STATE OF NEW YORK
DEPARTMENT OF LABOR
Governor W. Averell Harriman
State Office Building Campus
Albany, New York 12240

Dear New York State Employers,

As a partner in your workplace safety efforts, the New York State Department of Labor, Division of Safety and Health, has developed an Employer Guide and Model Permit-Required Confined Space Entry Plan to assist you in your efforts to comply with the OSHA Permit-Required Confined Spaces Standard for General Industry. The Plan is written in a clear, concise manner and contains relevant reference materials and samples of all forms needed to fulfill recordkeeping requirements. In short, it is designed to carry you step by step through the compliance process. The end result of our joint effort will hopefully be a workplace where employees are protected from the health and safety hazards posed by permit-required confined spaces.

Should you have any questions about the Plan or require further assistance, you may contact the Division's district office nearest you. Our PESH and On-Site Consultation Programs are available to assist employers in the public and private sectors on this and any other safety and health issues you may have.

We look forward to working with you in your continuing efforts to provide a safe and healthful workplace for your employees.

INSTRUCTIONS

This document is intended to serve as an employer's compliance and training guide to the Occupational Safety and Health Administration's (OSHA) Permit-Required Confined Space Standard 29 CFR 1910.146. It is designed to aid in the recognition, evaluation, and control of permit space hazards by the implementation of measures required by the standard. It is also organized to assist employers who have little or no knowledge of confined spaces and for employers who have existing programs but who want to verify compliance with the standard. The document contains five (5) color-delineated sections for this purpose.

Section I contains a summary and explanation of the standard.

Section II and III provide the means to recognize, evaluate, and control related permit space hazards.

Section IV is a non-mandatory fill-in-the-blank program provided to assist employers with addressing the mandatory general requirements of the standard, summarizing their specific program, and designating individuals' responsibilities for specific tasks under the plan.

Section V provides forms for use by the employer in developing the required written documentation and to assist with training.

INSTRUCTIONS

QUICK REFERENCE FOR THE MINIMALLY REQUIRED DOCUMENTATION FOR ACCEPTABLE ENTRY CONDITIONS FOR PRCS OPERATIONS

Listed below are appendices located in Section V that apply to documenting safe entry operations. The employer must first determine which entry procedure is required and then utilize the appropriate appendix.

Please keep in mind that additional appendices may be needed depending on the PRCS of concern. Generally, these appendices are those that are minimally required.

Full Permit-Required Confined Space (PRCS) Program

Appendix F PRCS Program Worksheet
Appendix G Host Employer' s Responsibilities with Contractor Worksheet (if applicable)
Appendix I Hot Work Permit (If applicable)
Appendix M Respiratory Protection Program (if applicable)
Appendix N Letter from Employer to Outside Rescue Service (if applicable)
Appendix Q Entry Permit

Alternative Procedures

Appendix D Alternative Procedure Worksheet
Appendix G Host Employer' s Responsibilities with Contractor Worksheet (if applicable)

Reclassifying Permit Space

Appendix E Reclassifying Permit Space Worksheet
Appendix G Host Employer' s Responsibilities with Contractor Worksheet (if applicable)

Note to the Employer: If entry is needed to determine the elimination of a hazard, a full PRCS Program is also required.

Rescue and Emergency Services

Appendix M Respiratory Protection Program
Appendix O Sample Letter from Rescue & Emergency Provider to Employer (if applicable)
Appendix P Rescue and Emergency Service
Appendix P-l Rescue Plan Checklist

Before proceeding to use this document, you should familiarize yourself with the standard, which is contained in Appendix A. You will note that in several areas of the document, you must exercise judgement as to how your program will operate. Should you have any questions or need clarification or guidance, you may contact the appropriate Division of Safety and Health Office listed on page 1-3.

CONTENTS

REFERENCES AND PERTINENT STANDARDS

INTRODUCTION

It is well recognized that working in permit-required confined spaces involves significant risks to employees. Fatalities and injuries have been caused by a variety of confined space related hazards, including:

- Atmospheric Hazards
- Entrapment Hazards
- Engulfment Hazards
- Mechanical and Electrical Hazards
- Untrained Personnel

The Permit-Required Confined Space (PRCS) Standard 29 CFR 1910.146 has been developed and implemented to alleviate or control these risks for the approximately 1.6 million workers who enter confined spaces annually. It is expected that this standard will prevent approximately 55-60 fatalities and more than 5,000 serious injuries each year.

The standard is based on a performance-oriented approach, which is designed to provide employers with the flexibility of achieving compliance through a pro-active system specific to their particular worksite. The standard covers all general industry, including agricultural services, manufacturing, chemical plants, refineries, transportation, utilities, wholesale and retail trade, and miscellaneous services. It does not cover the construction, maritime, agriculture, or shipyard sectors of industry. In the construction industry, the American National Safety Institute (ANSI) document 2117.1 is used in conjunction with the OSHA General Duty Clause 5(a)(1).

Additionally, the following vertical standards take precedence over the Permit-Required Confined Entry Space standard for the specific hazards they address.

<u>General Industry</u>

1910.120 (b)(4)(ii)(1)	Hazardous Waste Site Specific Safety & Health plan must address confined space entry procedures.
1910.252 (a)(4)(i)	Removal of arc welding electrodes during suspension of work in confined spaces.
1910.252 (b)(4)(i) to (vii)	Protection of personnel welding in confined spaces (ventilation, securing welding equipment, lifelines, electrode removal, gas cylinder shutoff, warnings).
1910.252 (c)(4)	Health protection and ventilation during welding operations in confined spaces.

1910.252 (c)(9)	Specifies ventilation and respiratory protection requirements for welding in confined spaces using cadmium-bearing filler metal.
1910.252 (c)(10)	Specifies local exhaust ventilation or respiratory protection for welding and cutting mercury-coated or - bearing materials, including paint, in confined spaces.
1910.261 (b)(5)	Specifies safe practices (lifeline, safety harness, attendant, atmospheric testing, availability of SCBA, and lock out) for entering a vessel in pulp, paper, and paperboard mills.
1910.268 (o)	Addresses certain hazards involving manhole and unvented vault entry by telecommunication workers.
1910.272 (g)	Specifies entry procedures for bins, silos, and flat storage buildings and tanks with a diameter less than the height, and for all top entries of these structures in grain facilities.

Marine Terminals

1917.23	Addresses entry into hazardous atmospheres at marine terminals (testing, ventilation, standby observers).
1917.152 (b)	Requires that work not be performed in confined space until it is determined, through atmospheric testing, that the space is not hazardous.
1917.152 (f)(2)	Requires ventilation and respiratory protection, with standby person, when hot work is done in confined spaces.
1917.152 (f)(2)	Specific requirements for welding, cutting, or heating of toxic metals in confined spaces.

Longshoring

1918.23	Addresses entry into storage spaces or tanks where potential hazardous atmospheres exist.

Please note that the above vertical standards address specific hazards in specific operations, and therefore take precedence over 1910.146 for these situations. However, other hazardous conditions, not addressed by these vertical standards, are still covered under 1910.146.

Again, it is the responsibility of the employer to institute the appropriate protective measures required. Doing so will provide a safe and healthier work environment.

INTRODUCTION

Private sector employers who have additional questions concerning this standard or desire a free on-site consultation visit may contact the nearest New York State Department of Labor On-Site Consultation Program Office. A list of locations is provided below:

Albany	(518) 457-2810
Binghamton	(607) 721-8211
Buffalo	(716) 847-7166
Garden City	(516) 228-3959
New York City	(212) 352-6130
Rochester	(585) 258-4570
Syracuse	(315) 479-3205
Utica	(315) 793-2319
White Plains	(914) 997-9511

For Public Sector Employers who have additional questions, you may contact the following State Labor Department Public Employee Safety and Health (PESH) District Office:

Albany	(518) 457-5508
Binghamton	(607) 721-8211
Buffalo	(716) 847-7133
Garden City	(516) 228-3959
New York City	(212) 352-6132
Rochester	(585) 258-4570
Syracuse	(315) 479-3212
Utica	(315) 793-2258
White Plains	(914) 997-9514

SCOPE AND APPLICATION - PARAGRAPH (a)

Paragraph (a) states that 1910.146 contains requirements for practices and procedures to protect employees from the hazards of entry into permit-required confined spaces. This paragraph explicitly excludes agriculture, construction, and shipyard employment from the scope of the standard.

Under current OSHA practice, as outlined in 1910.5(c), confined spaces that are presently regulated in other sections of Part 1910 will continue to be regulated under those sections, to the extent that permit spaces are already regulated under those sections. For example, telecommunications work in manholes and underground vaults is normally covered under 1910.268(0). Such work will continue to be covered under the telecommunications standard, and the provisions of 1910.146 would not apply as long as the provisions of 1910.268(o) protect against the hazards within the manhole[1]. Confined spaces that are not covered by any other OSHA rule will fall under 1910.146.

OSHA is aware that confined space accidents occur in agriculture, construction, and maritime workplaces and that employees in those industries do face a significant risk or death and serious injury from these accidents. However, the Agency believes that sufficient differences exist between these industries and general industry to warrant separate rulemaking activities. The Agency also believes that agriculture, construction, and shipyard work is likely to possess permit-space working conditions that are unique to these industries. Therefore, OSHA believes that confined space standards for agriculture, construction, and shipyard work should be addressed separately so that the Agency can focus on aspects of permit space safety that are specifically appropriate for these areas.

DEFINITIONS - PARAGRAPH (b) - See Appendix A for definitions relating to 1910.146.

GENERAL REQUIREMENT - PARAGRAPH (c)

Paragraph (c) of the standard provides information and general requirements for employers to identify any permit spaces at their workplaces and to take the appropriate measures for employee protection.

Paragraph (c)(1) requires employers who are covered by the standard to inspect their workplaces to determine if they have permit-required confined spaces (refer to Appendix C). Employers must identify any permit spaces by the time the final rule goes into effect (April 15, 1993) rather than waiting until a space will be entered. By doing so, the employer can take measures to prevent unauthorized entry, ensure that effective training is given, and have plans in place so the safety of workers is not compromised.

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[1] Taking the telecommunications examples further, the Agency can envision manholes that may be more appropriately covered by 1910.146. Although it is rare, manholes can become overwhelmingly contaminated with toxins or other hazardous chemicals. If the work area could not be made safe for entry, as required by 1910.268(o)(2)(i)(B), entry would have to be performed under the provisions of 1910.146.

Note to the Employer: After proper evaluation of the workplace by an individual knowledgeable in the standard and where no space meeting the criteria of a permit required confined space is found, no further action is required. However, if the space is altered or circumstances change in some manner to create a hazard, a reevaluation of the space is required.

Paragraph (c)(2) requires the employer to inform exposed employees of the location and dangers posed by permit space(s) at their worksite. Signs or any other effective means may accomplish this so long as they know the existence, location, and dangers of the permit spaces. If a sign is used, the sign must indicate the danger involved in the permit space, but does not need to list all the specific hazards that might be encountered.

A sign conspicuously posted by the permit space reading **"DANGER -- PERMIT-REQUIRED CONFINED SPACE -- DO NOT ENTER"** is acceptable. Awareness Training is another means available to employers to comply with paragraph (c)(2) by effectively informing employees of the existence, location, and dangers of those spaces.

Note to the Employer: In enforcing this provision, OSHA will check to ensure that methods, other than warning signs, are truly effective in imparting the required information to employees. General training on the OSHA Standard 1910.146,for example, cannot be expected to adequately inform employees of the specific location of permit spaces in the workplace. The standard places the burden of identifying the spaces and of controlling the resultant hazards on the employer, not on the employee.

Paragraph (c)(3) requires that if a permit space is present but the employer will not allow employees to enter the space, effective measures must be taken to prevent employee entry. These measures could include permanently closing the space by locking the entrance and/or controlling any specialized tools needed to open the space. These measures must be supplemented by employee awareness training and/or the posting of danger signs. Whatever method is ultimately chosen by the employer, it must be effective in preventing employee entry into the permit space.

Paragraph (c)(4) requires employers who decide to have employees enter a permit space establish and implement a *written* permit space program which complies with 1910.146. The written program must be available for employees and their authorized representatives to review. It also requires that employees and their authorized representatives will have access to all monitoring and certification data required by this standard.

A written Permit-Required Confined Space Program includes the following topics:

- Measures to prevent unauthorized entry.
- Identifying hazards.
- Development of the means, procedures, and practices for safe entry.
- Providing, maintaining and using the appropriate equipment.
- Testing atmospheric conditions.
- Providing attendant.
- Duties of permit space team members.
- Rescue and emergency medical services.
- Development and cancellation of entry permits.
- Coordination of entries during multi-employer operations.
- Review procedures of entry program.

For additional information, see paragraph (d) and Appendix F.

Paragraph (c)(5) states that OSHA has determined that it is not always necessary to require a full permit entry program (paragraphs (d) through (k) when *only atmospheric hazards* are of concern and if the employer can demonstrate that the hazard can be controlled with continuous forced air ventilation alone.

Historically, some industries, such as telecommunications (regulated under 1910.268(o)), have successfully protected employees from atmospheric hazards in work spaces through testing and continuous ventilation, without following all the requirements stated in 29 CFR 1910.146. OSHA believes that such experience indicates that ventilation and testing could protect employees throughout general industry from atmospheric hazards posed by similar types of permit spaces. Accordingly, OSHA has decided to allow employers, under certain conditions, to control atmospheric hazards within a permit space following specific procedures that are spelled out in paragraph (c)(5)(i) and (c)(5)(ii) in lieu of compliance with paragraphs (d) through (f) and (h) through (k). The only requirements from the full permit space program that would apply are the training requirements in paragraph (g). Note that the general requirements in paragraph (c) apply in all situations where the standard applies.

Paragraph (c)(5)(i) sets forth the conditions that must be met before a permit space may be entered under the alternative procedures, which are specified in paragraph (c)(5)(ii).

To qualify for these alternative procedures, the following provisions must be followed:

1) Paragraph (c)(5)(i)(A) requires ensuring that only atmospheric hazards are of concern and no physical hazards (entrapment, engulfment, mechanical hazards,) exist or potentially exist. If the space poses other hazards, then the hazards must be eliminated using paragraph (c)(7) criteria. If paragraph (c)(7) criteria cannot be used then a full permit space program (paragraph (d) through (k) is required.

2) Paragraph (c)(5)(i)(B) requires the employer to demonstrate that continuous forced air ventilation alone is sufficient to maintain the permit space safe during the entire entry operation.

Note to the Employer: To be considered safe, the atmosphere within the space after ventilation must not be expected to approach a hazardous atmosphere. This is necessary so that, if the ventilation shuts down for any reason (such as loss of power), the employees will have enough time to recognize the hazard and either exit the space or quickly restore the ventilation. Employers in making this determination could use a general guideline of 50 percent of the permissible flammable or toxic substance level.

Two examples may help to clarify this recommended guideline.

- The LFL for methane is a concentration of 5 percent by volume. Ten percent of the value is 0.5 percent, a concentration which would be considered hazardous by definition. Under the general safety guideline, mentioned above, the measured concentration of methane should not exceed 0.25 percent after ventilation in order to ensure a safe margin of protection.

- The 8-hour time weighted average PEL for chlorine, under table Z- 1, is 0.5 parts per million. This concentration of chlorine would be considered hazardous by the definition of "hazardous atmosphere". Under the guideline, the measured concentration of chlorine should not exceed 0.25 parts per million after ventilation in order to ensure a safe margin of protection.

Additionally, the work to be performed within the space must not introduce any new hazards. For example, work with hazardous quantities of flammable or toxic substances and hot work are not permitted. This additional work would introduce hazards beyond those accounted for by the initial determination and the permit space may not be maintained safe for entry. Paragraph (c)(5)(i)(B) clearly indicates that an employer who relies on continuous forced air ventilation to maintain the space safe for entry must be able to establish that other measures are not needed to protect entrants. When other measures are needed such, as when welding is performed, a full PRCS program is required.

3) Paragraph (c)(5)(i)(C) requires the gathering of atmospheric monitoring and inspection data to support item (1) and (2). The data must show that the forced air ventilation will keep the air within the space at safe levels.

4) Paragraph (c)(5)(i)(D) states that if entry is necessary to conduct initial data gathering, the entry must be performed under a full entry permit program (paragraphs (d) through (k)).

5) Paragraph (c)(5)(i)(E) mandates providing written certification to verify that the space is safe for entry and that all measures listed here to qualify for these alternative procedures have been performed. It also mandates that employees and their authorized representatives be provided an opportunity to observe the measures taken to qualify the space for the alternative procedures. Supporting documentation must also include:

- the certification date,
- the location of the space, and
- the signature of the person providing the determination.

Ensure that this information is available to each employee, authorized representative, and OSHA representatives. Again, Appendix D has been included to assist employers with this task.

6) Paragraph (c)(5)(i)(F) stipulates that the entry must be performed in accordance with the specific procedures required by paragraph (c)(5)(ii).

Paragraph (c)(5)(ii) states that if qualified for the alternative procedures as outlined above, the entry can take place after the following specific procedures are performed:

1) Paragraph (c)(5)(ii)(A) requires that any conditions that will make it unsafe to remove an entrance cover be eliminated before the cover is removed. Some conditions within a permit space, such as high temperature and high pressure, may make it hazardous to remove a cover from the space. For example, if the atmospheric hazards within the space cause high pressure to be present within the space, the cover could be blown off in the process of removing it. To protect employees from such hazards, a determination must be made as to whether or not it is safe to remove the cover. Such determination would require the employer to examine the conditions that are likely to occur in the permit space. For example, the cover should be checked to see if it is hot; and, if it is fastened in place, it should be loosened gradually to release any residual pressure. An evaluation must also be made of whether conditions at the site could cause a hazardous atmosphere to accumulate in the space, which would make it unsafe for employees to remove the cover. The cover must not be removed until it is safe to do so.

2) Paragraph (c)(5)(ii)(B) requires that openings to permit spaces be guarded to protect employees from falling into the space, to protect employees in the permit space from being injured by objects entering the space, and from the hazards of vehicle traffic. The guard could be in the form of a railing, a temporary cover, or any other temporary barrier that provides the required protection. If the opening to the space is situated so that employees and objects cannot fall into the space, no additional guarding is necessary.

3) Paragraph (c)(5)(ii)(C) requires the internal atmosphere of the permit space to be tested with a calibrated, direct reading instrument before any employee enters the space. The atmosphere must be tested, in sequence, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants. Any employee who enters the space (or his/her authorized representative) shall be provided the opportunity to observe the pre-entry testing.

