space activity.

11. Personal Protective Equipment (PPE)

11.1 General. A qualified person shall determine personal protective equipment needed by all personnel entering the confined space including rescue teams.


Ventilation normally consists of a pre-entry purge of several air changes, then continuous introduction of fresh air during occupancy.

Natural ventilation may be acceptable if it can achieve the same results as the mechanical ventilation. Consideration should be given to bonding and using intrinsically safe air movers when moving flammable atmospheres. Ventilation may not be appropriate under conditions such as the presence of friable or loose asbestos; significant bird/rodent droppings presenting a biological risk; gas, vapor, dust concentrations above UEL, etc.

E10. 1 In some instances, the purpose of the entry is to clean the confined space. In these cases, the confined space should be cleaned and decontaminated as much as possible before personnel enter. Proper PPE and other precautions should be used to address any hazards, which will remain after the pre-entry cleaning. Prior to commencing cleaning and decontamination, care should be exercised in the selection of cleaning compounds to ensure their compatibility with the environment in which they will be used.

E11.1 A hazard evaluation should be done to determine what PPE should be used. Combinations of equipment such as respirators, full suits, etc., may be needed. A guide can be found in Appendix B, General Description and Discussion.
11.2 **Selection.** Employees shall wear personal protective equipment selected in accordance with the requirements of the job to be performed. PPE shall meet the specifications of applicable standards and regulations. PPE that will not exacerbate present hazards or create additional hazards shall be selected.

E11.2 Head Protection. Consideration should be given to: 1) falling objects, both from within the confined space and also through the entryway, and 2) structures and equipment that present hazards to the head. (Ref. ANSI Z89.1-1997).

Fall arresting systems should be used by personnel entering vertical confined spaces and personnel exposed to falling into the space as determined by a qualified person. Fall arrest systems should conform to ANSI Z359.1-1992 (R-1999).

Eye and Face Protection. Consideration should be given to irritant dusts, vapors, mists, abrasive particles and flying objects. Safety glasses, impact goggles, chemical goggles, or face shields appropriate to the conditions in the confined space and the work to be performed should be provided as needed. (Ref. ANSI Z87.1-1989 (R-1998).

Hand Protection. Consideration should be given to mechanical protection (sharp edges, abrasions, and punctures), chemical protection (acid solvents), physical protection (heat, cold), electrical protection and handling of slippery tools and materials.

Foot Protection. Consideration should be given to physical hazards (falling objects, rolling equipment), chemical hazards (acids, solvents), slip resistance, electrical conductivity, and generation of sparks. (Ref. ANSI Z41-1991).

Protective Clothing. Consideration should be given to temperature, moisture, chemical resistance, vapor, and liquid permeability, flame retardancy, static resistance and likelihood of contamination of clothing with toxic materials. Protective clothing should be cleaned and decontaminated, or disposed of, after each use in accordance with the manufacturer’s instructions.

Respiratory Protection. Respirators should be selected and used in conjunction with an organized respiratory protection program. Breathing equipment used should be NIOSH approved. When conditions warrant, consideration should be given to conformity with NFPA 1981. Users should follow manufacturer’s instructions. (Ref. ANSI Z88.2-1992 and 29CFR 1910.134).

Hearing Protection. If hearing protection is required, consideration should be given to how it will affect communications between the personnel in the confined space and the attendant. (Ref. 29CFR 1910.95).
11.3 Inspection. PPE shall be inspected prior to each use.

12. Auxiliary equipment

12.1 Entry and Exit. Each entry and exit point shall be evaluated to determine the most effective methods and equipment to be utilized to enable employees to safely enter and exit the confined space. Safe entry and exit means shall be provided for confined spaces.

12.2 Retrieval Equipment. Appropriate retrieval equipment or methods shall be used whenever a person enters a PRCS. Exception: If the retrieval equipment increases the overall risks of entry or does not contribute to the rescue, its use may be waived.

12.3 Fall Protection. Where a potential exists for persons or objects falling into a confined space, warning systems or barricades shall be employed at the entrance.

12.4 Electrical Equipment. Electrical equipment used in hazardous locations shall meet the appropriate requirements of Article 500 of the National Electrical Code (NFPA-70).

12.4.1 Where there is potential for electrical shock, appropriate electrical equipment or systems shall be used.

13. Warning Signs and Symbols

13.1 Identification. All permit required confined spaces that can be entered without the use of tools, special equipment, or key(s) shall have a sign identifying it as a permit required confined space.

13.1.1 Signs shall be maintained in a legible condition.

13.1.2 The sign shall read “Danger-Permit Required Confined Space”.

E12.1: This may involve the use of ladders. However, if use of a ladder is impractical, another means of lowering and raising employees should be selected, i.e., bosun chairs, winch/hoist devices, etc. Access winches/hoists, bosun chairs, harness components, scaffolds, etc., should be compatible with the intended use according to the manufacturer’s instructions and suitable for confined space applications.

E12.2 In general, mechanical lifting devices should have a mechanical advantage adequate to safely rescue personnel. A manually operated device should be used. If a powered (electric, pneumatic, hydraulic) lifting device is used, then it should be equipped with a slip clutch or similar device to stop motion against a preset resistance and a back-up manual mode of operation. Mechanical lifting devices should have a mechanical advantage of at least four to one and the capacity to lift entrants including any attached tools and equipment.