4) Paragraph (c)(5)(ii)(D) prohibits employees from being in the space when a hazardous atmosphere is present. Any entry into a permit space containing a hazardous atmosphere must be conducted in accordance with the full permit space program requirements given in paragraphs (d) through (k).

5) Paragraph (c)(5)(ii)(E) sets out requirements for the use of continuous forced air ventilation. First, no employee may enter the space until the forced air ventilation has eliminated any hazardous atmosphere found within the space. Second, the ventilation must be directed to ventilate the immediate areas where an employee is or will be present. Third, the air supply for the ventilation must be from a clean source and must not increase the hazards in the space.

6) Paragraph (c)(5)(ii)(F) requires the permit space to be tested frequently or continuously to ensure the air is safe. It also allows any employee who will be entering the space and/or that employee's authorized representative to observe the periodic testing. The frequency for testing during entry will depend on the space and the results from the initial testing conducted. If, for example, the initial testing found no detectable levels of airborne contaminants and if the permit space is not normally expected to present atmospheric hazards, no further testing may be necessary. However, if the initial testing detected airborne contaminants, then frequent or continuous testing would be appropriate.

7) Paragraph (c)(5)(ii)(G) requires employees to exit the permit space immediately if a hazardous atmosphere is detected. Additionally, the employer is required to reevaluate the permit space to determine how the hazardous atmosphere developed and to implement measures to protect employees from the hazardous atmosphere before any subsequent entry is undertaken.

8) Paragraph (c)(5)(ii)(H) requires the employer to verify that the permit space is safe for entry and that the measures required by paragraph (c)(5)(ii) have been taken. This verification must be in the form of a certification that contains the date, the location of the space, and the signature of the certifying individual. The certification must be made available to entrants and those employees' authorized representative, This certification, in combination with the documentation required under paragraph (c)(5)(i)(E), will maintain employer accountability for compliance with paragraph (c)(5)(ii). Appendix D has been included for this task.

Paragraph (c)(6) requires that if there are any changes in the use or configuration of a non-permit space that may increase hazards to entrants, the space must be reevaluated, and if necessary, reclassified as a permit required space. This does not mean that employers have to reevaluate spaces because of trivial changes. Only those changes that may increase the hazards to the workers need to be addressed.

Paragraph (c)(7) states that OSHA has determined that permit spaces that have all hazards eliminated can be temporarily reclassified as non-permit spaces for as long as the hazards remain eliminated.

Note to the Employer: OSHA believes that employees are fully protected from the hazards of permit spaces once all hazards within the space have been eliminated. Clearly, if there are no hazards within the permit space, an entrant is in very little or no danger. By contrast, if the hazards are simply controlled rather than removed, the entrant could be injured upon failure of the control system. Therefore, the Agency has determined that it is appropriate to allow employers who eliminate hazards within permit spaces to reclassify those spaces as non-permit confined spaces.

Paragraph (c)(7)(i) allows employers to reclassify a permit space to a non-permit confined space if there are no potential atmospheric hazards and if all other hazards within the space are eliminated without entry into the space. The reclassification would be valid as long as the non-atmospheric hazards remain eliminated.

The reclassification of permit spaces allowed under paragraph (c)(7)(i) recognizes that spaces such as mixers and material bins can have their hazards removed before entry, so that entrants are fully protected without the need for permits, attendants, or other features required by the full permit space program requirements given in paragraphs (d) through (k). Mixers can be locked out before they are entered for servicing or maintenance, thereby removing the mechanical hazards. A material bin posing an engulfment hazard can be emptied before entry, thus removing that hazard. These are examples of the types of spaces that can be made safe for entry following paragraph (c)(7)(i). In these circumstances, after the hazards have been eliminated, it is believed that entry into the space is at least as safe as (if not safer) than entry in accordance with the full entry permit program.

Note to the Employer: If the equipment or machinery is not de-energized and locked out or tagged out in accordance with 29 CFR 1910.147, then it must be guarded as required in other general industry standards, such as Subpart 0, for machine guarding, and 29 CFR 1910.303(g), and (h), for the guarding of electric equipment. As long as the equipment inside the permit space remains guarded, employees within the space are not considered to be exposed to any equipment-related hazards. For spaces posing only engulfment hazards, it may be possible to remove the hazard by removing the engulfing material from the space before entry.

In many permit spaces possessing the above noted conditions, employees can eliminate the hazard without having to enter into the space. However, if it is necessary to enter the space to verify elimination of the hazards, then this entry must be performed in accordance with a full permit space program as stated in paragraph (d) through (k).

Paragraph (c)(7)(ii) allows permit spaces that contain or have the potential to contain hazardous atmospheres to also be reclassified as non-permit spaces by elimination of the hazards. These types of spaces must first be isolated, purged, and ventilated. The elimination of a hazardous atmosphere must be verified by testing the atmosphere and inspecting the interior conditions of the space. The entry to determine that the source of the hazard has been eliminated must be conducted in accordance with the full permit space program requirements (paragraph (d) through (k) of the standard). Types of permit spaces that may fall into this category include chemical tanks and boilers.

Some chemical tanks can frequently be made safe by draining them of their contents, purging the residual chemicals with water, and ventilating the space after purging is complete. Boilers can be made safe for entry by shutting them down, opening the access ports to allow for temperature reduction and natural ventilation, and entering the space to remove any residual hazards, such as loose buildup that could fall onto entrants. In each case, an entry, conducted in accordance with the full permit space program requirements must be conducted to ensure that the hazards have been eliminated.

If the atmospheric hazard has been found to be eliminated, the permit space can be reclassified to a non-permit space.

Note to the Employer: The control of atmospheric hazards with forced air ventilation, as stated in paragraph (c) (5) of the standard, is different than elimination of the hazard as stated in paragraph (c)(7)(ii) of the standard. Forced air ventilation will control the hazard but does not constitute elimination of it. If the forced air ventilation is terminated, the hazardous atmosphere may return.

Paragraph (c)(7)(iii) requires employers who desire to reclassify a permit confined space to provide employees and their authorized representatives written certification that includes:

- documentation to substantiate that all hazards have been eliminated.
- the date of the certification,
- the location of the space, and
- signature of the individual certifying the elimination of the hazards.

Note to the Employer: Appendix E has been included for this task.

Paragraph (c)(7)(iv) requires that if conditions in the space were to change and a hazard was found to arise, the entrants must evacuate the space immediately. The employer is then required to reevaluate the space to determine the cause of the hazards and to determine if the space should revert back to a permit-required confined space.

Paragraph (c)(8) contains requirements pertaining to the responsibilities of host employers to employees of other employers (contractors) who are to perform permit-required confined space entry. If the "host employer" has employees of another employer (contractor) perform work that involves permit space entry; the host employer must perform the following duties:

1) Paragraph (c)(8)(i) requires informing the contractor that the work site contains permit required confined spaces. It is also necessary to inform the contractor that entry into these permit spaces must be in accordance with a permit space program (paragraphs (d) through (k) that is program-specific to the space.

2) Paragraph (c)(8)(ii) requires informing the contractor of any known hazards and the host employer' s experiences with the space. This provision of the standard does not require the host employer to make a detailed investigation of any permit spaces, but just to provide whatever information was used for identifying the space as a permit space.

3) Paragraph (c)(8)(iii) requires informing the contractor of any precautions that have been instituted by the host employer to protect employees in or near the permit space.

4) Paragraph (c)(8)(iv) requires that the host employer develops and implements procedures to coordinate entry operations when both the host employer and the contractor have employees working in the space.

5) Paragraph (c)(8)(v) requires that at the conclusion of the entry operation, a debriefing session must be held with the contractor concerning the permit space program used and any hazards confronted or created while working in the space. Any information concerning hazards or potential hazards should be documented and steps taken to control or eliminate the situation.

Note to the Employer: The above information should be provided to the contractor in written form. By doing so, all required responsibilities are performed and available information is communicated. Appendix G has been included for this purpose.

Paragraph (c)(9) contains requirements pertaining to the responsibilities of contractors who are retained to perform permit space entry operations, including:

1) Paragraph (c)(9)(i) requires contractors to obtain any available information from the host employer regarding any hazards and entry operations in the permit space.

2) Paragraph (c)(9)(ii) requires contractors to coordinate entry operations with the host employer if both parties will have personnel working in the permit space.

3) Paragraph (c)(9)(iii) requires the contractors to inform the host employer of the contractors' permit space program that will be followed during the entry operation.

Coordination requirements between the host employer and contractor are included in paragraphs (c)(8)(iv), (c)(9)(ii), and (d)(11) of the standard. Paragraph (d)(11) requires employers to coordinate entry operations when employees of more than one employer are working simultaneously as authorized entrants in a permit space, so that employees of one employer do not endanger the employees of any other employer. This provision applies generally to all multi-employer permit space entry operations. The potential hazards of multi-employer permit space entry operations exist whether or not one of the employers acts as a host employer. For example, a manhole that is shared by two utility companies (gas and water, for example) is one case in which neither employer may be considered the host employer. If employees of both employers are present, but neither employer acts as the host, paragraph (d)(11) would still require coordination of permit space entry operations. Therefore, OSHA has adopted paragraph (d)(11) to cover coordination among all employers whose employees are present during entry operations. Paragraphs (c)(8)(iv) and (c)(9)(ii) direct the host employer and contractor, respectively, to the basic requirement for coordination including a determination of what permit program is to be used by the contractor. The standard does not prohibit the host employer from requiring a contractor to use the host' s permit program, nor does it require the contractor to use the host' s program. However, the host employer may choose to condition its contract on the contractor' s compliance with the host' s program, as is often the case in the petrochemical industry.

Additionally, contractors are required to inform host employers of the permit program to be followed and of any hazards confronted or created in the permit space during entry operations. At the completion of the operation, a debriefing session must be held between the host employer and contractor to exchange any information and hazards found or created in the permit space.

Note to the Contractor: The above information should be provided to the host employer in written form. By doing so, all required responsibilities are performed and available information is communicated. Appendix H is included for this purpose.

PERMIT-REQUIRED CONFINED SPACE PROGRAM - PARAGRAPH (d)

The general requirements that an employer must follow were discussed in the previous section. The requirements needed for the actual design and implementation of a written permit space program are included in this section entitled Permit-Required Confined Space Program. Though employers may defer the specific hazard evaluation of the permit space until the actual entry operation, employers are expected to begin developing their written program once they know

employees will eventually perform an entry operation. These steps are needed prior to the entry operations to ensure that the permit space program is effective. Employers who wait until the last minute before an entry operation to begin to develop a program are likely to have problems that could significantly increase the risks to employees.

Note to the Employer: Remember, if alternative procedures ((c)(5)) or reclassify to a non-permit space procedures ((c)(7)) can be used, paragraphs (d) through (f) and (h) through (k) are not required.

Paragraph (d)(1) requires the employer to implement measures to prevent unauthorized entry into a permit space. It is the employer' s responsibility to use whatever measures are necessary to prevent unauthorized entry; such as:

- locks
- fences
- guardrails
- signs in combination with training
- any other effective measure

Paragraph (d)(2) requires that the identification and evaluation of hazards in a confined space must be conducted in detail prior to entry so that the operation can be safely planned. Identifying the existence of permit spaces must be accomplished by the effective date of the final rule April 15, 1993.

Note to the Employer: OSHA anticipates that employers will identify and evaluate permit space hazards as necessary for development of written permit space programs. For example, OSHA expects that employers who conduct frequent entries into permit spaces will be identifying and evaluating permit space hazards at the same time they are identifying permit spaces. On the other hand, OSHA understands that employers may not need to identify or evaluate the hazards of permit spaces that are entered at 5- or 10-year intervals until several years after the identification of those spaces. In the interim, since there are no authorized entries into those spaces, the program would only require that unauthorized entries be prevented. The hazards in the spaces need only be evaluated in detail some time before entry. The standard makes this clear -- the basic identification of permit spaces required by paragraph (c)(1) must be performed by the effective date of the final rule; the evaluation of the specific hazards posed by permit spaces identified under paragraph (d) (2) is required "before" entry.

Paragraph (d)(3) requires the employer to develop and implement the means, procedures, and practices necessary for safe entry operations, including, but not limited to the following elements:

1) Paragraph (d)(3)(i) requires specifying the acceptable entry conditions. This control measure ensures that the employer has identified the hazards that could reasonably be expected to be found in the space and has limited entry conditions to those that are safe for entry. For example, if a space could contain a flammable gas, the employer would set a limit of 10 percent of the LFL of the gas as an entry condition. This would ensure that a flammable mixture is not present upon entry into the space.

2) Paragraph (d)(3)(ii) requires that each authorized entrant or that employee's authorized representative is given the opportunity to observe any monitoring or testing of permit spaces.

3) Paragraph (d)(3)(iii) requires specifying the isolating procedures to be used. The permit space must be isolated from serious hazards. For example, if energized parts of electric equipment are exposed, the circuit parts must be de-energized and locked out in accordance with 29 CFR 1910.333(b). Mechanical equipment posing a hazard within the space must be locked out or tagged in accordance with 29 CFR 1910.147 or guarded in accordance with Subpart 0 of the General Industry Standards. Chemical or gas lines that are open within the permit space must be isolated by such means as blanking or binding, misaligning or removing section of lines, pipes, or ducts, or double block and bleed system.

4) Paragraph (d)(3)(iv) requires specifying if purging, inerting, flushing, or ventilating the space is needed to eliminate or control any atmospheric hazards.

5) Paragraph (d)(3)(v) requires the use of barriers. Barriers must be provided around the permit space opening for two reasons: (1) to prevent unauthorized entry into the space and (2) to protect employees inside the space from objects and persons outside the space. Paragraph (d)(3) requires barriers whenever they are necessary to protect employees within the permit space. If entrants face a substantial risk of injury due to unauthorized entry, objects falling into the space, or vehicular hazards during entry into and exit from the space, then barriers would be required.

6) Paragraph (d)(3)(vi) requires testing and monitoring of the space. The employer must ensure that conditions in the permit space are acceptable for entry throughout the duration of entry operations. This is accomplished through the use of ventilation to maintain a safe atmosphere, and the use of inspections to ensure that isolation procedures are being maintained for the space.

Paragraph (d)(4) requires the employer to provide the equipment needed for safe entry operations. This equipment must be available at no cost to employees, and must be properly maintained. The employer must ensure its proper use by employees. The equipment required may vary on the specific permit space to be entered. Equipment likely to be needed includes:

1) Paragraph (d)(4)(i) atmospheric testing and monitoring equipment.

2) Paragraph (d)(4)(ii) ventilation equipment.

3) Paragraph (d)(4)(iii) communication equipment.

4) Paragraph (d)(4)(iv) personal protective equipment.

5) Paragraph (d)(4)(v) lighting equipment.

6) Paragraph (d)(4)(vi) barriers.

7) Paragraph (d)(4)(vii) access and egress equipment such as ladders.

8) Paragraph (d)(4)(viii) rescue and emergency equipment.

9) Paragraph (d)(4)(ix) any other equipment deemed necessary for safe entry into and rescue from the permit space.

Paragraph (d)(5) requires evaluation of the permit space for atmospheric hazards. The specific requirements for atmospheric monitoring to ensure that the hazard is controlled or eliminated are listed below:

1) Paragraph (d)(5)(i) requires the employer to test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin. This testing is important to detect any hazardous atmospheres or other hazards that may be present in the permit space.

An exception to the above would be applied in the case where isolation of the space is infeasible because the space is large or is part of a continuous system (such as a sewer system). In that case, the employer must perform pre-entry testing to the extent feasible before authorizing entry. If entry is authorized, then continuous monitoring of entry conditions in the areas where authorized entrants are working is required.

The type of testing that needs to be performed is dependent on the specific hazards that are present within the space. For permit spaces posing atmospheric hazards, atmospheric testing would be necessary. If the permit space poses thermal hazards, then the temperature within the space would need to be tested.

Because sewers and similar permit spaces are large, continuous systems, conditions encountered at the point of entry may not be indicative of conditions at distances further from the point of entry. Also, since the space usually cannot be effectively isolated, conditions at any particular point in the space may deteriorate suddenly due to the introduction of a material from another point in the system that creates a hazardous environment for the entrants. Under these conditions, pre-entry testing often will not detect such hazards, and the need for continuous atmospheric monitoring becomes paramount. Atmospheric monitoring is necessitated virtually from the time pre-entry testing is done until the last entrant leaves the permit space. Because of these

conditions, the procedure for authorizing entry into sewers has evolved so that authorization is usually granted immediately before entry.

2) Paragraph (d)(5)(ii) of the final rule requires permit spaces to be tested or monitored, as necessary, to determine if acceptable entry conditions are being maintained during the course of entry operations. This provision requires whatever period of monitoring (frequent or continuous) that would be necessary to protect employees.

3) Paragraph (d)(5)(iii) specifies the proper sequence to be used when permit spaces are tested for atmospheric hazards. This provision requires employers to test first for oxygen, secondly for combustible gases and vapors, and then for toxic gases and vapors.

A test for oxygen must be performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen-deficient atmosphere.

4) Paragraph (d)(5)(iv) requires that each authorized entrant or that employee's authorized representative be provided the opportunity to observe the pre-entry and any subsequent testing or monitoring of permit spaces.

5) Paragraph (d)(5)(v) requires that permit spaces shall be reevaluated in the presence of the authorized entrant or the employee's authorized representative if they have reason to believe that the evaluation of the space may not have been adequate.

6) Paragraph (d)(5)(vi) requires that the results of any testing conducted in accordance with paragraph (d) be provided to the employee and the employee's authorized representative.

Paragraph (d)(6) requires providing at least one attendant outside the permit space for the entire duration of the entry operation.

Attendants may monitor no more permit space entry operations than they can safely handle. For example, if the attendant is communicating with authorized entrants by voice contact only, that attendant would not be able to monitor any other permit spaces that were not within voice contact. Also, if the number of spaces and the number of authorized entrants are too much for one attendant to keep track of, then additional attendants would be required.

In **Paragraph (d)(7)** the standard also allows the use of electronic surveillance and other devices as aids or augmentations to the monitoring process. The use of such devices would allow an employer to increase the number of permit spaces a single attendant could effectively and simultaneously monitor (although OSHA is not permitting the use of such devices to replace an attendant entirely). Additionally, the attendant would normally be stationed near the entry point of the permit space, but the use of an electronic monitoring device makes it possible for an attendant to effectively perform his or her assigned duties from a remote location. Television monitors, public address systems, and barricades can be used to assist the attendant in monitoring activities outside the space and in warning unauthorized personnel away from the space.