E12.3 While protection is desired to prevent attendants or others from falling into a confined space, such protection should not interfere with ventilation or egress from the confined space.

E12.4 Tools, lighting, communications and test equipment which will be used in hazardous or classified locations should be listed, labeled or otherwise determined to be safe for the class and use by an Accredited nationally recognized testing laboratory acceptable to the Occupational Safety and Health Administration or other authority having jurisdiction.

E12.4.1 This would include protection such as ground fault circuit interrupters (GFCI), assured grounding systems, double insulated tools, and/or low voltage systems.

E13.1 Permit required confined spaces such as vessels, tanks, silos, ovens, reactors, etc. may be identified by signage in order to supplement the training of personnel regarding confined space identification and hazards.
14. Emergency Response

14.1 Emergency Response Plan. A plan of action shall be written with provisions to conduct a timely rescue for entrants in a confined space should an emergency arise. Included in these provisions shall be:

1. Evacuation when certain hazards are identified during an entry;

2. Retrieval by trained crew members using non-entry methods;

3. Rescue entry by trained emergency response personnel familiar with confined space hazards as well as rescue procedures and equipment.

14.1.1 Determination of what methods of rescue must be implemented to retrieve entrants;

14.1.1.1 Horizontal Rescue

14.1.1.2 Vertical Rescue: This rescue methodology shall include the use of fall protection for the entrant as well as suspended rescuers.

14.1.2 Determine the type and availability of appropriate equipment needed to rescue or retrieve entrants:

14.1.3 Designation of trained rescue personnel that are available where PRCS entries are conducted;

14.1.4 An effective means to summon rescuers in a timely manner;

14.1.5 Training and drilling attendant(s) and rescue personnel in preplanning, rescue and emergency procedures according to section 15 of this standard.

14.2 Atmospheric Monitoring shall be conducted to ensure the safety of the rescue personnel.

14.3 Respiratory Protection Equipment: All rescue personnel shall use self-contained breathing apparatus

E14.1 These rescue provisions will normally be present in the form of emergency response procedures.

E14.1.1.1 A review should be conducted of all the different types of confined spaces which will be entered and what steps/equipment it will take to get someone out. Consideration should be given to the size and configuration of the confined space, whether the space would require a vertical or horizontal rescue, anchor placement, hazards likely to be encountered, and the body size of entering personnel.

E14.1.1.2 Consideration should be given to prevent abrasive injury to the entrant from the supporting surface he/she is being moved upon. Additionally, entanglement and obstruction hazards must be negotiated safely. To avoid further injury, a constant watch should be utilized anytime a entrant is being physically moved.
(SCBA) or Combination Type C Airline/SCBA breathing equipment when potential atmospheric hazards exist. Users shall follow manufacturer’s instructions.

14.4 Rescue Equipment Inspection: All rescue equipment shall be inspected, by a qualified person, periodically and prior to use, to ensure that it is operable.

15. **Training**

15.1 **General Requirements.** Personnel responsible for supervising, planning, entering or participating in confined space entry and rescue shall be adequately trained in their functional duties prior to any confined space entry. Training shall include:

15.1.1 An explanation of the general hazards associated with confined spaces;

15.1.2 A discussion of specific confined space hazards associated with the facility, location or operation;

15.1.3 The hazard for which the PPE was selected, and the proper use, inspection, care and maintenance, and limitations of PPE and other safety equipment;

15.1.4 An explanation of the permit system and other procedural requirements for conducting a confined space entry;

15.1.5 How to respond to emergencies;

15.1.6 Duties and responsibilities as a member of the confined space entry team;

15.1.7 A description of how to recognize probable air contaminant overexposure symptoms to themselves and co-workers, and method(s) for alerting attendants.

15.2 **Training for Atmospheric Monitoring Personnel**

Training shall include training in the proper use of atmospheric monitoring instruments. This shall include field calibration, basic knowledge of the work being performed, the anticipated hazardous contami-

15.2 It is important for individuals conducting atmospheric tests to possess adequate knowledge of the proper operation of monitoring equipment as well as its limitations associated with anticipated conditions (such as inaccurate measurement readings for flammable gas when the oxygen level

E15.1 Training, whether basic or advanced, formal or informal, should be commensurate with the complexity of the confined space entry requirements. For general requirements regarding training, refer to Z490.1-2001 Accepted Practices in Safety, Health, and Environmental Training.

E15.5 Consideration should be given to rescue strategies and techniques. Additionally, crisis decision making including a scene evaluation and risk vs. reward (some rescues should not be attempted) should be taught and practiced. Rescue team access and patient extraction should include packaging which considers type and degree of injury and/or nature of incapacity. The entry team should be taught an incident management system stressing team member task assignments.
nants, and any process which could significantly alter original conditions inside or outside the confined space.

15.3 Training for Attendants. Training shall include the following:

15.3.1 Duties, responsibilities and procedures for both routine and emergency operations;

15.3.2 Hazards that may be encountered by entrants and the signs and symptoms of over exposure;

15.3.3 Procedures for summoning rescue or other emergency services;

15.3.4 The proper use of equipment used for communicating with entry and emergency/rescue personnel;

15.3.5 Performance of non-entry retrievals;

E15.3.4 Entry by an attendant for rescue may only be accomplished if the attendant has been trained in rescue procedures, is properly equipped, and only if the attendant is relieved by another trained attendant.