- If the attendant is monitoring activities in multiple spaces, the specific procedures used to respond to an emergency situation affecting one or more spaces must be documented in the written permit program.

Paragraph (d)(8) requires the employer to designate in writing the specific employees who will perform the various functions of the permit space entry, such as:

- authorized entrant,
- attendant,
- entry supervisor, and
- person performing the atmospheric testing.

Additionally, identify the specific duties of each individual and ensure that they are properly trained for their assigned role.

Paragraph (d)(9) requires the employee to develop and implement written rescue procedures for summoning rescue and emergency medical services to:

- rescue entrants,
- provide necessary emergency medical services, and
- prevent unauthorized personnel from attempting a rescue.

Paragraph (d)(10) requires the development and implementation of a system for the:

- preparation,
- issuance,
- use, and
- cancellation of the entry permit as stated in paragraphs (e), (f) and (j) of the standard.

Paragraph (d)(11) requires employers to coordinate entry operations when employees of more than one employer are working simultaneously as authorized entrants. Effective communication and coordination between employers will reduce the risk of employees of one employer endangering the welfare of employees of another employer.

Paragraph (d)(12) requires employers to establish the necessary procedures for concluding the entry once the entry operation has been completed. This is required so that the employer may carefully plan and control the entry operation from start to finish. Cancellation of the permit by established procedures alerts the employer to take the appropriate measures, which include:

- the shut down of the space,
- the closing of the entry portal, and
- the return of the space to normal operating conditions.

By implementing these control procedures, situations such as these can be avoided:

- accidentally locking an employee inside the space,
- employees accidentally entering the space,
- possible fire or explosion when the space is returned to its normal operating activity,
- leakage from misaligned pipes that have not been reconnected.

Paragraph (d)(13) requires that the employer must institute a review of entry operations if the employer has reason to believe that the control measures taken under the program are not adequately protecting employees. Correct any deficiencies found before subsequent entries are authorized. Circumstances that may prompt such review include:

- any unauthorized entry into the permit space,
- detection or discovery of a permit space hazard not covered by the entry permit,
- detection of a condition prohibited by the entry permit,
- a change in the use or configuration of the confined space, and
- employee complaints about the effectiveness of the program.

Paragraph (d)(14) requires the employer to conduct a review of the permit space program using canceled permits within one year after each entry. The program may be reviewed sooner if needed, to ensure employees are protected from permit space hazards. Employers can perform a single annual review covering all entries performed during a 12month period if they desire. If no entry is performed during a 12-month period no review is necessary.

Note to the Employer: Appendix F PRCS Program Worksheet and Appendix F- I contains an example of a completed written PRCS Program that is considered to comply with the standard. The program should be modified as necessary to meet the specific demands of the permit space to be entered.

PERMIT SYSTEM - PARAGRAPH (e)

It is well documented that many injuries and fatalities are the result of employers not taking the proper precautions necessary to ensure the safety of the employees working in permit spaces. Paragraph (e) Permit System requires employers to systematically implement measures to prevent these injuries and fatalities by instituting the following:

Paragraph (e)(1) requires the employer to document the completion of the measures needed for safe entry operations through the preparation of an entry permit as required in paragraph (d)(3).

Careful and thorough planning is required to ensure all measures are taken to ensure the safety of the authorized entrants. The specific elements that must be included on the permit are dependent on the particular space and the operation to be conducted in the space.

Appendix Q provides an example of an entry permit that is considered to comply with the section. The elements in the entry permit can be modified to meet the specific hazards to be encountered.

Paragraph (e)(2) requires the entry supervisor to sign the entry permit to authorize entry.

Paragraph (e)(3) requires the employer to make the completed permit available to all entrants or their authorized representatives at the time of entry. It may consist of posting the permit at the entry portal or any other acceptable means so long as the authorized entrants can check to see if pre-entry preparations have been completed.

Paragraph (e)(4) requires that the duration of the permit not exceed the time required to complete the task or job identified on the permit. The entry permit is limited to the duration of whatever period of time is necessary for completion of the assigned task or job. The employer can state the permit' s duration in terms of a specific task to be performed; for example, the cleaning of interior surface of a tank, or the removal and installation of a relief valve. The duration of the permit is not of major concern to the safety of employees as long as acceptable entry conditions are maintained.

If conditions within the space change so that entrants are endangered, then the following steps are needed to fully protect these employees:

1) The entry supervisor, when he or she assumes responsibility for a space and when he or she performs periodic checks, ensures the presence of acceptable entry conditions (paragraph (j)(6)).

2) If the hazard being introduced is atmospheric in nature, the testing and monitoring of the space will detect it (paragraph (d)(5)(ii)).

3) If other hazards are being introduced, the entry supervisor, the attendant, and authorized entrants are trained to detect their presence (paragraphs (g), (h)(1), and (j)(1)).

4) Entrants would vacate the permit space (paragraphs (h)(4) and (h)(5), (i)(6), and (j)(3).

Paragraph (e)(5) requires the entry supervisor to terminate the entry and cancel the permit when:

- Entry operation has been completed, or
- A prohibited condition arises in or near the permit space.

Note to the Employer: It is understood that there are situations where more than one entry supervisor may be needed over the course of an entry operation. For example, when multi-shift entry operations are conducted, more than one entry supervisor would be used for a permit space. Additionally, even for entry operations that do not extend across more than one shift, the original entry supervisor may be absent from the workplace for other reasons. Therefore, OSHA has adopted language to provide that the entry supervisor, not the person who authorized entry, will cancel the permit. As noted under the discussion of the term "entry supervisor", OSHA does not intend to restrict the position of entry supervisor to a single individual. Any individual who has been designated as the entry supervisor has the authority to terminate entry and cancel a permit.

Paragraph (e)(6) requires that all canceled permits be maintained for a minimum of one year to assist in the annual review process. (i.e., paragraph (d)(14) of the standard). By making canceled permits available, any problems that arise can be evaluated and steps taken to avoid a reoccurrence.

ENTRY PERMIT - PARAGRAPH (f)

Paragraph (f) requires that each permit space have an entry permit prepared as part of the employer' s determination that conditions in the space are safe for employee entry. A specific, properly prepared entry permit will help assure that employees will be protected against any permit space hazards. The regulation requires all the information listed in paragraphs (f)(1) through (f)(15) of the standard to be included and addressed on an entry permit.

Paragraph (f)(1) requires identification of the space to be entered.

Paragraph (f)(2) requires the purpose of entry to be listed on the permit.

Paragraph (f)(3) requires the date and the authorized duration of the entry permit.

Note to the Employer: The duration of the entry permit need not be stated in terms of actual time, but may be stated in terms of the completion of the specific task (see (e)(4) of the Permit System paragraph for additional information).

Paragraph (f)(4) requires a listing of the authorized entrants. The employer may place the names on the entry permit, choose to use entry tags, badges, sign-out sheets, or any other effective means to track the authorized entrants. Whatever method is used, it must allow for quick and accurate accountability of the authorized entrants by the attendant. The method to be used must be stated on the entry permit.

Paragraph (f)(5) requires that the names of current attendants involved with the entry operation be placed on the permit.

Paragraph (f)(6) requires the names of the current entry supervisors, including a space for their signatures or initials for the entry supervisor who originally authorized entry.

Note to the Employer: New attendants or entry supervisors must have their names recorded when they assume the role at the permit space. This also provides these individuals with an opportunity to review the permit, as required by paragraph (j)(6) of the standard.

Paragraph (f)(7) requires the permit to contain a list of the hazards of the permit space to be entered.

Paragraph (f)(8) requires the permit to contain a list of the specific measures taken to isolate the permit space to either control or eliminate the hazards.

Note to the Employer: The permit need only refer to the procedures in sufficient detail to enable employees to know what measures should be taken and how to perform them (e.g., the use of blanking to isolate the permit space). The standard does not require the entry permit to contain an in-depth discussion of the procedures used. The detailed procedures are required under paragraph (d)(3) of the written PRCS Program, and authorized personnel trained in their use under paragraph (g) of the standard.

Paragraph (f)(9) requires the permit to contain a list of the acceptable entry conditions.

Note to the Employer: These conditions must be included on the permit so permit space personnel are aware of the acceptable entry conditions. For example, the acceptable conditions that may be listed on the permit might include:

- oxygen, flammable gas and vapor, and toxic substance levels that must be met before entry.
- energy isolation controls, etc.

Paragraph (f)(10) requires the recording of pre-entry and periodic atmospheric testing results on the permit along with:

- the name or initials of the individual performing the tests.
- the date and time of the testing, and
- an indication where the testing was performed.

Having this information on the permit assists confined space team members in accessing the conditions during entry operations and also facilitates the review of canceled permits.

Paragraph (f)(11) requires the permit to list the rescue and emergency services (i.e., inhouse, outside) that can be summoned and the means for contacting those services (e.g., phone, CB radio, etc.)

Paragraph (f)(12) requires the permit to list the communication procedures that will be used between the attendants and authorized entrants.

Paragraph (f)(13) requires that the permit contain a list of equipment that is required for the entry operation, such as:

- personal protective equipment,
- testing equipment,
- communications equipment,
- alarm systems,
- rescue equipment,
- barriers and fences, and
- any other equipment deemed necessary for the safety of the workers.

Paragraph (f)(14) requires that the permit contain any other information that is needed for the protection of the employees during the entry operation.

Paragraph (f)(15) requires that any other additional permits (i.e., hot work permits) that have been issued to authorize work be identified on the permit or attached to it (see Appendix I for a copy of a typical hot work permit).

TRAINING - PARAGRAPH (g)

A major factor in permit space accidents is the lack of employee awareness of the dangers involved in the spaces. For example, many times, the lack of adequate training can result in death or serious physical harm to workers. Employees may enter a permit space unaware that the space contains an immediately Dangerous to Life and Health (IDLH) atmosphere since in many situations there are no obvious symptoms associated with these life-threatening environments. Additionally, untrained rescuers of incapacitated individuals often become victims themselves because they are unaware of the hazards and of safe rescue procedures. To prevent these types of

situations from occurring, the regulation requires mandatory training of all members of the permit space team. The elements are listed in paragraph (h), (1), (j) and (k) for the authorized entrants, attendants, entry supervisors, and rescue personnel, respectively. Paragraph (g) requires employers to provide this training to these individuals so they obtain the background necessary for safe permit space entry. Training under paragraph (g) requires the following:

Paragraph (g)(1) requires employees to provide training to those employees whose work involves or may involve contact with permit spaces to acquire the understanding, and skills necessary for the safe performance of their assigned duties.

Note to the Employer: This requires the employer to develop and implement the most effective confined space training program needed to meet the specific demands of the permit space at the worksite.

Paragraph (g)(2) sets out the general conditions under which training would have to be provided.

1) Paragraph (g)(2)(i) requires an employee to be trained when he or she is first assigned duties involving permit space entry.

2) Paragraph (g)(2)(ii) requires training before there is a change in assigned duties. Such changes could be from introduction of new equipment, techniques, or reassignments.

Note to the Employer: Employees who are currently performing duties outlined in the standard and who have previously been trained need further instruction only insofar as they are unfamiliar with the hazards involved and must change their work practices so as to conform to 1910.146. The employer must still certify the training of these individuals. Additionally, OSHA will accept on-the-job training as long as the employee involved is under the direct supervision of a trained individual and has received sufficient instruction to enable the trainee to work safely at his or her level of training.

3) Paragraph (g)(2)(iii) requires training before there is a change in the permit space operation that presents a hazard for which the employee has not previously received training.

4) Paragraph (g)(2)(iv) requires training whenever the employer believes that there are deviations by the employees from the prescribed permit space entry procedures, or lack of employee knowledge or use of these procedures.

Note to the Employer: Refresher or follow-up training is required in paragraphs (g)(2)(ii), (g)(2)(iv), or whenever there is a demonstrated need for it.

Paragraph (g)(3) requires that the training must make the employees proficient in the tasks assigned to them.

Paragraph (g)(4) requires the employer to certify that employees have received training as required by (g)(1) through (g)(3) by maintaining a record of the following:

- employee' s name,
- signature or initial of the trainer(s), and
- date of training.

Note to the Employer: Appendix R has been included for recording employee training. The employer is not required to generate individual certificates; a list or roster is sufficient. Also, make this training record available for inspection to the employees or authorized representatives.

DUTIES OF AUTHORIZED ENTRANT - PARAGRAPH (h)

An authorized entrant is an employee who is authorized by the employer to enter a permit space. Since this individual is at the greatest risk, it is imperative that this individual fully understands and practices safe permit space entry procedures. To accomplish this goal, the employer must provide training, communicate safe work practices, and effectively implement the permit space program.

Paragraph (h)(1) requires entrants:

- to know the potential hazards associated within a specific permit space,
- to be able to recognize the signs or symptoms of exposure, and
- to understand the consequences of exposure to the hazards.

Paragraph (h)(2) requires that the entrants properly use all the equipment necessary for a safe entry operation.

Paragraph (h)(3) requires that the entrant communicate with the attendant as necessary to enable the attendant to monitor the entrant' s status and to enable the attendant to alert him/her of The need to evacuate the space.

Note to the Employer: Depending on the types of atmospheric contaminants that might be present within a permit space, subtle behavioral changes detected in the authorized entrant's speech or deviation from set communication procedures could alert the attendant that it is necessary for the authorized entrant to evacuate the space or be rescued. Additionally, the attendant needs to be able to communicate with authorized entrants to order them to evacuate the space in an emergency.

Paragraph (h)(4) requires authorized entrants to alert the attendant when the entrant recognizes any warning sign or symptom or exposure to a dangerous condition or when the entrant detects a prohibited condition. The entrant ensures that informing the attendant of the presence of these conditions protects other entrants.

Paragraph (h)(5) through (h)(5)(iv) requires the entrant to exit from the permit space as quickly as possible whenever:

- The attendant or entry supervisor orders evacuation.
- The authorized entrant recognizes any warning sign or symptom of exposure to a hazardous substance.
- The entrant detects a prohibited condition.
- An evacuation alarm is activated.

Given the speed with which permit space hazards can incapacitate and kill entrants, it is essential that the entrants evacuate permit spaces as soon as any one of the four conditions set out in paragraphs (h)(5)(i) through (h)(5)(iv) is found to exist. OSHA believes that self-rescue will often provide the entrant' s best chance of escaping a permit space when a hazard is present.

Note to the Employer: Alerting other authorized entrants can also improve their chances of escape as well. However, there are several reasons why OSHA is not mandating this. First, the permit space may well be so large that the entrant who detects a hazard cannot quickly or efficiently communicate with other authorized entrants. Under paragraph (i)(5), the attendant is required to have the means of communicating with all authorized entrants in the space. The quickest and most effective means of ordering the evacuation of the space is therefore normally through the attendant. In fact, this is required under paragraph (i)(6). Furthermore, OSHA does not believe that it is appropriate to require one employee to risk injury or death to warn another. While in some cases it may be reasonable for entrants to inform each other of the presence of uncontrolled hazards and in other cases an employee may voluntarily risk injury or death to warn his or her fellow employees, OSHA has determined that the final rule should only require authorized entrants to inform attendants.

DUTIES OF ATTENDANTS - PARAGRAPH (i)

Paragraph (i) requires an attendant to be located outside the permit space to monitor the status of authorized entrants, watching for safety hazards that may arise in and around the space, keeping unauthorized employees away from the space, and summoning rescue services in the event of an emergency. To accomplish this task, the employer must ensure that the attendant is familiar with the following information as outlined in paragraph (i)(1) - (i)(10):

Paragraph (i)(1) requires the attendant to know and recognize the hazards and potential hazards associated with the specific permit space.

Paragraph (i)(2) requires the attendant to be aware of possible behavioral effects of exposure to atmospheric hazards (e.g., carbon monoxide, hydrogen sulfide, etc.). Review Material Safety Data Sheets (MSDS) for the chemical substances contained in the permit space. Refer to Appendix K for MSDS of some common airborne contaminants frequently found in permit spaces.

Paragraph (i)(3) requires the attendant to maintain an accurate count of authorized entrants within the permit space. The system used should quickly enable the attendant to determine if authorized entrants are inside the permit space.

Paragraph (i)(4) requires the attendant to remain outside the permit space until termination of the entry operation or being relieved by another authorized attendant. Additionally, the attendant may only enter a permit space to attempt a rescue if it is allowed under the specific permit program, if they are properly equipped and trained, and if another attendant relieves them.

Paragraph (i)(5) requires the attendant to maintain communication with the authorized entrant to monitor his/her authorized status and to alert the entrant of any need to evacuate the space. Subtle behavioral changes detected in the authorized entrant' s speech or deviation from a set communication procedure could be the first signs of trouble.

Paragraph (i)(6) requires the attendant to monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space or order evacuation if the attendant:

(a) detects a prohibited condition;
(b) detects behavioral effects manifested from exposure to atmospheric hazards in the authorized entrant;
(c) detects a condition outside the space (e.g., weather conditions, other work activity, etc.) that could endanger the authorized entrants; or
(d) cannot effectively and safely perform all required duties of an attendant.

Paragraph (i)(7) requires the attendant to summon rescue and other emergency services as soon as it is determined that an emergency exists.

Note to the Employer: As long as the attendant is certain that self-rescue can be performed, no rescue summoning would be necessary. However, if the attendant has any doubts as to whether an authorized entrant can exit the space under his or her own power, then the attendant is required to summon rescue and emergency medical services.

Paragraph (i)(8) requires that the attendant takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

1) Warn the unauthorized persons that they must stay out of the permit space;
2) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and
3) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

Paragraph (i)(9) requires the attendant to perform non-entry rescues as specified by the employer' s rescue procedure.

Note to the Employer: OSHA wishes to emphasize that attendants monitoring more than one space must not perform any duties that would distract them from their responsibilities for all the spaces being monitored. OSHA does expect such attendants to be permitted to perform any type of rescue, including non-entry rescue, as long as they are still acting as attendants. As noted earlier, the employer's permit space program must establish procedures to enable the attendant to respond to an emergency affecting one or more of the permit spaces being monitored without distraction from the attendant's responsibilities under paragraph (i).

Paragraph (i)(10) prohibits the attendant from performing other duties that may interfere with the attendant' s primary duty to monitor and protect the authorized entrant. Passing tools to authorized entrant and monitoring the permit space atmosphere would be acceptable, so long as the attendant does not break the plane of the opening. Tasks that distract the attendant from his/her primary duty, such as repairing equipment outside the space, are prohibited.

DUTIES OF ENTRY SUPERVISOR - PARAGRAPH (j)

Many of the permit space accidents are the result of the employer' s lack of enforcement of appropriate permit space entry procedures. Employers must take responsibility for ensuring that acceptable entry conditions exist before allowing entry, and during entry operations. Employers must also enforce safe work practices and procedures necessary to protect employees.

In order to place the burden of employee safety on employers, the standard requires each permit space entry to have an entry supervisor who has overall accountability for safe entry operations. The standard requires the entry supervisor to verify the existence of acceptable entry conditions and the presence of rescue and emergency medical services, to authorize the entry (which is evidenced by his or her signature on the permit), to remove unauthorized persons from the space, and to terminate the entry operation when necessary.

Paragraph (j) lists the duties of the entry supervisor.

Paragraph (j)(1) requires the entry supervisor to know the hazards that may be faced during entry.

Paragraph (j)(2) requires the entry supervisor to verify, by checking that the appropriate entries have been made on the permit, that all tests specified on the permit have been conducted and that all procedures and equipment specified on the permit are in place, before endorsing the permit and allowing entry to begin.

Paragraph (j)(3) requires the entry supervisor to terminate the entry and cancel the permit as required by paragraph (e)(5).

Paragraph (j)(4) requires the entry supervisor to verify that rescue services are available and that the means for summoning them are operational.

Paragraph (j)(5) requires the entry supervisor to remove unauthorized individuals who enter or who attempt to enter the permit space during entry operations.

Note to the Employer: OSHA recognizes that some persons near a permit space may have legitimate reasons for being there. These persons must be warned by the attendant (under paragraph (1)(8)(i) to stay out of the permit space. They must know the danger involved and, under the observations of the attendant, can safely remain near the space.

Paragraph (j)(6) requires the entry supervisor to determine, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

Note to the Employer: For entries lasting more than one work shift, the original entry supervisor will normally have to be relieved at the end of his or her shift. The responsibilities of the entry supervisor will then be passed on to someone else. OSHA believes that it is important for the new entry supervisor to review the permit and to determine that acceptable entry conditions have been maintained. OSHA also believes that guidance, beyond that of transfer of responsibility, must be given as to what "appropriate intervals" might be. In order to accomplish these goals, paragraph (j)(6) specifies that reevaluation of conditions within the space must occur whenever responsibility for permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space.

RESCUE SERVICES - PARAGRAPH (k)

The requirements of the standard are in place to eliminate or control any hazards prior to and during the entry operation. However, in spite of all these precautions, hazards may arise which could incapacitate an entrant and prevent his or her self rescue. This may be the result of extraordinary circumstances suddenly appearing without warning or possibly due to some deficiency in the employer' s program. Paragraph (k) of the standard has been devised to address the need for rescue and emergency services in such cases.

The regulation requires each employer who has employees who will enter a permit-required confined space to make arrangements for rescue and emergency services.

Employers must determine if they are going to rely on on-site or off-site rescue services. The regulation treats all rescue services identically, whether they are provided by employers or from an outside source, such as the local fire department.

It is very important for the employer to remember that an individual can only go without oxygen for approximately four (4) minutes before he/she has permanent brain damage or is asphyxiated. The need for quick response is clearly evident. In light of this, non-entry rescue methods should be the primary means of rescue stressed.

A retrieval system that allows outside personnel to extricate an incapacitated individual without having to enter the space is the preferred method. Retrieval systems must be provided whenever an authorized entrant enters a permit space, unless the employer can demonstrate that the retrieval equipment would increase the risk of entry or inhibit the rescue. If this is the situation, then an effective rescue alternative must be used.

It is also well documented that the majority of fatalities that occur are would-be rescuers who rush into a permit space without receiving proper training and/or without instituting the appropriate precautions. It cannot be stressed enough that properly trained and equipped individuals must only perform entry rescues. During an emergency situation, emotions must not be allowed to dictate actions. An appropriate rescue plan is required.

The following requirements under paragraph (k) apply to all employers who have individuals enter a permit space to perform rescue services:

Paragraph (k)(1) sets requirements for employers who designate rescue and emergency services.

1) Paragraph (k)(1)(i) requires the employer to evaluate a prospective rescuer's ability to respond to a rescue call in a timely manner considering the hazards identified.

2) Paragraph (k)(1)(ii) requires the employer to evaluate the prospective rescue service's ability in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit spaces or types of spaces identified.

3) Paragraph (k)(1)(iii) requires the employer to select a rescue team that has the capability to reach the victim within an appropriate time frame for the hazard(s) identified and is properly equipped and proficient in the needed rescue services.

Note to the Employer: Appendix S has been included for recording Rescue Service Evaluations and Selection. Make this information available for inspection to the employees or authorized representatives.

4) Paragraph (k)(1)(iv) requires the employer to inform each rescue team of the hazards they may confront when called to perform a rescue at the site.

5) Paragraph (k)(1)(v) requires the employer to provide the rescue service with access to all the permit spaces from which rescue may be necessary in order for them to develop appropriate rescue plans and to practice rescue operations.

Note to the Employer: Rescue services need to know in advance the location, configuration and hazards of a permit space in order to develop and practice effective rescue procedures. To gather this information, the host employer must provide access to the space to the rescue service. This standard does not require the rescue service to actually use the permit space for practice. However, in the best interest of safety, the host employer is encouraged to provide the rescue service the opportunity for actual rescue practice with the permit space.

Additionally, paragraph (d)(9) of the Permit-Required Confined Space Standard requires the employer to ensure the availability of necessary emergency medical services (such as paramedic

services). Someone with this more advanced medical training is needed to treat the rescued individual after he/she is removed from the space.

Paragraph (k)(2) has the following requirements under paragraph (k) apply to all employers who have employees enter a permit space to perform rescue services:

1) Paragraph (k)(2)(i) requires the employer to ensure that personnel assigned as rescuers are equipped with and trained to use all personal protective equipment (PPE) and rescue equipment necessary to enable the rescuers to enter and perform rescue operations.

2) Paragraph (k)(2)(ii) requires the members of the rescue service to be trained to perform their assigned rescue duties. They are also required to receive the same training required for authorized entrants as stated in paragraph (g) and (h).

3) Paragraph (k)(2)(iii) requires that each member of the rescue service shall be trained in basic first aid and in cardiopulmonary resuscitation (CPR). At least one member of the rescue operation must hold current certification in first aid and in CPR.

4) Paragraph (k)(2)(iv) requires rescuers to practice making permit space rescues at least once every 12 months, by simulating an actual rescue operation in which they remove dummies, manikins, or actual persons from the actual permit space or representative permit space. The representative permit spaces must with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

Note to the Employer: Practice sessions can be in actual permit spaces or spaces that simulate the permit space expected to be entered. It is important that the practice openings resemble those of the actual spaces to be entered. By providing this type of practice, rescue service members will be familiar with the possible problems associated with restricted openings while wearing personal protective equipment (e.g., Self-Contained Breathing Apparatus), using rescue equipment, and removing incapacitated entrants. This practice also provides feedback to the employer on the adequacy of the rescue equipment, the rescue procedures used, and the training provided.

Actual rescues conducted during the 12-month period can substitute for a practice rescue. During the course of the actual rescue if the rescuers performed their assigned tasks in a satisfactory manner, they need not perform a practice rescue for that 12-month period, regardless of the outcome of the rescue attempt. OSHA notes that even if a rescue is performed in a satisfactory manner, the entrants could still not survive, through factors beyond the rescuers' control. It should also be noted, however, that the unsatisfactory performance of a rescue team indicates the need for further training.

Note to the Employer: Because rescue service members' duties include the rendering of first aid and CPR, they are covered by the OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030. A copy of an Employer Guide and Model Exposure Control Plan can be obtained by contacting the nearest NYS Department of Labor office listed on page viii.

Paragraph (k)(3) sets requirements for the use of non-entry retrieval systems that must be used by authorized entrants whenever they enter a permit space. Non-entry retrieval systems must be used unless this equipment would increase the overall risk of entry or would not contribute to the rescue of the individual.

Note to the Employer: The following guidelines are provided to help determine when retrieval systems may increase the risk to the authorized entrant:

(1) A permit space with obstructions or turns that prevent pulls on the retrieval line from being transmitted to the entrant does not require the use of a retrieval system.

(2) A permit space from which an employee being rescued with the retrieval system would be injured because of forceful contact with projections in the space does not require the use of a retrieval system.

(3) A permit space that was entered by an entrant using an air-supplied respirator does not require the use of a retrieval system if the retrieval line could not be controlled so as to prevent an entanglement hazard with the air line.

1) Paragraph (k)(3)(i) requires that authorized entrants must wear:

- 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 or at another point which the employer can establish presents a profile small enough for the successful remove of the entrant.

- Wristlets can be used in lieu of chest or full body harness if they can be demonstrated to be safer and more effective than the harnesses.

2) Paragraph (k)(3)(ii) requires that the retrieval line must be attached to a fixed point or a lifting device. A mechanical lifting device is required for vertical permit spaces more than 5 feet deep.

Note to the Employer: Any permit space whose opening is above the entrant is considered to be a "vertical-type permit space". The mechanical device used should be appropriate for the rescue. The employer should not use any mechanical device, such as a forklift, that could injure the entrant during rescue.

Paragraph (k)(4) requires that if an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is already required to be kept at the worksite, the MSDS or other written information must be provided to the treating medical facility. Employers can comply with this provision by having that information accompany the employee to the medical facility or by providing it to the facility as soon as practicable after the employee' s arrival there.

EMPLOYEE PARTICIPATION - PARAGRAPH (l)

The development of a successful permit-required confined space entry program relies on employees understanding its benefits and its proper implementation. When employees are consulted in the program's development it is more likely that it will be accepted and fully utilized. Paragraph l has been developed to address this important issue.

Paragraph (l)(1) requires that affected employees and their authorized representatives be consulted in regards to the development and implementation of all aspects of the permit space program required by paragraph (c) of the standard.

Paragraph (l)(2) requires that all affected employees and their authorized representatives be provided with all the information required to be developed by the standard.

CONFINED SPACE AND PERMIT-REQUIRED CONFINED SPACE RECOGNITION

The inherent danger associated with working in permit spaces is an ever-present risk for a large portion of today' s workforce. Many of the accidents that have been documented are a result of employers and employees failing to recognize the hazards or potential hazards involved with entering into permit spaces. This section is designed to assist employers and employees with the task of identifying confined spaces and permit-required confined spaces in their workplaces.

Before an employer can properly evaluate their worksite, it is important that they understand the definitions of confined space and permit-required confined space.

Confined Space

A confined space is a space that has the following characteristics:

- Is large enough and so configured that an individual can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit; and
- Is not designed for continuous employee occupancy.

Note to the Employer: All three criteria must be met for the location to be considered a confined space.

Confined spaces may include:

- Boilers
- Furnaces
- Sewers
- Septic Tanks
- Tunnels
- Manholes
- Vessels
- Digesters
- Tank Cars
- Cisterns
- Pits
- Diked Areas
- Silos
- Storage Bins
- Hoppers
- Vaults
- Process Vessels
- Pumping Stations
- Wells

Permit-Required Confined Space

Once a confined space has been identified, the next step is to determine if it is a permit-required confined space. In order for a space to be considered a permit-required confined space, it must

first meet the criteria of a confined space. Secondly, the space must contain one or a combination of the following conditions:

- Hazardous atmosphere
- Liquid or solid materials that can engulf an entrant,
- A configuration that can trap and suffocate an entrant,
- Contains any other recognized serious safety and health hazards.

Non-Permit Required Space

Non-permit spaces are confined do not contain or, with respect to atmospheric hazards, have the potential to contain any hazards capable of causing death or serious physical harm. Examples of non-permit confined spaces include vented vaults, motor control cabinets, and dropped ceilings. Although they are "confined spaces", these spaces have either natural or permanent mechanical ventilation available to prevent the accumulation of a hazardous atmosphere, and they do not present engulfment or other serious hazards.

Note to the Employer: Some additional clarification is provided here concerning confined spaces, permit-required confined spaces, and entry into enclosed areas.

The standard is intended to cover only those spaces large enough for the entire body of an employee to enter.

The standard is not intended to address all locations that pose atmospheric hazards. For example, an open 55-gallon drum where an employee breaks the plane of the opening is not addressed by this standard. Provisions are already in place to protect the employee from atmospheric hazards by Subpart Z of the General Industry Standard.

OSHA states that doorways and other portals through which a person can walk are not considered limited means of entry or exit, and therefore, a confined space does not exist.

Spaces, which contain permanently installed mechanical ventilation that precludes a hazardous atmosphere from developing, would not be considered a permit required confined space. This system should consist of an exhaust flue stack(s) and low level air intakes that provide a cross draft in the space to prevent the formation of a hazardous atmosphere. If the ventilation system were to malfunction, the space would have to be reevaluated.

TYPES OF CONFINED SPACE HAZARDS

- Hazardous Atmospheres
  - Oxygen Deficiency or Oxygen Enrichment
  - Combustible/Flammable/Explosive Gases and Vapors
  - Toxic Gases and Vapors
  - Combustible Dust
- Engulfment Hazards
- Entrapment or configuration Hazards
- Mechanical Hazards
- Other Hazards
  - Corrosive Chemicals (acids, cleaning solutions, etc.)
  - Electrical
  - Access With Ladders
  - Lighting (poor visibility)
  - Temperature Extremes
  - Falling/Tripping/Insecure Footing
  - Falling Objects
  - Weather Conditions

HOW CONFINED SPACE HAZARDS OCCUR

- Confined space hazards occur as a result of both natural and man-made sources.

SOURCES OF CONFINED SPACE HAZARDS

- Chemical Reactions from Products Stored in Vessels
- Oxidation/Reduction Reactions (i.e., Rusting of Metals)
- Decomposition of Organic Matter
- Cleaning Reagents (Solvents, Acids)
- Welding, Spray Painting, Grinding, Brazing, Sand Blasting
- Inerting With Non-Flammable Gases
- Fire and Explosion Hazards from Organic Hydrocarbon Based Substances
- Ignition Sources from Static Electricity, Hot Work Operations, Electrical Equipment
- Lack of Proper Training
- Lack of Permit Entry Program

- Loose Materials Stored in Tank (Grain, Sawdust, etc.)
- Pyrophoric Chemicals
- Lack of Good Safety Policies and Practices

Hazardous Atmospheres

Hazardous atmospheres account for a majority of the fatalities that occur in permit spaces. The standard ensures the safety of the workers by requiring pre-entry testing and frequent or continuous monitoring during the entry operation. Various types of atmospheric hazards could be encountered depending on the specific type, use, and work performed in the space. It is important to know the hazards and potential hazards that might be present and to monitor accordingly. Once the employer has determined that atmospheric hazards could exist, the standard mandates that testing be conducted in the following sequence:

- Oxygen deficiency/Oxygen enrichment
- Combustible gases and vapors
- Toxic gases and vapors
- Combustible dust

Oxygen Hazards

Air is a mixture of many gases, oxygen being just one of them. The normal oxygen concentration in air is approximately 20.9% by volume.

- Oxygen Deficiency

  An oxygen-deficient atmosphere is considered to exist when the oxygen level falls below 19.5% by volume. This condition could exist in a permit space from either consumption or displacement of oxygen by natural and man-made sources such as:

  - Oxygen consumption by individuals
  - Decomposition of organic matter
  - Displacement of oxygen by gases and vapors (e.g. inert gases such as nitrogen, carbon dioxide, helium, or steam used to purge tanks and vessels)
  - Oxidation of metals (e.g. rusting)
  - Combustion (e.g. fire, welding, etc.)

- Oxygen Enrichment

  Oxygen enrichment levels greater than 23.5% by volume present a serious fire hazard in permit spaces. This condition could result from leaking oxygen cylinders or lines brought into a space. Also, oxygen must never be used to ventilate a confined space.

Potential Effects of Oxygen-Deficient and Enriched Atmospheres

Oxygen Content -- % by Volume	Effects and Symptoms (At Atmospheric Pressure)
23.5% and above	Extreme fire hazard.
19.5%	Minimum permissible oxygen level.
15-19%	Decreased ability to work strenuously. May impair coordination and may induce early symptoms in persons with coronary, pulmonary, or circulatory problems.
12-14%	Respirations increase, pulse increases, impaired coordination, perception, judgement.
10-12%	Respirations further increase in rate and depth, poor judgement, lips blue.
8-10%	Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea, and vomiting.
6-8%	8 minutes, 100% fatal; 6 minutes, 50% fatal; 4-5 minutes, recovery with treatment possible.
4-6%	Comas in 40 seconds, convulsions, respirations cease, death.

These values are approximate and vary with the individual' s state of health and his or her physical activities.

Exposure to atmospheres containing 12% or less oxygen can bring about unconsciousness without warning so quickly that the individuals cannot help or protect themselves.

Combustible/Flammable Gases and Vapors

Combustible/flammable gases and vapors can pose a significant threat of fires and/or explosion in permit spaces.

The lowest concentration (air-fuel mixture) at which a gas or vapor can ignite is called its Lower Explosive Limit (LEL) or Lower Flammable Limit (LFL). Concentrations below this limit are too lean to burn.

The highest concentration that can be ignited is its Upper Explosive Limit (UEL) or Upper Flammable Limit (UFL). Above this concentration, the mixture is too rich to burn.

A gas or vapor is only explosive/combustible between its LEL and UEL, but any concentration of combustible gas or vapor should be of concern when in a confined space. Lean mixtures can collect in an area and reach a combustible level, or rich mixtures can be diluted with air to become combustible.

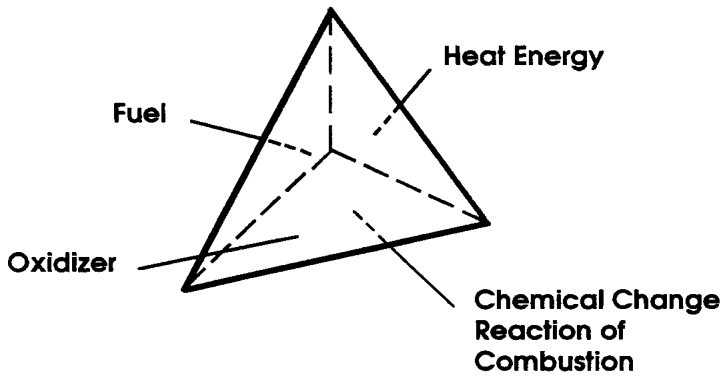
Lower Explosive Limit (LEU vs. Upper Explosive Limit (UEL) for Toluene

	LEAN (Too little gas)				**EXPLOSIVE** (Flammable mixture)	**RICH** (Too much gas)	
AIR	100%				98.8%	92.9%	0%
LEL	0%		50%		100%		
TOLUENE	0%		0.2% (IDLH)	.6%			

.02% (PEL) .6% 1.2% (LEL) 7.1% (UEL) 100%

1% = 10,000 parts per million (ppm)

In order for an explosion or fire to occur, all components of the "fire tetrahedron" have to be present: fuel, oxygen, ignition source, and a chain reaction.