E15.3.5 Attendants should understand that not all retrievals should be attempted or are possible. Line entanglement is common and entrants that sustained a traumatic injury should be properly packaged (possibly including spinal immobilization) before being moved.

15.4 Training for Emergency Response Personnel shall include:

15.4.1 The rescue plan and procedures developed for each type of confined space they are anticipated to encounter;

E15.4.1 Emergency response personnel should simulate actual rescue conditions by conducting practice drills.

Typical potential rescue problems which should be addressed are egress restrictions, ability to lift without injury, problems in using rescue equipment, and fall hazards.

Such training should not be limited to internal emergency response personnel. When possible, outside response agencies should receive the same type of training to ensure their effectiveness in a rescue situation.

15.4.2 Use of emergency rescue equipment;

E15.4.2 Individuals involved in rescues should receive training in the use of rescue equipment including medical equipment they would be expected to use or operate during an emergency rescue.

15.4.3 First Responder/Emergency Response training Level or equivalent with confined space specific

E15.4.3 Persons performing Cardio Pulmonary Resuscitation, Automated External Defibrillator, and/or first aid or both,
should possess current certification,

E15.4.4 Rescuers should be able to effectively locate the
emergency site without undue delay. Consideration should
be given to notifying on-site Emergency Rescue Personnel
of the location of entries into PRCS's prior to entry.

15.5 Verification of Training

15.5.1 Periodic assessment of the effectiveness of
employee training shall be conducted by a qualified
person.

E15.5.1 Training effectiveness may be evaluated by several
techniques. Written, as well as practical testing is recom-
mended. Personnel should be questioned or asked to demon-
strate their practical knowledge of confined space hazards
that are in their work areas, to identify locations of confined
spaces, their role is exercising proper permit procedures, use
and donning of personal protective equipment, such as res-
pirators, and their role in response to emergency situations.

15.5.2 Training sessions shall be repeated as often as
necessary to maintain an acceptable level of personnel
competence.

E15.5.2 Personnel who are routinely entering the same con-
fined space on a daily basis will require less refresher train-
ing than employees who only occasionally enter a confined
space. Periodic skill evaluation will determine the frequency
of refresher training.

15.5.3 Written records of training shall be maintained
and include as a minimum:
  a. employee name;
  b. trainer’s name;
  c. date(s) of training;
  d. training duration
  e. training content.

E15.5.3 Documentation should be maintained in a central
location and periodically reviewed to ensure proper follow-
up for refresher training.

16. Medical Suitability. The physical and psychological
suitability of persons to adequately perform required
duties of confined space work shall be considered as
needed prior to working in confined spaces.

E16. Work in confined spaces may involve a variety of stres-
sors which should be evaluated by a physician or other
licensed Health Care Professional (HCP) against an essential
job function based job description specific to the confined
space, as appropriate.

Examples include, but are not limited to, thermal extremes
(hot or cold), vertigo, claustrophobia, and physical and psy-
chological stressors associated with specific confined space
environments.

Observation during field activities associated with confined
space work or training may be useful in assessing candi-
dates’ physical or psychological medical suitability for this
type work.

The confined space employer should make the final decision
regarding medical suitability after reviewing recommendations and input.

17. Contractors

17.1 Hazard Appraisal. When an employer arranges to
have employees of another employer (contractor) perform work that involves confined space entry, the employer shall inform the contractor about the confined space including:

- the classification of the space (e.g., permit or non-permit);
- hazards and operations within or near the space;
- the employer’s experience with the space;
- any precautions or procedures that the host employer had implemented for the protection of employees in or near the confined space where contractor personnel will be working.

17.2 Identification of Rescue Responder

Responder. The employer and contractor shall establish who will serve as the rescue responder in an emergency and what system will be used to notify the responder that an emergency exists.

17.3 Permit System. Contractors shall ensure a permit confined space program is being followed, meeting the requirements of this standard. If the confined space is a permit space, entry is allowed only through compliance with a permit space program.

17.4 Coordination. When both employer and contractor personnel will be working in or near permit spaces entry, the two parties must coordinate their operations for activities impacting confined space entry.

17.5 Ongoing Dialogue. The contractor must inform the host employer immediately of any hazards encountered or created during the course of entry. A follow-up discussion must be held at the conclusion of the entry operation concerning any additional hazards or problems encountered.

ensure they have appropriate qualifications for the full scope of work to be performed, including a confined space safety program meeting this standard.

It should be noted that a variety of employer/contractor interface scenarios are possible. The employer may be on a scene and physically controlling day-to-day contractor operation, the contractor may be working largely independently of employer oversight, or some other interface may be in place. The key factor is to ensure responsibility/authority is clearly delineated in the project contract to avoid confusion and/or omission of elements key to safe confined space entry operations.

E17.2 Pre-planning should be conducted between the contractor and the employer to establish who will be responsible to perform rescue and provide medical services in the event of an emergency situation. If the contractor expects to use the employer’s rescue capability, this should be agreed upon before the entry and the method of contacting the rescue responder established.