FIRE TETRAHEDRON

Many provisions in the standard address prevention of fire and explosion hazards by removing components of the fire tetrahedron, including:

- Preventing an atmosphere from containing a flammable gas, vapor or mist concentration in excess of 10% of the Lower Explosive Limit.
- Conducting atmospheric testing to determine the percentage of the LEL present. Elimination or control of sources of ignition.
- Preventive measures are discussed in greater detail in the Control Section of this document.

Toxic Atmospheres

An additional concern is the presence of toxic or potentially toxic substances existing in the permit space. These substances may come in the form of gases, vapors, mists, dusts, fumes, or radiation. The standard references Subpart Z, Toxic and Hazardous Substances (i.e., chemical hazards), and Part 1910.94 - 100, Subpart G, Occupational Health and Environmental Controls (e.g., non-chemicals hazards such as ionizing radiation). A hazardous atmosphere is said to exist when atmospheric concentrations exceed a dose or a permissible exposure limit (PEL) for substances published in Subpart Z and G. Additionally, any other atmospheric condition that is immediately dangerous to life or health (IDLH) must be addressed as part of the permit space entry protocol.

Substances for which OSHA has not established a dose or PEL must be evaluated by the employer to determine their hazards. Sources of information include:

- Material Safety Data Sheets (MSDS)
- Published information on the substance
- Industry established exposure levels
- National Consensus Standards, including, American conference of Governmental Industrial Hygienists (ACGIH), National Institute of Safety and Health (NIOSH)

Subpart Z contains a list of substances for which OSHA has established PELs. PELs may be expressed as 8-hour Time Weighted Averages (TWAs), 15-minute Short Term Exposure Limits (STELs), or ceiling limits. The ACGIH Threshold Limit Values (TLVs) and NIOSH Recommended Exposure Limits (RELS) are recommended exposure limits. In the absence of an OSHA PEL, OSHA can enforce TLVs and RELs.

Toxic substances will have acute (short-term) or chronic (long-term) health effects, some have both. It is important for the employer to know which, since acute health hazards are of an immediate concern when determining the presence of a hazardous atmosphere. Three (3) of the most common toxic gases found in permit spaces include carbon monoxide, hydrogen sulfide, and methane.

- Carbon Monoxide

  Carbon monoxide is a very toxic, colorless, odorless combustible gas that is a product of incomplete combustion. It is generated by many sources such as gasoline-powered internal combustion engines, arc welding where carbon dioxide is used as an inert gas, and fires, just to name a few. Carbon monoxide has a high affinity for the hemoglobin in blood and can quickly replace oxygen. In high concentrations, carbon monoxide can cause chemical asphyxiation.

Effect of Various CO Levels

CO Level in PPM*	Resulting Condition/Effect on Humans
50	Permissible exposure level, 8 hours (OSHA)
200	Possible mild frontal headache in 2 to 3 hours
400	Frontal headache and nausea after 1 to 2 hours Occipital after 2½ to 3½ hours
800	Headache, dizziness, and nausea in 45 minutes Collapse and possibly death in 2 hours
1500	IDLH
1600	Headache, dizziness, and nausea in 20 minutes Collapse and possibly death in 2 hours
3200	Headache and dizziness in 5 to 10 minutes Unconsciousness and danger of death in 30 minutes
6400	Headache and dizziness in 1 to 2 minutes Unconsciousness and danger of death in 10 to 15 minutes
12,800	Immediate effect unconsciousness Danger of death in 1 to 3 minutes

*PPM = Part Per Million
10,000 PPM = 1% by volume
IDLH = Immediately Dangerous to Life and Health

All values are approximate with the exception of the OSHA PEL. The effects can vary depending on the individual' s health and the type of physical activity being performed.

Source: American Industrial Hygiene Association

- Hydrogen Sulfide

  Hydrogen Sulfide is a flammable, colorless gas with characteristic rotten-egg odor and is soluble in water. It is commonly found in areas where petroleum products are processed, is a by-product of manufacturing operations such as tanneries, is released during the decay of sulfur-containing organic matter, and is encountered in sewers and sewage treatment plants. Hydrogen sulfide has a strong odor noticeable at low concentrations, but overall, this substance has poor warning properties because of rapid olfactory fatigue.

  Employees will quickly lose their ability to smell the gas, even though the gas is still present in the space.

EFFECT OF VARIOUS H_2S LEVELS

H_2S Level in PPM*	Resulting Condition/Effects on Humans
0.13	Minimal perceptible odor
4.60	Easily detectable, moderate odor
10.0	Beginning eye irritation. Permissible exposure level, 8 hours (OSHA, ACGIH)
27.0	Strong, unpleasant odor, but not intolerable
100	Coughing, eye irritation, loss of sense of smell after 2 to 5 minutes
200	Marked conjunctivitis (eye inflammation) and respiratory tract irritation after one hour of exposure
300	IDLH
500-700	Loss of consciousness and possibly death in 30 minutes to one hour
700-1000	Rapid unconsciousness, cessation (stopping or pausing) of respirations, and death
1000-2000	Unconsciousness at once, with early cessation of respiration and death in a few minutes. Death may occur even if individual is removed to fresh air at once.

*PPM = Part Per Million
10,000 PPM = 1% by volume
IDLH = Immediately Dangerous to Life and Health

All values are approximate. The effects can vary depending on the individual' s health and the type of physical activity being performed.

Source: American National Standards Institute (ANSI Standard No. Z37.2-1972)

- Methane (Natural Gas)

  Methane is a colorless, odorless, flammable gas. It is a simple asphyxiant and displaces air in a confined space. The natural decaying process of organic materials is the most common source.

- Other Atmospheric Hazards

  In addition to the above-mentioned atmospheric hazards, there are other substances that may also pose a danger to permit space entrants. These substances can result from residues remaining in vessels, cleaning solvents, welding operations, by-products from chemical reactions with cleaning solvents, leaks from lines not blocked and bled off correctly, etc.

It is very important for employers to know the particular substances that could be found in a particular permit space that will be entered. Material Safety Data Sheets (MSDS) as required by the OSHA Hazard Communication Standard (29 CFR 1910.1200) must be available for the contents of any vessels/tanks/containers and for any solvents or by-products generated. The MSDS will provide valuable information on the substance including:

1) Flammability
2) Density (heavier or lighter than air)
3) Any acute or chronic health hazards
4) Lower Explosive Limit (LEL)
5) Upper Explosive Limit (LIED
6) OSHA Permissible Exposure Limits (PELs)
7) ACGIH Threshold Limit Values (TLV5)
8) Immediately Dangerous to Life and Health (IDLH) Levels

A list of toxic substances commonly found in industrial settings is listed in Appendix J for quick reference.

MSDS for carbon monoxide, methane and hydrogen sulfide are also included and can be found in Appendix K.

Note to the Employer: OSHA has determined that an atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability for self-rescue, injury, or acute illness due to its health effects is not covered by this provision of the standard. An atmosphere that contains a substance at a concentration exceeding its PEL which is intended solely to prevent long-term adverse health effects is not considered to be a PRCS hazardous atmosphere on that basis alone, according to the standard.

Keeping this in mind, it is important for employers to accurately determine the health hazards associated with the specific substance(s) in the space. The substance(s) must be evaluated to see if it has either long-term (chronic) effects, acute (short-term) effects, or both. Consult the Material Safety Data Sheets (MSDS) for the specific health hazard data. Substances that have Short Term Exposure Limits (STELs) and/or ceiling limits can generally be considered to have acute effects and thereby be considered a potential hazardous atmosphere.

It is important for employers to know that a space may be tested and found to have acceptable oxygen and combustible gas/vapor levels, but still have a toxic gas hazard. For this reason, the specific toxic substance must be tested and the results compared to Subpart Z or other available sources. When testing for toxic gases and vapors, it is especially important to know what substance is expected because toxic gas detectors are very specific. If the PEL is only to protect employees from long-term health effects, the atmosphere may not be a hazardous atmosphere under the Permit-Required Confined Space Standard. But, control measures must be taken such as ventilation controls, respiratory protection, etc., to ensure compliance with the OSHA General Industry Standard subpart Z 29 CFR 1910.1000 through 1910.1048.

- Combustible/Explosive Dust

  Combustible dust may also pose a significant hazard to employees should their airborne concentration reach the lower flammability limit for the specific dust. Some common types of combustible/explosive dust include:

<u>Food Products</u>
- grain dusts
- flour
- starches

<u>Metal Powders</u>
- aluminum
- magnesium
- zinc

<u>Wood Products</u>
- wood dust
- cellulose

<u>Spices</u>
- pepper
- tea

<u>Other Dusts</u>
- hard rubber
- plastic cinnamon

Many other organic as well as inorganic materials, if ground finely enough, will burn and support a flame.

OSHA believes that there is currently no reliable dust-monitoring equipment available to provide on-site combustible dust concentration measurements, especially at high dust levels. As such, OSHA suggests employers and employees safely approximate the condition visually. If the dust concentration obscures vision at a distance of five (5) feet or less (1.52 meters), the concentration is likely excessive and control measures are required.

Steps that must be taken to prevent and control the potential hazard include such methods as:

- controlling sources of ignition
- utilization of exhaust ventilation
- fire suppression systems
- housekeeping

Engulfment Hazard

Engulfment is the surrounding or capturing of an individual by a liquid or finely divided loose (flowable) solid substances (e.g. sand, grain, sawdust, etc.). These substances may be already in a confined space or inadvertently allowed to enter a space and engulf worker. Death of the occupant can be caused by suffocation or drowning. Asphyxiation of the entrant is due to inhalation, or plugging of their respiratory system, or compression of their torso. Particular care must be taken in storage containment areas (e.g., silos) where these materials may have air pockets that can collapse under the weight of an individual.

To prevent engulfment hazards, the liquid or fine bulk material should be removed from the permit space to eliminate the hazard prior to authorized entry. In situations where the material cannot be removed from the space, have the entrant wear a full-body harness and retrieval line (when it does not create an additional hazard), and only allow entry if the individual can be rapidly pulled out. Also, the space must be isolated. Isolation procedures are means to keep out any potential hazardous substance whether it is solid, liquid, or gas.

Isolation procedures include such means as:

- Locking out and/or tagging out all electrical circuits and valves.
- Disconnecting all lines entering the space and at a location as close to the space as possible.
- Using double block and bleed techniques.
- Blanks and blinds inserted in a flange as close to the vessel as possible to completely block it off. Also, test for leaks with an atmospheric monitoring device if toxic substances are a concern.

Entrapment or Configuration Hazards

An entrapment hazard exists when a permit space has an internal configuration that could trap or asphyxiate an entrant. Configurations that promote these types of hazards have inwardly converging walls or a floor that slopes downward and tapers to a small cross-section. Entrants can become trapped in the space or caught in machinery and severely injured or succumb to exposure or suffocation before they can be extricated. Proper permit entry procedures must be instituted.

Mechanical Hazards

Confined spaces may also pose mechanical hazards created by moving equipment or parts, and energized systems. Mechanical systems such as compressing devices, drive shafts, gears, grinding equipment, conveyors, mixers, rotors, mulchers, cutters, or the actual rotating or tumbling of the space itself are common hazards in some industries. Most accidents associated with these types of hazards are the result of not properly isolating the space. Machinery may be accidentally activated and the entrant crushed or electrocuted. Therefore, it is important to first identify any mechanical hazards present and effectively deactivate the system in accordance with standard isolation procedures including:

- Lockout and/or tagging out all electrical circuits and valves.
- Completely de-energize all mechanical, pneumatic, hydraulic systems.
- Ensure all stored energy is removed from the equipment.
- Block any equipment that could have stored energy or gravity-activated parts.
- Guard machinery.

Other Hazards

- Corrosive Chemicals

  Corrosive chemicals may present a hazard to entrants by causing eye or skin irritation sufficient to impair their ability for self-rescue. The permit space should be drained and purged, whenever possible. Care must be taken to ensure that the purging agent (e.g. air, steam, water, surfactant, etc.) will not adversely react with the substance. Personal protective equipment (e.g. protective clothing, gloves, boots, splash-proof goggles, etc.) must be available and worn during the entry operation. Eye wash and shower facilities, whether portable or stationary, must be available outside the space and must provide a minimum of 15-minutes of flushing capacity.

- Noise

  Excessive noise levels can be generated within permit spaces by grinding, welding, riveting, mechanical ventilation, etc. Due to sound reverberation within the space, noise levels are generally much higher than when the same task is performed outside the space. Noise levels

could be high enough to interfere with communication between authorized entrant and attendant. In such circumstances, alternate or backup communication methods must be in place. The provisions outlined in the OSHA Noise Standard (1910.95) of Subpart G may also be required to protect the worker' s hearing. In such cases monitoring to determine noise levels is required using a properly calibrated sound level meter. Hearing protection may also be required.

- Electrical Equipment

  Do not allow employees to take new hazards into the confined space. Routinely inspect all electrical equipment and tools, use ground fault circuit interrupters (GFCI) or low voltage transformers. If flammable/explosive atmospheres could possibly be of concern, use only explosion-proof equipment and spark-proof tools.

- Access with Ladders

  It is essential that authorized entrants be able to safely enter and quickly evacuate the permit space. Therefore, it is important to always maintain clear access to and from the space. Fixed or portable ladders are commonly used for access. In many situations ladders may be the only means of entry and egress. Therefore, ensure that proper ladder safety procedures are enforced.

- Lighting

  Adequate lighting must be provided to allow authorized entrants to safely enter and exit the confined space, and to perform their assigned tasks. If flammable or explosive atmospheres are possible, lighting must be approved for the location by being intrinsically safe. To avoid the potential of electrocution, which may be of concern when water is present or the vessel is constructed of metal, lighting must be connected to ground fault circuit interrupters (GFCI).

- Thermal

  Individuals engaged in strenuous activity in hot work environments are susceptible to heat stress exposure such as:

  - heat stroke
  - heat exhaustion
  - heat cramps
  - fainting
  - Individuals working in confined spaces are particularly at increased risk when wearing personal protective equipment.

- Falling/Tripping/Insecure Footing and Falling Object Hazards

  These types of hazards are common in confined space entry operations. However, just because they are common does not mean that steps cannot be taken to reduce the risk associated with them. Policies should be established and workers given hazard awareness training to help in this goal. Procedures to keep in mind include:

  - Use good housekeeping practices (e.g., picking up tools around the confined space opening).
  - Check ladders for slippery rungs. If there is any danger of falling from a ladder, have the worker wear a full-body harness attached to a fall-arresting and retrieval device.
  - Tie off portable ladders.
  - Wear the correct PPE (e.g., boots, helmets, etc.)
  - Lower the equipment and tools safely by rope or baskets; never have the worker climb a ladder while carrying tools.

ATMOSPHERIC MONITORING EQUIPMENT & GENERAL TESTING PROTOCOL

Dangerous concentrations of gases and vapors may exist in a confined space and these hazards cannot be seen and may not be smelled. Therefore, air monitoring equipment is necessary to properly test the space prior to entry.

There are two (2) major types of direct reading atmospheric testing equipment used, i.e., electronic gas detectors and gas detector tubes. Direct reading instruments are portable units, which can be carried in hand or worn on a belt. These devices may be subject to cross-sensitivity, which means that more than one chemical can give the same or similar response. Interfering chemicals may give a positive or negative deflection from the true atmospheric concentrations. Other factors, which are discussed later in this section, may have a direct influence on the proper use and reliability of this equipment. Therefore, it is very important that the individual performing the tests be properly trained on the actual use, maintenance, limitations, and proper selection of the appropriate instrument.

Electrical Gas Detection Monitors

Electrical gas detection instruments are battery-powered, direct-reading devices capable of providing continuous monitoring of a permit space. Oxygen monitors measure atmospheric concentrations generally over a range of 0 to 25 percent oxygen in air.

Combustible gas monitors display concentrations in percent of the LEL, some in percent by volume, and others display both. However, most combustible gas monitors display concentrations in percent of the LEL. Instruments that measure in the percent of the LEL are generally easier to use. For example, the LEL of methane is 5 percent by volume and the UEL is 15 percent by volume. When the concentration in a space reaches 2.5 percent by volume, it is 50 percent of the LEL. When the concentration reaches 5 percent by volume, it is 100 percent of the LEL.

Toxic gas monitors use specific electrochemical cells to measure substances such as carbon monoxide, hydrogen sulfide, chlorine, ammonia, or other toxic gases of interest. The instruments are direct reading, available with either meters or digital read-outs and may also be equipped with alarms. Some instruments are equipped with a single sensor while others have multiple sensors to simultaneously measure a variety of gases. These devices are commonly referred to as 2-in-1, 3-in-1, 4-in-1 monitors. It is very important to select the instrument for the specific

application(s) to be encountered. Therefore, whenever specific contaminants have been identified, substance specific detectors should be used.

Special consideration must also be given to the use and interpretation of the results obtained from electrical gas meters under certain circumstances. The operator must be aware of these situations which could interfere with the collection of accurate monitoring data. Instrument familiarization by the operator is needed for accurate atmospheric testing. A thorough understanding of the manufacturer' s written operating instructions is a major component for the safe and effective use of the instrument. Therefore, employees who use this equipment must be trained on these operating instructions and receive hands-on training as well. The operator should also be aware of the following facts concerning electrical gas monitors:

1) The instrument must be certified intrinsically safe for use in Class 1, Division 1, Groups A, B, C, and D hazardous locations.

2) Some combustible gas meter sensors are Wheatstone bridge type sensors. This type of sensor can be easily poisoned by silicone vapors, leaded gasoline, sulfur compounds, and repeated exposure to halogenated hydrocarbons. This desensitization will cause erroneous low readings and appreciably reduce the life expectancy of the sensor.

3) The instrument selected must be specific to the substances likely to be found.

4) High relative humidity (90-100%) may cause a reduction in sensitivity and erratic behavior including an inability to properly calibrate the instrument.

5) Sensors have a limited life span, for example, oxygen sensors typically have a one-year life span. Exposure to corrosive substances such as acid gases can significantly reduce sensors' life expectancy.