E17.3 Contractors may submit a copy of their permit entry program with the contracting entity, or agree by contract to follow the permit program of the contracting entity. The contractor and host employer may arrange for the contractor employees to adhere to the host employer’s permit space program or to follow the contractor’s program. If the host employer’s program will be used, the contractor must be informed of the program’s requirements and be given a copy of the completed permit for retention and review purposes. Likewise, if the contractor’s program will be used, the contractor must inform the host employer of the requirements of the contractor’s program.
Appendix A
Logic Diagram for Confined Space Entry

Scope (Section 1)

Definitions (Section 2)

Identification of Hazards (Section 3)

Evaluation of Hazards (Section 3)

Permit Required? Yes No

Non-Permit Confined Space (Section 4)

Entry Requirements as Needed (Section 6-17)

Permit Required Confined Space (Section 5)

Entry Requirements (Section 6-17)

Proceed With Entry

Periodically Re-evaluate Hazards and Operations

Activities or Conditions Change? Yes No

Complete Work
Appendix B - References
Pertinent Standards and Other Reference Materials
on the Subject of Confined Spaces.

United States Standards

Occupational Safety and Health Administration
29 CFR 1910.146 Permit-Required Confined Spaces
Numerous U.S. states have their own confined space regulations. Many of these are similar to the federal standard but some have significant differences.
Related OSHA standards
29 CFR 1910.147 Control of Hazardous Energy (lockout/tagout)
29 CFR 1910.252 Welding, Cutting and Brazing
29 CFR 1910.268 Telecommunications
29 CFR 1910.269 Electric Power Generation, Transmission, and Distribution
29 CFR 1910.272 Grain Handling Facilities
29 CFR 1915 Subpart B Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926.651 Specific Excavation Requirements.
29 CFR 1926.800 Underground Construction

American National Standards Institute
• Flammable and Combustible Liquids Code, ANSI/NFPA 30-2000
• Flammable and Combustible Liquid Tank Vehicles, ANSI/NFPA 385-2000
• National Electrical Code, ANSI/NFPA No.70-2001
• Practices for Respiratory Protection, ANSI Z88.2-1992
• Protective Headwear for Industrial Workers, ANSI Z89. 1-1997
• Safety Requirements for the Lockout/Tagout of Energy Sources, ANSI Z244.1-1982(R-1993)
• Personal Protection – Protective Footwear, ANSI Z41-1999
• Safety in Welding and Cutting, ANSI Z49. 1-1999
• Practice for Occupational and Educational Eye and Face Protection, ANSI Z87. 1-1989 (R-1998)
• Standard for Fire Prevention During Welding, Cutting, and Other Hot Work   NFPA 51B-1999
• Safety Requirements for Personal Fall Arrest Systems, ANSI Z359.1 - 1992 (R1999)

American Petroleum Institute
#2217A Guidelines for Work in Inert Confined Spaces in the Petroleum Industry
#2013 Cleaning Mobile Tanks in Flammable or Combustible Liquid Service
#2015 Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks
#2016 Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks
#2026 Safe Access/Egress Involving Floating Roofs of Storage Tanks in Petroleum Service
#2207 Preparing Tank Bottoms for Hot Work
#1141 Guidelines for Confined Space Entry on Board Tank Ships in the Petroleum Industry

American Society for Testing and Materials
#D4276 Practice for Confined Area Entry
#F1764 Standard Guide for Selection of Hardline Communication Systems for Confined Space Rescue

National Fire Protection Association Standards that reference Z117
NFPA 86 Standard for Ovens and Furnaces
NFPA 86C Standard for Industrial Furnaces Using a Special Processing Atmosphere
NFPA 86D Standard for Industrial Furnaces Using Vacuum as an Atmosphere
NFPA 306 Standard for the Control of Gas Hazards on Vessels
NFPA 326 Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair (also refers to API 2015)
NFPA 329 Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases
NFPA 385 Standard for Tank Vehicles for Flammable and Combustible Liquids
NFPA 560 Standard for the Storage, Handling, and Use of Ethylene Oxide for Sterilization and Fumigation

Overseas Standards
Australian Standard 2865 Work in Confined Spaces
United Kingdom Health and Safety Executive
Statutory Instrument 1997 No. 1713 The Confined Spaces Regulations 1997
Irish Health and Safety Authority
#218 Safety, Health and Welfare at Work (Confined Spaces) Regulations

Books and Publications about Confined Space
“Complete Confined Spaces Handbook”
John F. Rekus, © 1994 John Rekus
Lewis Publishers an imprint of CRC Press

“Safety and Health in Confined Spaces”
Neil McManus
© 1999 NorthWest Occupational Health and Safety, a division of Training by Design, Inc.
Lewis Publishers an imprint of CRC Press
ISBN 1-56670-326-3

“Confined Space Safety Manual” 2nd edition
R. Craig Schroll
© 1997 FIRECON
ISBN 0-945492-05-7

“Confined Space Entry: Guide to Compliance”
Frank R Spellman
© 1998 CRC Press
ISBN: 1-566767-04-0

“Guidelines for Hot Work in Confined Spaces”
Martin H. Finkel
© 2000 American Society of Safety Engineers
ISBN 1-885581-30-0

“Worker Deaths in Confined Spaces”
National Institute for Occupational Safety and Health
Publication #94-103

“Field Guidelines for Temporary Ventilation of Confined Spaces”
Michael K. Harris, Lindsay E. Booher, and Stephanie Carter
© 1996 American Industrial Hygiene Association
ISBN 0-932627-78-1

“Confined Space Entry an AIHA Protocol Guide”
© 2001 American Industrial Hygiene Association
ISBN 0-932670-08-4
Vernon E. Rose and Terry W. Krug
© 1995 American Industrial Hygiene Association