6) Erroneously low-readings can result from substances condensing in the sampling line or sensors. Substances such as chlorine, hydrogen sulfide, sulfur dioxide, and ammonia are some of the substances that can be absorbed into the sampling line. In drying ovens or unusually hot locations, solvent vapors with high boiling points may condense in the sampling lines.

7) Battery maintenance is very important. There are basically three (3) different types of batteries currently used: nickel cadmium, alkaline, or sealed lead-acid. Each has advantages and disadvantages that should be researched with the manufacturer at the time of purchase.

8) Make sure the instrument has remote sampling capabilities.

9) Calibration of Electronic Gas Detectors.

Gas detectors must be checked and calibrated each day prior to use. The inspection should include checking hoses, batteries, and any pumps the equipment might have. The unit must also be field-tested using test gas cylinders containing known amounts of the substance to be encountered.

Oxygen meters should be calibrated in fresh air to 21%. They should also be tested to see if they respond to changes by holding one' s breath and then breathing into the sensor. The sensor should drop to approximately 16%.

If the equipment does not calibrate properly, the unit must be removed from service. Replace the sensor or return the unit to the factory for repair and/or laboratory recalibration.

Operators should consult with the manufacturer' s instructions or calibration curves when sampling for gases and vapors that the instrument was not calibrated against.

Detector Tubes/Pumps Method

Detector tube pumps are portable instrument, which use a variety of detector tubes to measure the concentration of a wide variety of substances. The operating principle consists of drawing a known volume of air through a detector tube designed to measure the concentration of the substance of interest.

Detector tubes are easy to use and provide a relatively good idea of the concentration of a substance within a space. The length of stain or degree of color change corresponds to the relative concentration of the substance tested. The tubes are generally specific for the toxic substance of concern. However, the accuracy can be affected by cross-sensitivity. Therefore, the results must be interpreted in relation to the substances in the space.

Limitation for detector tubes include:

- Tubes cannot be interchanged with different brands.
- Tubes may lack specificity; cross-sensitivity with other compounds is possible. Refer to the manufacturer' s manual for effects of interfering substances.
- Detector tubes give only instantaneous results.
- Tubes have a limited shelf life (approximately 1-2 years). Refrigeration can extend their shelf life. However, tubes exceeding their expiration date should not be used.
- Accuracy ranges vary with each detector tube.
- Cold temperatures significantly affect type accuracy. In cold temperatures try to keep the tubes in a pocket close to the body to keep them warm.

Calibrations and Maintenance:

Operators are reminded to consult the manufacturer' s instructions for specific procedures for the calibration and maintenance of the instrument.

General recommendations when conducting atmospheric testing:

1) Use only monitoring instruments that have been properly calibrated and maintained and that are intrinsically safe.

2) Only trained operators who are skilled and knowledgeable with the use and limitations of the instrument should do the testing.

3) Check the area around the confined space opening for any hazardous gas or vapor concentrations.

4) Extreme care must be exercised when opening any confined space that may contain an explosive atmosphere. Some spaces may contain an atmosphere too rich to burn. But when opening the space, air entering will quickly change the atmosphere to an explosive one. Sparks from removing the hatch or cover could ignite the space. Therefore, insert the test probe into a vent hole when possible. If the manhole cover or hatch has no vent opening, open the cover just far enough to insert the probe into the space. Sparkproof tools must be used. If unacceptable levels are obtained, it will be necessary to purge and ventilate the space. All levels and remote areas of the space need to be tested. An extension device should be used for this purpose. If a hazardous atmosphere is detected, avoid having employees lean over the opening or breathe the air coming out of the space.

5) Oxygen content is always tested first. Make sure sufficient oxygen is available to support the use of the combustible gas monitor. A minimum of 16% oxygen is required for the combustible gas monitor to function properly. The sampling protocol requires that combustible gas levels in the confined space be checked next. Flammable gases or vapors must not exceed 10% of the lower flammability limit (LFL).

6) Toxic substances are measured next in parts per million (ppm). Again, the equipment used must be specific and sensitive to the substance likely to be found in the space. Never use a standard flammable gas monitor sensor to test for a toxic substance. The results could be deadly, as the following example will show:

Hydrogen Sulfide

Percentage of LFL	PPM
100%	43,000
10%	4,300
5%	2,150
.7%	300 IDLH
.02%	10 PEL

Hydrogen sulfide is a common toxic gas encountered in many permit space locations. Hydrogen sulfide has an LFL of 4.3% or 43,000 ppm. The standard requires maintaining an environment of less than 10% of the LFL to avoid a potential explosion. Hydrogen sulfide also has Permissible Exposure Limit (PEL) of 10 ppm and an Immediate Dangerous to Life and Health concentration of 300 ppm. Say, for example, the LFL is found to be 5%, though the testing indicates no explosive hazard, it does indicate a level of approximately 2,150 which exceeds the PEL and IDLH.

7) Some toxic substances may not respond very well to electrical gas sensors or detector tubes so more specialized test equipment or laboratory analysis may be necessary.

8) Depending on their density, some gases are heavier than air, others lighter, and some gases are nearly the same weight as air. As a result, gases and vapors will stratify within a given confined space. Therefore, the only safe way to test the atmosphere of a confined space is to sample all levels (top, middle, and bottom) with properly calibrated equipment. When monitoring for entries involving a descent into atmospheres which may be stratified, the atmospheric envelope should be tested a distance of approximately four (4) feet (1.22 meters) in the direction of travel and to each side. If a sampling probe is used, the entrant' s rate of progress should be slowed to accommodate the sampling speed and detector response.

GROUND LEVEL
Methane Combustible Gas (lighter than air)
Carbon Monoxide (CO) (approximately the same weight as air)
Hydrogen Sulfide (H_2S) (heavier than air)

Ventilation

Once a confined space has been determined to contain of potentially contain a hazardous atmosphere, steps must be taken to ventilate the space before personnel are allowed to enter. Ventilation can be accomplished by natural and mechanical means for the general purpose of:

- Controlling atmospheric contaminants
- Prevention of fire and explosion hazards
- Control of heat and humidity

Natural Ventilation

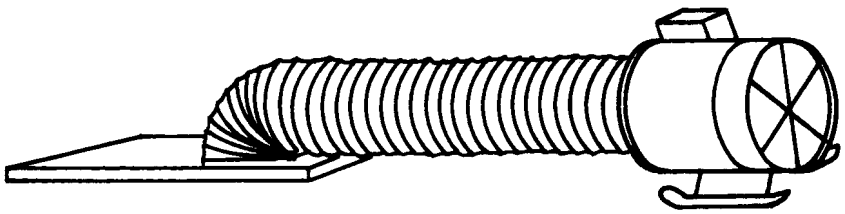
Natural ventilation is performed by removing roof and side covers and allowing natural air currents to remove gases and vapors. Natural ventilation employs wind and thermal convection to dilute any atmospheric hazard. However, the configuration of some confined spaces, and the unpredictability of wind currents and thermal effects makes natural ventilation unreliable as a primary control method. When natural ventilation is insufficient to achieve and maintain acceptable atmospheric levels, mechanical ventilation is necessary.

Mechanical Ventilation

Mechanical ventilation typically refers to mechanical dilution ventilation and local exhaust capture ventilation. The applicability of each method is dependent on the type of atmospheric hazard present, whether the hazard is created by the contents in the space, or created by an operation conducted within the space. When alternative procedures are used, mechanical dilution ventilation is a prerequisite.

Mechanical Dilution Ventilation

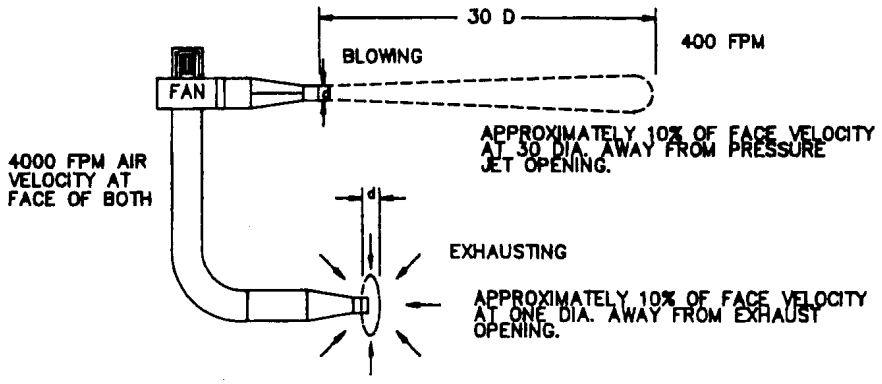
This method uses mechanical means (fans, blowers, etc.) to provide uncontaminated air to a permit space. This control measure places the permit space in a positive pressure atmospheric condition. If the amount of fresh air being supplied to the space is sufficient, the concentrations of toxic and flammable contaminants can be maintained at acceptable levels. The acceptable dilution ventilation method commonly used is to supply clean air by explosion-proof blowers located far enough away from any source of contamination.



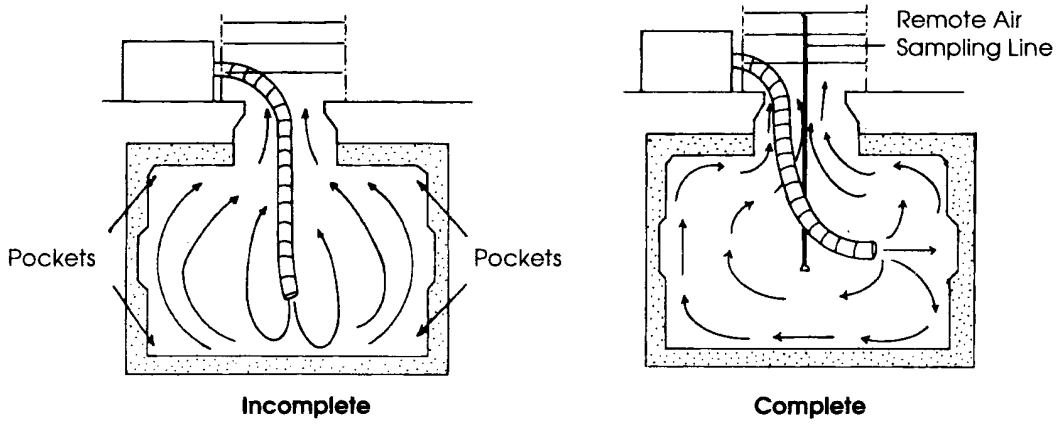
Portable Ventilating Unit with Flexible Ductwork

Air should be blown into a space that contains a hazardous atmosphere. Remember that contaminants are likely heavier or lighter than air. Blowing air into a space will agitate and help evaporate the contaminants and disperse them throughout the space. A space under positive pressure will eventually expel the contaminant through any openings in the space. Theoretically, air blows a distance of 30 times the hose diameter farther than it can be exhausted.

Blowing Versus Exhausting



If an actual or potential hazardous atmosphere exists, then purging of the space is necessary. Keep in mind that forced air ventilation must be directed to ventilate the immediate area where an employee will be or is working. However, during the initial pre-entry ventilation procedure, the blowing duct outlet should be positioned for uniform dilution and elimination of any gas pockets as illustrated. Shown below are examples of complete and incomplete ventilation of manholes:



When purging a space, an effective initial purging duration must be determined. The following is a list of instructions for determining purging times using the nomographs (line charts) provided on pages 55 and 56.

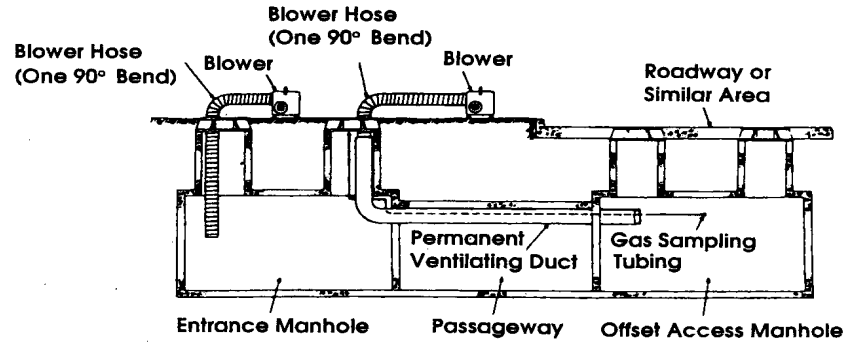
Instructions:

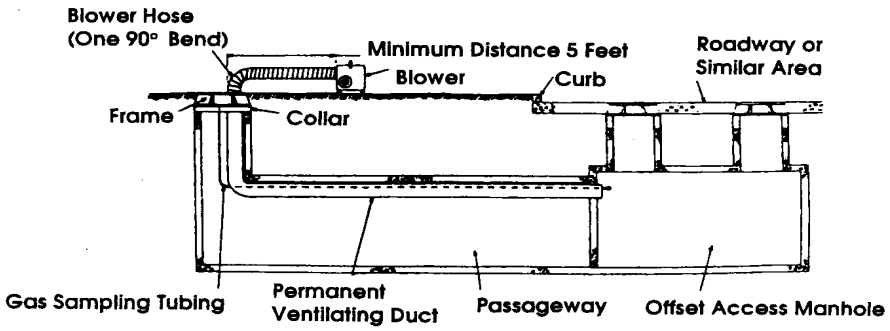
1) Test the confined space atmosphere to determine the initial atmospheric conditions.

2) Use the alignment charge to determine the minimum purging time required by:
   a) placing the straight edge on the Confined Space Volume (left scale);
   b) placing the other end of the straight edge on the Blower Capacity (right scale);
   c) read the minimum required purging time from the diagonal scale in minutes;
   d) if two blowers are used, add the two capacities, and then proceed as outlined above.

3) Note, the number of bends and the length of hose affect the effective blower capacity. As the length of hose and the number of bends increases, the effective blower capacity will decrease. The effective blower capacities listed in the alignment charts are based on one to two 90-degree bends and standard 15-foot blower hose.

4) It is very important to remember that these values are theoretical approximations with safety margins included. The duration for purging a space is dictated by not only the size and blower capacity, but also by the configuration, number of openings, and the airborne contaminant. The configuration of some confined spaces, for example multi-floor level spaces or baffled spaces, restrict airflow and require additional purging time. In some situations, adequate purging and venting can only be achieved through permanently installed ventilation ducts that will introduce fresh air directly into the space. In light of this, employers are encouraged to install permanent ventilation ducts whenever possible. Examples are shown in the following illustrations.



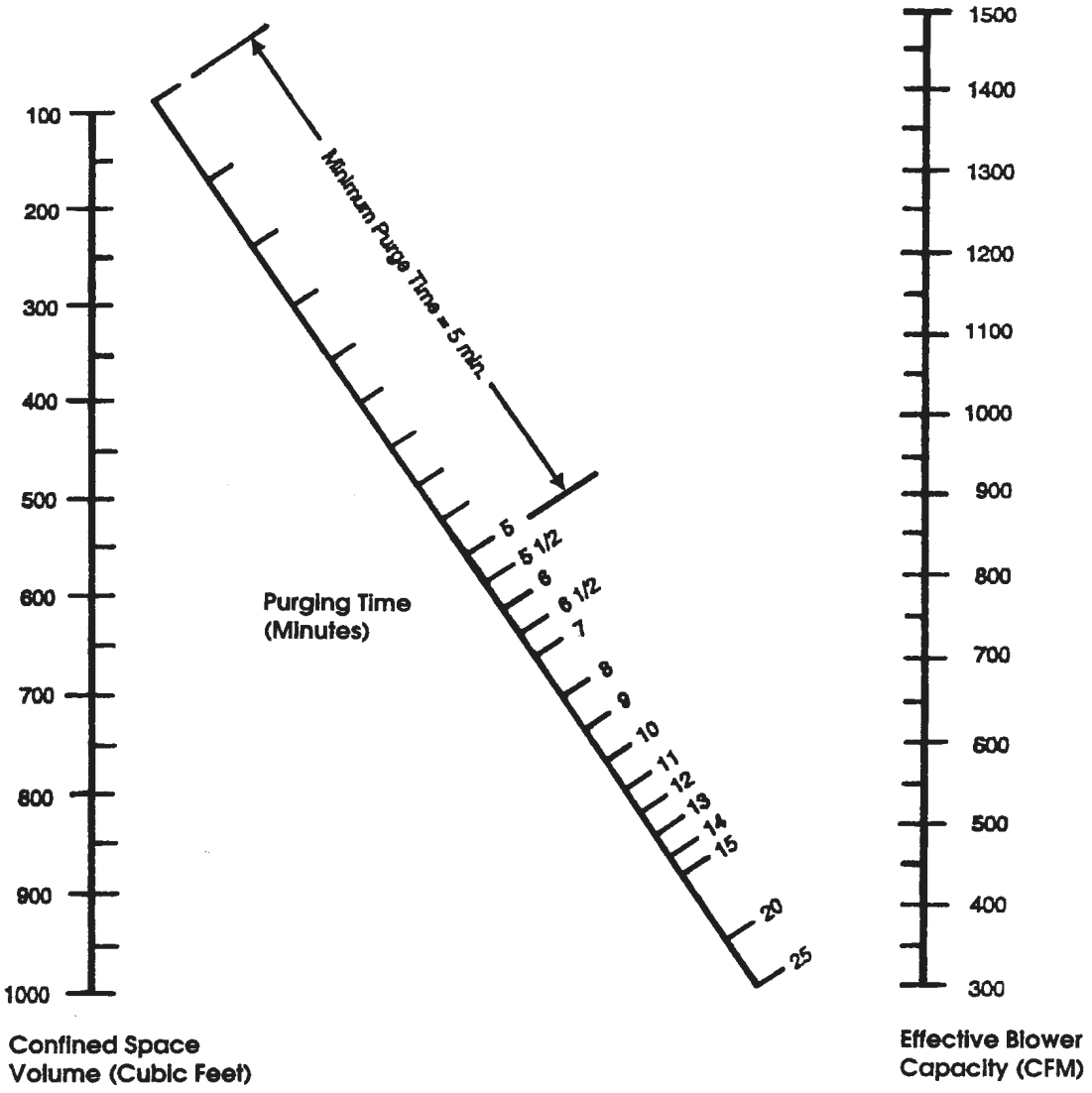


5) Employers are further reminded that under no circumstance should entry be allowed at the end of the purging time until the atmosphere is tested and shown to be within acceptable levels. If unacceptable levels are obtained, then it will be necessary to repeat the process.