“Confined Space and Structural Rope Rescue”
Michael Roop, Thomas Vines, and Richard Wright
© 1998 Mosby, Inc.
ISBN 0-8151-7383-0

Books on Related Topics
“Air Monitoring Instrumentation”
Carol J. Maslansky and Steven P. Maslansky
© 1993 Van Nostrand Reinhold
ISBN 0-442-00973-9

“Air Monitoring for Toxic Exposures an Integrated Approach”
Shirley A. Ness
© 1991 Van Nostrand Reinhold
ISBN 0-442-20639-9

“Direct-Reading Colorimetric Indicator Tubes Manual” 2nd edition
Edited by Janet B. Perper and Barbara J. Dawson
© 1993 American Industrial Hygiene Association
ISBN 0-932627-53-6

“Air Sampling Instruments for Evaluating Atmospheric Contaminants” 8th edition
© 1995 American Conference of Governmental Industrial Hygienists, Inc.
Technical Editors Beverly S. Cohen and Susanne V. Hering
ISBN 1-882417-08-9

“Manual of Recommended Practice for Combustible Gas Indicators and Portable Direct-Reading Hydrocarbon Detectors” 2nd edition
Edited by C. F. Chelton
© 1993 American Industrial Hygiene Association

The Dictionary of Terms Used in the Safety Profession, Fourth Edition,
©American Society of Safety Engineers, Edited by Richard W. Lack, 2001

“The Occupational Environment – Its Evaluation and Control”
Edited by Salvatore R. DiNardi
© 1997 American Industrial Hygiene Association
ISBN 0-932627-82-X
Chapter 9 Direct-Reading Instrumental Methods for Gases, Vapors, and Aerosols
Chapter author Lori A. Todd
Chapter 42 Confined Spaces
Chapter author R. Craig Schroll

“Lockout/Tagout The Process of Controlling Hazardous Energy”
Edward V. Grund
© 1995 National Safety Council
“Lockout Tagout A Practical Approach”
Stephen M. Kelley
© 2000 American Society of Safety Engineers
ISBN 1-885581-35-1


Appendix C - Examples
Of Confined Space Surveys and Permits

Committee Note: These examples are included in the appendices to provide readers with an example of some survey and per-
mit forms used in business and industry. It is not meant to constitute in any way that these are the only forms to use, nor does
this appendices specify any specific format or model to follow.

The information and materials contained in this appendix have been developed from sources believed to be reliable.
However, the American Society of Safety Engineers (ASSE) as secretariat of the ANSI accredited Z117 Committee or
individual committee members accept no legal responsibility for the correctness or completeness of this material or its
application to specific factual situations. By publication of this appendix material, ASSE or the Z117 Committee does
not ensure that adherence to these recommendations will protect the safety or health of any persons, or preserve prop-
erty.
# Confined Space Entry Permit

## 1. Location and Description
- **Location and Description**

## 2. Purpose of Entry
- **Purpose of Entry**

## 3. Department
- **Department**

## 4. Person in Charge of Work
- **Person in Charge of Work**

## 5. Supervisors (8) in Charge of Crews
- **Supervisors (8) in Charge of Crews**

## 6. Special Requirements
- **Special Requirements**

## 7. Test(s) to Be Taken
- **Test(s) to Be Taken**

## 8. Instruments Used
- **Instruments Used**

## 9. Safety Standby Person(s)
- **Safety Standby Person(s)**

## 10. Ambulance
- **Ambulance**

## 11. Fire
- **Fire**
**CONFINED SPACES ENTRY PERMIT**

<table>
<thead>
<tr>
<th>LOCATION OF CONFINED SPACE</th>
<th>DATE/TIME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTHORIZED BY</td>
<td>CUMULATION</td>
</tr>
<tr>
<td>ATTENDANT(S)</td>
<td>EXPRESSION</td>
</tr>
</tbody>
</table>

**AUTHORIZED ENTERS (LIST ON BACK OF FORM)**

**MEASURES FOR ISOLATING EQUIPMENT**

- **Lock-Out - De-Energize - Try-Out Equipment**
- **Line(s) Broken - Capped - Blocked**
- **Purge - Flush and Vent**
- **Ventilation**
- **Secure Area (Post and Flag)**
- **Full Body Harness &“D” Ring**
- **Tripod Emergency Escape Unit**
- **Listings**
- **Fire Extinguisher**

**ATMOSPHERE MONITORING**

<table>
<thead>
<tr>
<th>TEST(S) TO BE TAKEN</th>
<th>Acceptable Entry Conditions</th>
<th>Test No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
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<tbody>
<tr>
<td>Oxygen</td>
<td></td>
<td>11/4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustible Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>0.05 PPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>10 PPM</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>0.10 PPM</td>
<td></td>
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<tr>
<td>Sulfur Dioxide</td>
<td>0.05 PPM</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.05 PPM</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

Individual Conducting Test (name)

Any questions pertaining to test requirements, contact

**INSTRUMENTS USED**

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>IDENTIF.</th>
</tr>
</thead>
</table>

**STANDEY PERSONS**

**FOR RESCUE & EMERGENCY SERVICES CALL**

ENTRY SUPERVISOR AUTHORIZING ALL ABOVE CONDITIONS SATISFIED

LEL = Lower Explosive Limit
FPM = Parts-Per-Million

*Threshold Limit Values published by American Conference of Governmental Industrial Hygienists
**Permissible Exposure Limit as listed in OSHA 29 CFR 1910.1000
CONFINED SPACE ENTRY PERMIT

Description of Confined Space: ________________________________

Purpose of Entry: ____________________________________________

Department/Confined Space/Location: ____________________________

Duration of Permit: __________________ Entry Time: ____________

Name of Entrant(s) ____________________________________________

Name of Attendant(s) __________________________________________

Management Employee in Charge of Entry _________________________

Signed: _____________________________________________________

CONFINED SPACE TESTING

<table>
<thead>
<tr>
<th>P.E.L.</th>
<th>Time</th>
<th>Value</th>
<th>Time</th>
<th>Value</th>
<th>Time</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen 19.5-23.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability &lt; 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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TOXICITY TESTING

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<tr>
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<th>Value</th>
<th>Time</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>ppm</td>
<td>ppm</td>
<td>ppm</td>
<td>ppm</td>
</tr>
</tbody>
</table>

CONTINUOUS TESTING □ Yes □ No

COMMENTS:

□ Yes □ No
# IDENTIFICATION OF TEST INSTRUMENTS

<table>
<thead>
<tr>
<th>MFG. NAME</th>
<th>TYPE</th>
<th>IDENTIFICATION NO.</th>
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</thead>
</table>

**Name of Tester:** ____________________________________________________________

<table>
<thead>
<tr>
<th>SPECIAL REQUIREMENTS</th>
<th>YES</th>
<th>NO</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>Lockout/Tagout Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Lines - Capped/Blanked</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purging - Flush and Vent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathing Apparatus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resuscitator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Work Permit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic Communication Devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment for Maintaining Contact</td>
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<td></td>
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<tr>
<td>Lifelines</td>
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<td></td>
</tr>
<tr>
<td>Escape Harness</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tripod Emergency Escape Unit</td>
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</tr>
<tr>
<td>Fire Extinguishers</td>
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</tr>
<tr>
<td>Lighting</td>
<td></td>
<td></td>
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<tr>
<td>Alarm System</td>
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<tr>
<td>Respirator</td>
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</tr>
<tr>
<td>Personal Protective Equipment</td>
<td>(identify)</td>
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</tbody>
</table>

_____________________________  ___________________________  ___________________________

_____________________________  ___________________________  ___________________________
Confined Space Entry Permit

Permit Expires (date & time) | Confined Space #
Location
Description of Space
Purpose of Entry/Description of Work

Date of Entry | Time of Entry | Expected Duration

| Entrants | Attendants | Contractors |

Entry Supervisor (date & time) (print & sign)
Work Crew Supervisor | Area Supervisor
Person Monitoring Atmosphere
Hot Work Permit # | Type of Hot Work
Attach copy
Safety Approval OPTIONAL (print & sign)
Industrial Hygiene Approval OPTIONAL (print & sign)

This Permit Must Be Posted Near the Entry to the Space

Alarm device | Nearest phone
In-plant Rescue Team # | Off-site Rescue Team #
Training Qualifications
Pre-entry Briefing | Rescue Crew Available

Return this permit to Safety Department after work is completed.

Atmospheric Monitoring

<table>
<thead>
<tr>
<th>Prior to Entry</th>
<th>Retest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen 19.5-23.5%</td>
<td>LEL &lt;10%</td>
</tr>
<tr>
<td>Toxic Contaminants</td>
<td>Toxic Contaminants</td>
</tr>
<tr>
<td>Name</td>
<td>MSDS</td>
</tr>
<tr>
<td>Tested by</td>
<td>Tested by</td>
</tr>
<tr>
<td>Instrument(s) used</td>
<td>Instrument(s) used</td>
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<tr>
<td>Last calibration date</td>
<td>Last calibration date</td>
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<tr>
<td>Calibrated by</td>
<td>Calibrated by</td>
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Periodic Atmospheric Monitoring

<table>
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<tr>
<th>Date/Time</th>
<th>Date/Time</th>
<th>Date/Time</th>
<th>Date/Time</th>
<th>Date/Time</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>%LEL</td>
<td>#1</td>
<td>#2</td>
<td>#3</td>
<td></td>
</tr>
</tbody>
</table>
### Isolation of Space

| Electrical | Lockout | Tagout | Disconnect | Grounded | Piping | Blank | Double block & bleed | Lockout valves | Disconnect | Bleed lines | Purge lines | Hydraulic | Lockout valves | Disconnect | Lockout pump | Bleed lines | Bleed system | | Pneumatic | Lockout valves | Disconnect | Lockout compressor | Bleed lines | Bleed system | Mechanical | Disconnect linkage | Block linkage | Block movement | | Fire control system | Lockout control panel | Disconnect agent lines | Blank agent lines | Duct work | Lockout blowers | Lock dampers closed | Disconnect ducts |

### Hazards in Space

**Previous contents**

- Flammable
- Corrosive
- Toxic
- Irritant
- Oxidizer
- Dust

**Physical State**

- Solid
- Liquid
- Gas
- Pressure released
- Drained
- Cleaned

**Nature of Work**

- Welding
- Cutting
- Grinding
- Chipping
- Scraping
- Painting
- Spray application
- Spray cleaning