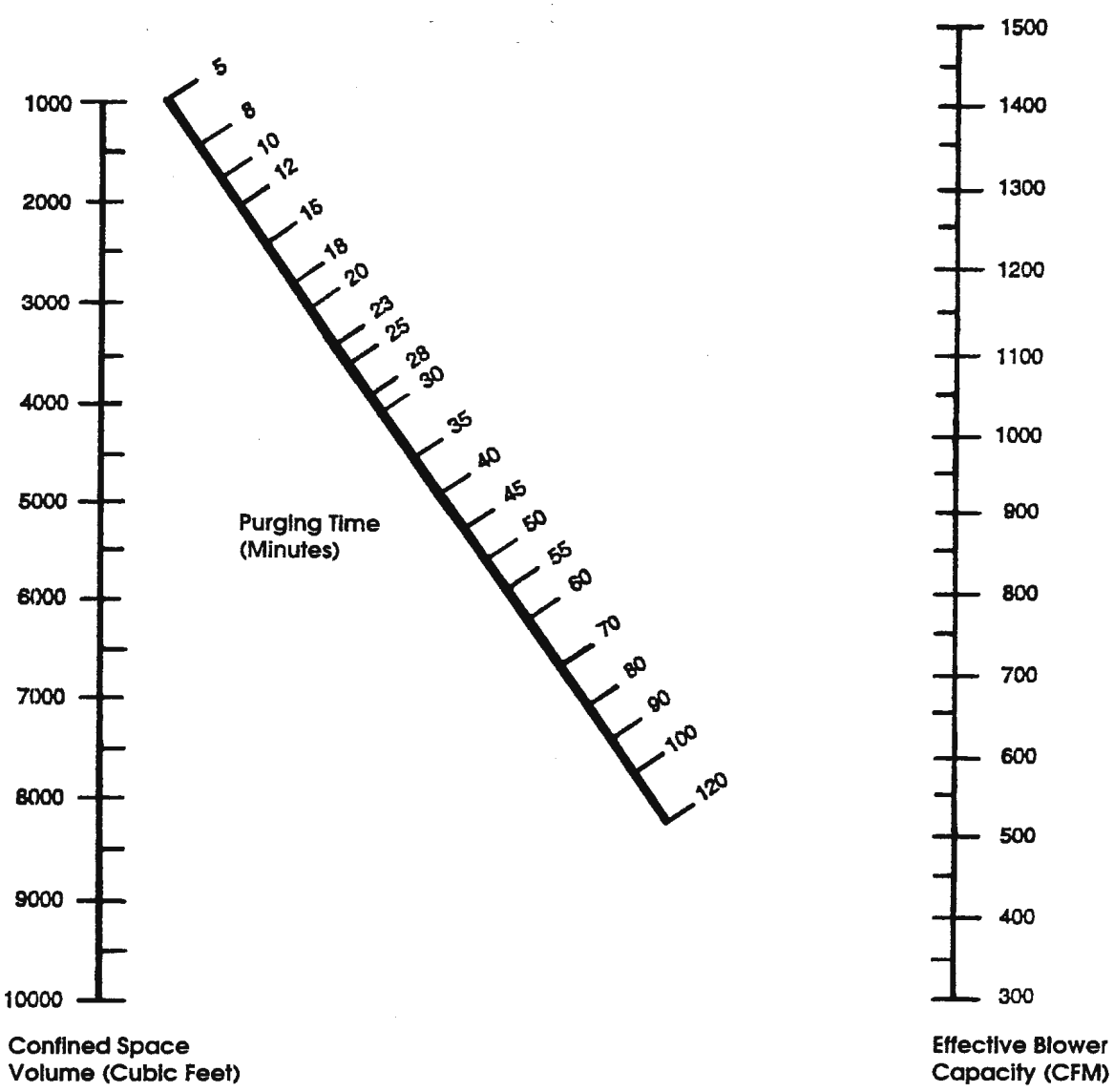
6) If forced air ventilation is necessary to control any existing or potential atmospheric hazards, then the blower must remain in constant operation for the duration of the permit space entry operation.

The theoretical purging time can also be determined using the ventilation calculations provided on pages 57 and 58.

Alignment Chart
Side 1



Alignment Chart
Side 2



VENTILATION CALCULATIONS

1) Determine the flow rate (Q) required to achieve 20 air changes per hour (ACH) in an underground lift station 20 ft. high, 40 ft. long, and 20 ft. wide.

EQUATION $N = \frac{Q \times 60}{VOL}$

$20\ ACH = \frac{Q \times 60\ min/hr}{16{,}000\ ft^3}$

$Q = \frac{20\ AC/Hr \times 16{,}000\ ft^3}{60\ mins/hrs}$

$= 5{,}333\ ft^3/min$ ANS

N = Nos. of ACH
Q = Ventilation Flow Rate (CFM)
60 = Constant (mins/hrs)
Vol = Space Volume (ft^3)
N = 20
Q = ?
Vol = 20'x40'x20'= 16,000 $ft.^3$

2) A permit-required confined space 20' x 30' x 10' in size is found to have an initial concentration of 250 parts per million (ppm) of carbon monoxide. How long will it take to lower the concentration to 50 ppm using a portable ventilation unit with a flow rate of 1000 cfm?

EQUATION $t = -2.303 \left(\frac{Vol}{Q}\right) \times \log\left(\frac{C_2}{C_1}\right)$

$t = -2.303 \times \left(\frac{6{,}000\ ft^3}{1{,}000\ ft^3/min}\right) \times \log\left(\frac{50\ ppm}{250\ ppm}\right)$

t= 9.6 mins. ANS

t = time (minutes)
Vol = space volume (ft^3)
Q = ventilation flow rate (CFM)
C_1 = initial contaminant concentration (ppm)
C_2 = final contaminant concentration (ppm)
t = ?
Vol = 20'x30'x10' = 6,000 ft3
C_1 = 250 ppm
C_2 = 50 ppm
Q = 1,000 cfm
-2.303 = constant

3) What will be the concentration of hydrogen sulfide (H_2S) after 20 minutes of purging a cylindrical tank (40' high with a 10' diameter)? The initial concentration is 200 ppm and the ventilation rate is 800 cfm.

EQUATION $$C_2 = C_1 \times e^{\left(\frac{-Q\,t}{Vol}\right)}$$

C_1 = initial contaminant concentration
C_2 = final contaminant concentration
e = inverse natural log
Q = ventilation flow rate (CFM)
t = time (minutes)
Vol = space volume (ft^3)

C_1 = 200 ppm
C_2 = ?
e = inverse natural log
Q = 800 fpm
t = 20 mins.

$$\text{Vol} = \text{space volume } (ft^3) = 40' \times \frac{\pi \times D^2}{4} = 40' \times \frac{3.14 \times 100}{4} = 40 \times 78.5 = 3140\ ft^3$$

$$C_2 = 200\ ppm \times e^{\left(\frac{-800\ ft^3/min \times 20\ mins}{3{,}140\ ft^3}\right)}$$

$$= 200\ ppm \times e^{-5.1}$$

C_2 = 1.2 ppm ANS

Localized Exhaust Ventilation

Dilution ventilation is seldom effective in controlling fume and dust-generating processes. However, localized exhaust ventilation is better suited to capture contaminants at or near their point of generation using hoods or enclosures with ductwork connected to an exhaust fan. The contaminated air is discharged outside the confined space, thereby preventing its release into the employees' breathing zones. This type of capture control is especially effective for welding, cutting, burning and brazing operations. The ventilation system should maintain an exhaust airflow velocity of at least 100 linear feet per minute in the capture zone. Capture velocities decrease significantly as the distance between the exhaust hood inlet and welding source is increased. A good rule is to keep the exhaust inlet within six to eight inches of the source.

Some operations may require both mechanical dilution and localized exhaust ventilation to adequately control contaminants in permit spaces. Ventilation must be continuous during the entire entry procedure. Frequent or continuous testing must be performed for the entire length of

the entry operation to ensure that the ventilation remains adequate and atmospheric hazards do not develop.

Choosing the most efficient ventilation system will depend on careful evaluation of the permit space. Some factor to, consider in this evaluation process include

- The fan or blower capacity.
- The configuration and size of the space.
- The number and size of the openings.
- The airborne contaminant, its properties, and its point of generation.
- Positioning the blower or exhaust fan so that there are no unnecessary bends in the hose. A 90-degree bend or two can reduce efficiency significantly.
- Increasing the length of hose will increase the friction and decrease the efficiency.
- Make sure the ventilation system does not block the exit if only one exit is available. Make sure the authorized entrants can quickly evacuate the space.

Cleaning and Purging of Permit Spaces

Residues of hazardous chemicals or materials capable of decomposing (e.g. food products) must be cleaned from the permit space to the extent feasible prior to allowing entry. Pre-entry cleaning and purging are necessary because even small amounts of some remaining materials can create hazardous atmospheres. Some basic steps to pre-entry cleaning include:

- First ensure that all material feed lines and equipment are completely and effectively isolated from the confined space.
- Drain or pump out contents and remove as much residue as feasible.
- Test for hazardous atmosphere, if the test indicates harmful gases, vapors or mists, the space must be purged and ventilated.
- The particular purging agent used will depend on such things as:

    - The product in the permit space and how it might react with the purging agent.
    - The work to be performed in the space.
    - The suspected hazards.

- To remove flammable atmospheres, it may be necessary to purge the space with an inerting gas such as nitrogen, carbon dioxide, argon, etc. Other times, it may be possible to open the space and allow air to naturally ventilate the space.
- Flammable and toxic residues on the walls and floor should also be removed prior to entry. Water is commonly used. If the residue cannot be washed away, steam may be used. However, be aware that steam may not be suitable for use in some situations where the

substance has a low ignition temperature or flash point. This is because the steam condensate could build up a static electric charge and create a spark, thereby igniting the flammable atmosphere. In situations where steam is needed to clean or purge a vessel, make sure that the static electricity is eliminated by bonding and grounding the steam lines and vessel. Also, allow plenty of time for the space to cool down after steam is used.

- Occasionally, cleaning solvents may be needed. In these circumstances make sure that the cleaning compound is compatible with the residue to be cleaned from the space.
- Never assume that the space is safe for entry after the purging and cleaning process is completed. The atmosphere in the space must be tested prior to entry. If a hazardous atmosphere still exists or potentially exists, purge and clean the space again.
- Continue to ventilate the space and conduct atmospheric testing frequently or continuously during the entire entry procedure.
- In the situations where the purpose of entry is to clean the confined space, the space must first be cleaned to the extent possible from the outside. Proper personal protective equipment must be used to protect individuals from any hazards that might remain after the pre-entry cleaning. If atmospheric hazards cannot be brought to acceptable levels by purging, cleaning, and continuous ventilation, then special procedures must be put in place after properly evaluating the situation. If it is determined that an individual must enter the permit space, then these special precautions will include respiratory protection such as an airline respirator with escape bottle or Self-Contained Breathing Apparatus (SCBA). Note, most companies only allow such types of entries during emergency situations because of the immediate dangers and risks.

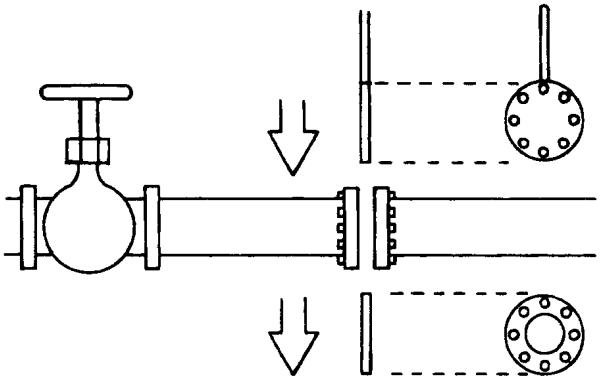
Isolation and Lockout/Tagout Procedures

Prior to allowing personnel to enter into a permit space, the space must be evaluated to determine what energy sources or hazardous materials are present or potentially present. Steps must be taken to isolate the space to prevent injury to entrants by disconnecting, releasing, or restraining all energy sources and/or hazardous chemical materials. Energy sources may include mechanical, electrical, pneumatic, hydraulic, thermal, radioactive, and the effects of gravity; chemical hazards may include flammable, reactive, toxic, irritating, corrosive, or oxygen displacing gases and vapors.

Isolation Procedures

Isolation procedures for chemical or gas lines must be instituted to eliminate potential hazards by such methods as:

- blanking and blinding,
- double-block and bleed,
- line breaking or misalignment, and
- lockout/tagout



Blanking and Blinding is the absolute closure of a pipe, line, or duct by the fastening of a solid plate, that completely covers the bore hold, in line with the system. This plate (such as a spectacle blind or a skillet blind) should be made of the same material as the line and must be able to withstand the maximum pressure exerted by the line. This method involves installing a blank between flanges with a leak-proof gasket at a point in the conducting line as close to the confined space area as possible. The blank or blind should be marked identifying its purpose.

Double Block and Bleed is a method that uses a three-point system to prevent leakage into the confined space, two closed valves and an open drain/or vent valve located in between. Lockout or tagging the valves in their required positions provides additional protection.

Line Breaking is the intentional and physical disconnection of a pipe, line, or duct. Added protection is obtained by misaligning or removing a section of the pipe, line, or duct. Lines where potentially hazardous residues might remain downstream from the disconnecting point should be purged. Any disconnected line, blank or block valve should be checked with an atmospheric testing monitor to make sure its not leaking.

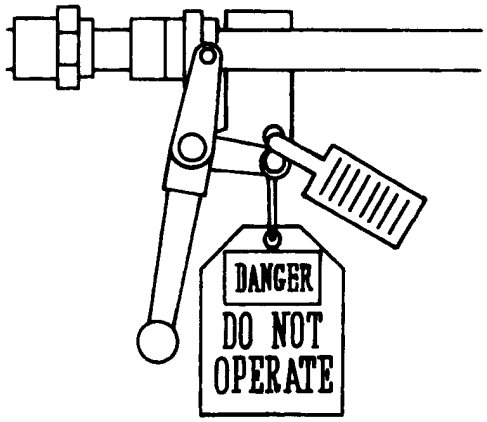
Lockout/Tagout

The standard recognizes that energized parts of electrical equipment and mechanical equipment pose a significant hazard in many permit spaces. As such, circuit parts of electrical equipment must be de-energized and locked out/tagged out or both in accordance with 29 CFR 1910.333. Mechanical equipment must be locked out/tagged out or both in accordance with 29 CFR 1910.147 or guarded in accordance with Subpart 0 of the General Industry Standard.

General requirements for effective lockout/tagout programs include the following items:

- Identify and implement specific procedures, in writing, for the control of hazardous energy including preparation for shutdown, equipment isolation, lockout/tagout application, release of stored energy, and verification of isolation.
- Use locks where equipment can be locked out.

- Ensure that new equipment or overhauled equipment can accommodate locks.
- Employ additional means to ensure safety when tags rather than locks are used.
- Institute procedures for release of lockout/tagout including machine inspection, notification and safe positioning of employees, and removal of the lockout/tagout device.
- Obtain standardized locks and tags that indicate the identity of the employee using them and which are of sufficient quality, durability, and quantity to ensure their effectiveness.
- Require that each lockout/tagout device be removed by the employee who applied the device.
- Train employees in the specific energy control procedures with training reminders as part of the annual inspection of the control procedures.
- Adopt procedures to ensure safety when equipment must be tested during servicing, when outside contractors are working at the site, when a multiple lockout is needed for a crew servicing equipment, and when shifts or personnel change.



Control of Combustible/Explosive Dust

As discussed on page 37 of this document, combustible dust may also pose a hazard in permit spaces. In circumstances where explosive dust concentrations may possibly meet or exceed their lower flammability limit, measures are required to control or eliminate the hazard. The following measures are recommended to provide a safe environment for the employees:

- Housekeeping - Dust explosions commonly occur in series. The initial explosion stirs up more dust and this additional dust propagates a secondary explosion. The interior surfaces should be kept as clean as possible and accumulations kept to a minimum.
- All sources of ignition must be removed from the permit space. All equipment must be in compliance with the National Fire Protection Association (NFPA) 70-National Electrical Code for hazardous locations.
- Static electricity must be prevented from accumulating by proper bonding and grounding methods. The relative humidity should also be maintained to approximately 40-60%.
- Ventilation may also be necessary to control the airborne dust hazard where needed (see

Ventilation Control Section).

PERSONAL PROTECTIVE EQUIPMENT

Permit spaces may pose many types of potential hazards for personnel required to enter or working nearby. Various types of equipment may be necessary to ensure the safety of these individuals. Proper planning and evaluation will determine what equipment is needed. Equipment which may generally be required include:

Head Protection: Head injuries are caused by falling or flying objects, or by bumping the head against a fixed object. Head protection, in the form of protective hats, must do two things -- resist penetration and absorb the shock of a blow.

Selection - Each type and class of head protectors is intended to provide protection against specific hazardous conditions. An understanding of these conditions will help in selecting the right hat for the particular situation.

For industrial purposes, three classes are recognized:

Class A - general service, limited voltage protection (equivalent to old 'A');
Class B - utility service, high-voltage helmets (equivalent to old 'B'); and
Class C - special service, no voltage protection.

Eye and Face Protection: Employers must provide eye and face protection suitable for the work to be performed and employees must use this equipment.

Suitable eye protectors must be provided where there is a potential for eye injury from machines, flying objects, glare, liquids, injurious radiation, or a combination of these. Protectors must meet the following minimum requirements:

- Provide adequate protection against the particular hazards for which they are designed;
- Be reasonably comfortable when worn under the designated conditions;
- Fit snugly without interfering with the movements or vision of the wearer;
- Be durable;
- Be capable of being disinfected;
- Be easily cleanable; and
- Be kept clean and in good repair.

Where employees are at risk of contact with corrosive chemicals, an eyewash with at least 15 minutes flushing capacity is required.

Design, construction, testing, and use of eye and face protection must be in accordance with ANSI Z87.1-1989.

Hearing Protection: Exposure to high noise levels can cause hearing loss. It may also create physical and psychological stresses such as increased blood pressure, abnormal secretion of hormones, and tensing of muscles.

The extent of damage primarily depends on the intensity of the noise and the duration of exposure. Short-term exposure to noise can cause temporary hearing loss. Permanent damage is generally gradual and the result of prolonged exposure to high noise levels. There is no cure for permanent noise-induced hearing loss, so prevention is the key.