**Configuration of and environment in space**

- Slippery surfaces
- Vertical drop
- Sharp surfaces
- Low overhead
- Slope of interior
- High temperature
- Low temperature
- Other

**External hazards**

- Traffic
- Machinery
- Equipment
- Processes
- Termites

**Miscellaneous hazards**

- Noise
- Animals
- Insects
- Disease organisms
- Ionizing radiation
- Non-ionizing radiation

**Other Hazards**

**Equipment Required**

**Respiratory Protection**

- SCBA
- ABA
- SAR
- PAPR

**Cartridge Respirator**

- Full face
- Half mask
- Cartridge

**Organic Vapor**

- Acid Gas
- Organic vapor/Acid gas
- Ammonia
- Methane

**N95**

**P95**

**P100**

**Other**

**Personal Protective Clothing & Equipment**

- Hard hat
- Safety shoes/boots
- Safety glasses
- Goggles
- Faceshield
- Leather gloves
- Ear plugs
- Ear muffs
- Splash suit
- Chemical gloves
- Chemical boots
- Welding hood
- Welding gloves
- Welding jacket
- Lighting
- Flashlight
- Handlight
- Light sticks
- Cord light
- Portable light
- Electric Power
- Power connection
- Generator
- GFCI's
- Cords

**Ventilation**

- CFM Required
- Ventilator # & CFM rating
- Ducts
- Elbows
- Connectors
- Saddle/Tank vent

**Entry Equipment**

- Ladder
- Body harness
- Personal alert
- Emergency signal
- Communications
- Retrieval device
- Tripod
- Anchor point

**Alternate Procedure Entry -**

**Reclassified -**

**Permit canceled (date & time)**
<table>
<thead>
<tr>
<th>Date of Survey</th>
<th>Confined Space #</th>
<th>Permit Required?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Location of Space**

**Description of Space**

Possible Atmospheric Hazards: Oxygen; deficiency  
 enrichment  
 Flammable  
 Toxic

Specific hazard for flammable and/or toxic: 
Comments:

Possible Content Hazards: Previous contents  
 Content fill or removal  
 Shifting contents  
 Fluid levels  
 Dust

Comments:

Potential Energy: Electrical  
 Hydraulic  
 Pneumatic  
 Mechanical  
 Fire control system

Comments:

Environment in the Space
Slippery surfaces  
 Ambient temperature high or low  
 Surface temperatures high or low  
 Noise

Comments:

Configuration of Space
Interior shape & slope  
 Low overhead clearance  
 Drop offs  
 Complex layout  
 Stability  
 Structural integrity

Comments:

External Hazards: Traffic  
 Machinery  
 Equipment  
 Processes  
 Terrain

Comments:

Other Hazards: Animals  
 Insects  
 Biological organisms  
 Non-ionizing radiation  
 Ionizing radiation

Comments:

<table>
<thead>
<tr>
<th>Confined Space</th>
<th>Permit Required Confined Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be bodily entered?</td>
<td>Yes</td>
</tr>
<tr>
<td>Limited or restricted entry?</td>
<td>Yes</td>
</tr>
<tr>
<td>Not designed for continuous human occupancy?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Hazardous Atmosphere?  
 Potential for engulfment?  
 Internal configuration hazard?  
 Other serious safety hazard?  
 Eligible for Alternate Procedure?  
 Eligible for Reclassification?  
 External connections to space
Comments:

Survey completed by
## CONTRACTOR CONFINED SPACE ENTRY

### INQUIRY

<table>
<thead>
<tr>
<th>Job Description:</th>
<th>Plant:</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Potential Confined Space Hazards:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Special Rules/Requirements:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Emergency Procedures:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Does Contractor exhibit confined space entry competence, i.e. experience in this type of work, written procedures, testing equipment, etc?</strong></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is Contractor aware of requirements of applicable state/federal standards?</strong></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td><strong>Does Contractor confirm that assigned employees are trained in confined space entry procedures?</strong></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td><strong>Is Contractor equipped to handle emergencies/rescue?</strong></td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Authority</th>
<th>Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
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<tr>
<th>Date</th>
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</tbody>
</table>

(PRINT NAME AND SIGN)
HOT WORK CONTROL PERMIT
(CUTTING - HEATING - WELDING - ETC.)

Date: __________________________ Time Started: ______________ Completed ______________

Area: ____________________________________________________________
      (Building - Floor - Department - Equipment)

Work to be done: __________________________________________________

To be Supervised by: ______________________________________________

Fire watch (if required): ____________________________________________
      (Name/Badge No.)

• Safeguards required -----------See Reverse

• Flammable gas indicator test needed ----------------------------- Yes □ No □
      Result ______________________________________________________

• Confined Space ----------------------------------------------------- Yes □ No □

• Permit expires __________________ Date __________ Time ____________

Signed: __________________________________________________________
      (Individual responsible for issuance of permit)

FINAL FIRE PREVENTION CHECK
Work area and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite sides of walls) were inspected 30 minutes after work was completed and the area was found “fire-safe”.

Signed: __________________________________________________________
      (Permit Issuer)

_________________________ (Date and Time)

________________________________________

Production Supervisor ___________________________ (Date and Time)

________________________________________

Maintenance Supervisor ___________________________ (Date and Time)
SAFEGUARDS

FIRE EQUIPMENT
- Sprinkler System in service
- Fire Extinguisher required. NQ/Type
- Hose Line (charged)

WITHIN 35 FEET OF WORK
- Floors swept clean of combustibles
- Combustible floors wet down or shielded with damp sand, metal or other non-combustible materials
- Remove combustible material or flammable liquids, if possible
- Non-removable combustibles and flammable liquids shall be protected with covers, guards or non-combustible shields
- All wall and floor openings covered
- Covers suspended beneath work to collect sparks

WORK ON ENCLOSED EQUIPMENT
(Tanks, containers, ducts, duct collectors, etc.)
- Equipment cleaned of all combustibles
- Containers purged of flammable vapors/safe atmosphere verified
- Confined Space Entry Permit Issued

FIREFIGHTER
- If required, the firewatch will continue until 30 minutes after the work is completed
- No firewatch required

I have inspected the work and confirm that the above checked safeguards have been implemented to prevent fire or explosion.

Signed ____________________________

Date ____________________________ Time ____________________________
## (SAMPLE ONLY)

### CONFINED SPACE HAZARD IDENTIFICATION/EVALUATION

**FACILITY:** Beverage 2-Pc.

**CONFINED SPACE:** Washer - Wash Tank

**LOCATION:** Front End

**DATE:** November 1992

<table>
<thead>
<tr>
<th>IDENTIFIED/POTENTIAL HAZARDS</th>
<th>TESTING</th>
<th>PROTECTIVE EQUIPMENT</th>
<th>SPECIAL REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oxygen Deficiency</td>
<td>MSA Passport – General</td>
<td>None</td>
<td>Prior to Entry</td>
</tr>
<tr>
<td>2. Combustibles</td>
<td>MSA Passport – Natural Gas</td>
<td>None</td>
<td>Prior to Entry</td>
</tr>
<tr>
<td>3. Toxics (Acid/Caustic)</td>
<td>Pump/Tube – Acid Mist – Litmus Paper – Residue</td>
<td>Goggles, gloves, acid gas respirator</td>
<td>Neutralize tank(s)</td>
</tr>
<tr>
<td>4. Electrical Energy</td>
<td>Cycle control circuits to verify isolation</td>
<td>None</td>
<td>Lockout drive motor</td>
</tr>
<tr>
<td>5. Chemical Supply</td>
<td>Cycle control circuits to verify isolation</td>
<td>None</td>
<td>Lockout pump motor breaker</td>
</tr>
<tr>
<td>6. Steam Supply</td>
<td>Cycle control circuits to verify isolation</td>
<td>None</td>
<td>Lockout steam line valves</td>
</tr>
<tr>
<td>7. Hot Surfaces/Temperature</td>
<td>Check air/surface temperatures</td>
<td>Protective suit, gloves, and goggles</td>
<td>Cool down cycle and ventilate</td>
</tr>
<tr>
<td>IDENTIFIED/POTENTIAL HAZARDS</td>
<td>TESTING</td>
<td>PROTECTIVE EQUIPMENT</td>
<td>SPECIAL REQUIREMENTS</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------------------------------</td>
<td>------------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>8. Wet Interior Surfaces</td>
<td>None</td>
<td>Protective clothing, boots, gloves, and goggles</td>
<td>Drain and ventilate</td>
</tr>
<tr>
<td>9. Head Contact (Tight Quarters)</td>
<td>None</td>
<td>Bump Cap</td>
<td>None</td>
</tr>
<tr>
<td>10. Inadequate Lighting</td>
<td>None</td>
<td>Class I Division I Portable Lighting</td>
<td>Ground fault circuit interrupter in line</td>
</tr>
<tr>
<td>11. Power Failure</td>
<td>None</td>
<td>Flash Lights</td>
<td>Portable generator or suspend operations</td>
</tr>
<tr>
<td>13. Welding Hazards</td>
<td>Check welding rod MSDS for metal fume (Ni, Cr, Fe, Mn) generation Chlorinated organics may produce Phosgene gas when heated</td>
<td>Complete welder protective gear; issue Hot Work Permit; respirator – metal fume cartridge or air supplied</td>
<td>Provide ventilation at minimum of 1000 CFM/ Welder</td>
</tr>
</tbody>
</table>
# RESCUE/RETRIEVAL INCIDENT REPORT

**NOTICE:** This information may be published on ASSFS's website, newsletter, etc., as a learning tool for other rescuers.

<table>
<thead>
<tr>
<th>Rescue Team</th>
<th>Date of Incident</th>
</tr>
</thead>
<tbody>
<tr>
<td>City/State</td>
<td>Time of Incident</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Names of Rescuers</th>
<th>Total Rescue Time: (Team Arrival to Victim Eval)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Incident Location</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Special Challenges, Weather Conditions, etc.</th>
<th>Possible Cause of Incident Injury</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reason for Victim Being on Site</th>
<th>Briefly Describe Patient's Injuries</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Confined Space</th>
<th>Elevated</th>
<th>Below Grade</th>
<th>Other</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Rescue Techniques Used</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Horizontal Hauling System</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Simple MIA Hauling-Lowering</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Other:</th>
</tr>
</thead>
</table>

**Describe Incident:** (Or attach report, sketches, or photos of incident)

**Key Lessons Learned from This Incident...**

*Option Note: Provided information will not be made public at the request of the reporting entity. As a learning tool, only the very basic facts of the incident will be made public. Initial here if names and locations are to be withheld...*