Control measures must be instituted to prevent hearing loss. When possible, noise should be reduced or controlled by engineering controls. In situations where engineering controls cannot be used, another effective method is the use of hearing protection. Hearing protection comes in many different types such as formable premolded plugs, semi-aural or canal caps, and earmuffs. Each type has advantages and disadvantages, as well as different noise reduction ratings (NRR). The protection used should reduce the noise levels to at least 90 decibels (dB), and 85 dB for those individuals who have experienced a significant hearing threshold shift. Under some conditions, such as when noise levels exceed 100 dB, it is necessary to use combinations of hearing protection to ensure adequate protection.

When employees are exposed to noise levels exceeding 85 decibels, OSHA requires that the exposed individual be included in a hearing conservation program. For more specific information on a hearing conservation program, refer to 29 CFR 1910.95 - Occupational Noise Exposure.

Employees must be properly trained in correct use, maintenance, and the limitations of the hearing protection they use. Employees should be able to select from a variety of hearing protection to ensure that the equipment fits properly and is comfortable to wear.

In permit spaces, excessive noise can interfere with communication between the authorized entrant and attendant. In situations where excessive noise exists and the entrant must wear hearing protection, steps must be taken to ensure that communication is maintained. The communication method used must ensure that the entrant can immediately respond to an attendant' s order to evacuate the space if a prohibited condition or situation arises. The method used must also enable the attendant to detect any behavioral changes in the authorized entrant. In some entry operations, tugging on a rope may be adequate to ensure effective communication. In other circumstances an intrinsically safe electronic communication system may be needed. Some electronic communication systems have headsets, which also have a noise reduction rating assigned to them.

Intrinsically safe American National Standards Institute (ANSI) Type II Sound Level Meters (SLM) should be used to determine employee noise exposure levels. A SLM is a lightweight instrument for the measurement of sound pressure levels in decibels (dB). At a minimum, the device should measure of the A-weighted scale at the slow level response setting. The instrument should be calibrated in accordance with the manufacturer' s instructions.

Torso Protection: Many potential chemical and physical hazards may threaten the torsos of permit space entrants such as contact with chemicals, temperature extremes, and cuts and abrasions. Part of any pre-entry evaluation involves determining the proper protective clothing to use to protect workers from these hazards. Manufacturers provide a large selection of protective clothing for specific applications. General selection categories include single use and reusable clothing for particulate and chemical protection, full body chemical splash protection suits, insulated work wear, and specialty flame-resistant clothing.

Arm and Hand Protection: Potential hazards to the arms and hands of employees working in or around confined spaces can result in such injuries as absorption of chemicals, burns, cuts, and electrical shock. There is a wide assortment of gloves, hand pads, sleeves and wristlets for protection from various hazardous situations. The protective device should be selected to fit the job.

The following items should be considered when selecting chemical protective gloves and clothing:

- Choose gloves designed to protect against the specific chemical of concern.
- Keep in mind all chemicals will eventually permeate through protective clothing.
- Combinations of protection may be required since no single protective material can protect against all chemicals.
- Chemicals absorbed by protective clothing continue to permeate through the protective material.
- It is recommended that employers consult with the chemical protective clothing manufacturer to determine the appropriate material for the specific chemical of concern. Employers may also want to test the material against the chemicals to be encountered to ensure its integrity.
- Certain occupations call for special protection. For example, electricians need special protection from shock and burns. Rubber is considered the best material for insulating gloves and sleeves.
- Rubber protective equipment for electrical workers must conform to the requirements established by ANSI.

Foot and leg Protection: For protection of feet and legs from falling or rolling objects, sharp objects, molten metal, hot surfaces, and wet slippery surfaces, workers should use appropriate footguards, safety shoes, or boots and leggings. To be acceptable, safety footwear must meet ANSI requirements.

RESPIRATORY PROTECTION

OSHA standards require employers to establish and maintain a respiratory protection program whenever respirators are necessary to protect the health of employees. Before discussing the requirements of OSHA' s respirator standard, it will be useful to review the various types of

available respirators.
Respiratory protective devices fall into three classes: air purifying; atmosphere or air supplying; and combination air-purifying and air-supplying devices. A brief discussion of each follows:

Class 1. Air-Purifying Devices

The air-purifying device cleanses the contaminated atmosphere. Chemicals can be used to remove specific gases and vapors and mechanical filters can remove particulate matter.
This type of respirator is limited in its use to those environments where the air contaminant level is within the specified concentration limitation of the device. These devices do not protect against oxygen deficiency.

"Oxygen deficiency" means that concentration of oxygen by volume below which atmosphere-supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

The various types of air-purifying devices include mechanical-filter cartridge; chemical-cartridge, combination mechanical-filter/chemical-cartridge, gas masks; and powered air-purifying respirators.

Mechanical-filter respirators offer respiratory protection against airborne particulate matter, including dusts, mists, metal fumes, and smokes, but do not provide protection against gases or vapors.

Chemical-cartridge respirators afford protection against low concentrations of certain gases and vapors by using various chemical filters to purify the inhaled air. They differ from mechanical-filter respirators in that they use cartridges containing chemicals to remove harmful gases and vapors.

Combination mechanical-filter/chemical-cartridge respirators use dust, mist or fume with a chemical cartridge for dual or multiple chemical exposures.

Gas masks afford respiratory protection against certain gases, vapors, and particulate matter. Gas masks are designed solely to remove specific contaminants from the air; therefore, it is essential that their use be restricted to atmospheres that contain sufficient oxygen to support life. Gas masks may be used for escape only from atmospheres that are immediately dangerous to life or health (IDLH), but never for entry into such environments.

"IDLH" means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual' s ability to escape from a dangerous atmosphere.

Canisters for gas masks are color-coded according to the contaminant against which they provide protection. This information is included in the standard.

Powered air-purifying respirators protect against particulates, gases and vapors. The air--purifying element may be a filter, chemical cartridge, combination filter and chemical cartridge, or canister. The powered air-purifying respirator uses a power source (usually a battery pack) to operate a blower that passes air across the air-cleaning element to supply purified air to the respirator. The great advantage of the powered air-purifying respirator is that it usually supplies air at positive pressure (relative to atmospheric) so that any leakage is outward from the facepiece. However, it is possible at high work rates to create a negative pressure in the facepiece, thereby increasing facepiece leakage.

Class 2. Atmosphere- or Air-Supplying Devices

Atmosphere- or air-supplying devices are the class of respirators that provide a respirable atmosphere to the wearer, independent of the ambient air. Atmosphere-supplying respirators fall into three groups: supplied-air respirators, self-contained breathing apparatus (SCBA), and combination-SCBA and supplied-air respirators. A brief discussion of each follows:

Supplied-air respirators. These devices deliver breathing air through a supply hose connected to the wearer' s facepiece or enclosure. The air delivered must be free of contaminants and must be from a source located in clean air. The OSHA requirements for compressed air used for breathing, including monitoring for carbon monoxide, are listed in 1910.134(d). Supplied-air respirators should only be used in non-IDLH atmospheres.

There are three types of supplied-air respirators: Type A, Type B and Type C. Type A supplied-air respirators are also known as hose masks with blower. Air is supplied by a motor-driven or hand-operated blower through a durable, large diameter hose. Type B supplied-air respirators are hose masks as described above without a blower. The wearer draws air through the hose by breathing. Type C supplied-air respirators are commonly referred to as air-line respirators. An air-line respirator must be supplied with respirable air conforming to Grade D Compressed Gas Association' s Standard CGA G7.1-1989, Commodity Specification for Air, 1989. This standard requires air to have the oxygen content normally present in the atmosphere, no more than 5 milligrams per cubic meter (mg/M^3) of condensed hydrocarbon contamination, no more than 10 parts per million (ppm) carbon monoxide, no pronounced odor, and a maximum of 1,000 ppm of carbon dioxide.

There are three basic classes of air-line respirators -- continuous-flow, demand-flow, and pressure-demand flow.

Continuous flow. A continuous-flow unit has a regulated amount of air fed to the facepiece and is normally used where there is an ample air supply such as that provided by an air compressor.

Demand flow. These air-line respirators deliver air flow only during inhalation. Such respirators are normally used when the air supply is restricted to high-pressure compressed air cylinders. A suitable pressure regulator is required to make sure that the air is reduced to the proper pressure

for breathing.
Pressure-demand flow. For those conditions where the possible inward leakage (caused by the negative pressure during inhalation that is always present in demand systems) is unacceptable and where there cannot be the relatively high air consumption of the continuous-flow units, a pressure-demand air-line respirator may be the best choice. It provides a positive pressure during both inhalation and exhalation.

Types A, B. and C that are approved for abrasive blasting are designated AE, BE, and CE respectively. These respirators are equipped with additional devices designed to protect the wearer' s head and neck against impact and abrasion from rebounding abrasive material and with shielding to protect the windows of facepieces, hoods, and helmets.

Self-contained breathing apparatus (SCBA) provide complete respiratory protection against toxic gases and an oxygen deficiency. The wearer is independent of the surrounding atmosphere because he or she is breathing with a system that is portable and admits no outside air. The oxygen or air supply of the apparatus itself takes care of respiratory requirements.

Self-Contained Breathing Apparatus

There are two basic types of self-contained breathing apparatus: closed-circuit and open-circuit. In the closed-circuit apparatus, the exhalation is rebreathed by he wearer after the carbon dioxide has been effectively removed and a suitable oxygen concentration restored from sources composed of: compressed oxygen; or chemical oxygen; or liquid-oxygen. In the open-circuit apparatus, exhalation is vented to the atmosphere and is not rebreathed. There are two types of open-circuit SCBAs: demand and pressure-demand.

Combination -SCBA and supplied-air respirators are air-line respirators with an auxiliary self-contained air supply. An auxiliary SCBA is an independent air supply that allows a person to evacuate an area or enter such an area for a very short period of time where a connection to an outside air supply can be made. These devices are approved for use in IDLH atmospheres. The auxiliary air supply can be switched on in the event the primary air supply fails to operate. This allows the wearer to escape from the IDLH atmosphere. Combination air-line respirators with auxiliary SCBA are designed to operate in three modes: continuous-flow, demand-flow, and pressure-demand flow.

Class 3. Combination Air-Purifying and Atmosphere-Supplying Devices

This type of device is a combination of an air-line respirator with an auxiliary air-purifying attachment, which provides protection in the event the air supply fails. These respirators are available in either continuous-flow or pressure-demand flow and are most often used with a high-efficiency filter as the air-purifying element. Use in the filtering mode is allowed for escape only. Because of the positive-pressure and escape provisions, these respirators have been recommended for asbestos work.

A summary of the classification of respiratory protective devices follows:

1) Air Purifying Devices

a. Mechanical-filter cartridge
b. Chemical-cartridge
c. Combination mechanical-filter/chemical cartridge
d. Gas masks
e. Powered air-purifying

2) Atmosphere or Air Supplying Devices

a. Supplied-air
    1. Type A and AE
    2. Type B and BE
    3. Type C and CE (Airline)
        a. Continuous-flow
        b. Demand-flow
        c. Pressure-demand flow
b. Self-contained breathing apparatus (SCBA)
    1. Closed-circuit
    2. Open-circuit
        a. Demand
        b. Pressure-demand
c. Combination-SCBA and supplied-air
    1. Continuous-flow
    2. Demand-flow
    3. Pressure-demand flow

3) Combination Air-Purifying and Atmosphere Supplying Devices

a. Continuous-flow
b. Pressure-demand flow

OSHA requires employers to develop written standard operating procedures for employees who wear respiratory protection. This written program must address each element specified in 29 CFR 1910.134(c) which are briefly outlined below.

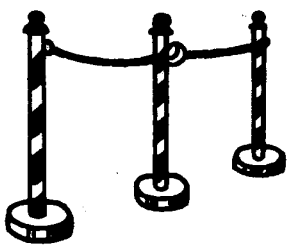
MINIMAL ACCEPTABLE RESPIRATOR PROGRAM

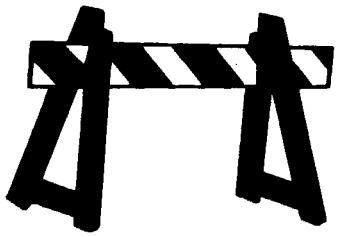
Requirement	**Standard**
Written Operating Procedures	.134 (c)(1)
Proper Selection	.134 (d), (j)
Training and Fitting	.134 (f), (k)
Cleaning and Disinfecting	.134 (h)(1)
Storage	.134 (h)(2)
Inspection and Maintenance	.134 (h)(3), (h)(4)
Work Area Surveillance	.134 (g)(2)
Inspection/Evaluation of Program	.134 (l)
Medical Evaluations	.134 (e)
Approved Respirators	.134 (i), (j)

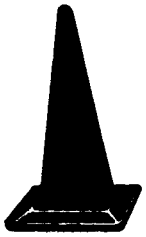
Note to the Employer: Refer to the sample respiratory protection program provided in Appendix M.

Precautionary Equipment

Once an entrance cover is removed, a railing, temporary cover, temporary fences or other temporary barriers must promptly guard the opening. This is necessary to protect individuals from falling into the space, to protect entrants from having objects fall onto them or due to vehicular hazards. Barricades and/or pylons may also be used so long as they physically block access to the work area. Additionally, warning signs are recommended to warn unauthorized individuals not to enter the area. This may be accomplished with a warning sign reading, **"Danger -- Confined Space Entry in Progress -- No Unauthorized Entry"**.







Communication and Communication Systems

A reliable method must be in place for attendants to monitor the activities of the authorized entrants and for the entrants to keep attendants informed of their status in the event the permit space must be evacuated. The standard allows any effective means to be used to accomplish this objective. Types of communication methods include:

1) Battery operated, voice-activated communication systems.
2) Continuous electronic monitoring equipment such as televisions, cameras, etc.
3) Battery operated hand-operate communications devices (e.g., two-way radios).
4) Body alarm devices may also be helpful where communication between the entrant and attendant is difficult. This type of device is designed to sound an alarm if the wearer does not move during a specified period of time.
5) Continuous and uninterrupted voice contact.
6) Visual observation from outside the space by the attendant.

A clearly understandable back-up system (line-jerk signals) is suggested should the primary system fail. Failure of the primary system is sufficient cause for immediate evacuation of the permit space. Therefore, special attention must be given to ensure that the communication system is working properly, and that a device is used that it has sufficient transmission range. Also, ensure outside lines of communication have been established to summon rescue services.

The exact type and extent of communication required will depend on the operations being performed and the hazards within the space. For example, work that can only be performed in an IDLH atmosphere (because engineering controls are infeasible) would necessitate the use of continuous contact monitoring equipment. In contrast, authorized entrants working in a permit space that pose only mechanical hazards would need a communication system that provides only periodic monitoring. The desired system is one that alerts the entrant of any situation where evacuation is needed and the entrant can perform self-rescue. If no means of communication is available, then the entry should be prohibited.

Retrieval Equipment

The standard requires employers to provide, maintain and ensure the use of protective equipment. This includes equipment necessary to facilitate both entry into and exit from a permit space. Whenever possible, rescues should be performed outside the confined space so rescuers are not exposed to hazardous conditions. Proper retrieval equipment generally needed for permit space entries include:

1) chest or full-body harness
2) heavy-duty life-line
3) mechanical winches
4) tripods

5) wristlets

Winches should be self-braking to prevent free falls and to hold personnel in place when raising and lowering has stopped. Additionally, tripods should have two winches; one for lowering, arresting and retrieving an entrant and a second for tools. By having two winches, the entrant would not be tempted to disconnect himself/herself from the lifeline.

A wide variety of harnesses are available. Some coveralls have been specifically designed with a built-in full-body harness for easy donning.

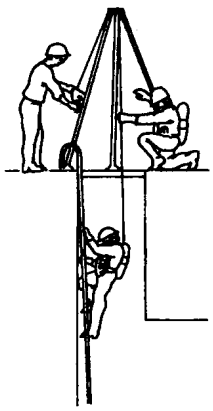
In deciding what type of retrieval equipment is needed for a specific entry operation, an evaluation of the permit space must be conducted with the following conditions in mind:

1) the size and configuration of the confined space
2) the size and location of the opening
3) any obstacles within the space
4) whether or not a rescue of the entrant would be vertical or horizontal
5) the potential hazards within the space

Retrieval lines are very effective in assisting in the safe removal of unconscious personnel from many permit spaces. Therefore, each authorized entrant must 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, or at another point which the employer can establish presents a profile small enough for the successful removal of the entrant.

Wristlets may be used in lieu of chest or full body harness if the employer can demonstrate the use of a harness is not feasible or creates a greater hazard. Wrist harnesses are used where the entrant may need to be withdrawn through a small opening.

In some situations, however, retrieval lines have been known to pose an additional risk by creating an entanglement hazard. In these particular situations, the use of retrieval lines may be inappropriate. In such cases, the following guidelines are provided to determine if retrieval lines are appropriate:



1) A permit space with obstructions or turns that prevent pull on the retrieval line from being transmitted to the entrant does not require the use of a retrieval system.

2) A permit space from which an employee being rescued with the retrieval system would be injured because of forceful contact with projections in the space does not require the use of a retrieval system.

3) A permit space that was entered by an entrant using an air supplied respirator does not require the use of a retrieval system if the retrieval line could not be controlled so as to prevent entanglement hazards with the air

line.
In circumstances where retrieval lines or harnesses cannot be worn, an alternative method must be in place should an entrant need assistance. If an acceptable alternative method is not available, then entry is prohibited. In all circumstance, inspect retrieval equipment prior to use.

Portable Power Tools

Portable power tools are generally grouped according to their power source such as electrical, pneumatic, hydraulic, gasoline, and power-actuated.

In confined spaces, air-operated pneumatic power tools are normally recommended to avoid the hazards associated with using these other types of portable tools. Compressors servicing any pneumatic tools must be located outside the confined space and not pose a hazard. Ensure that all safety devices are in place such as air line safety check valves, safety retainers, etc. before using air-powered tools. If portable electrical tools must be used, the electrical equipment must meet the requirements of Article 500 of the National Electrical Code for the specific hazardous location. An effective grounding system must be instituted, or ground fault circuit interrupter used to protect individuals from electrical shock. Use double insulated tools whenever possible. Low voltage lights operated at a maximum 12 volts should be used. Lights should be shielded to prevent breakage of the bulb. Gasoline power tools should not be used in confined space situations. Power-activated tools may also be prohibited for use in many confined space operations.

Eye and face personal protective equipment is required when using portable power tools. Hearing and respiratory protection may also be needed depending on the circumstances.

Ladder Safety and Other Forms of Entry and Egress

Ladders are often the only means of entry and egress from permit spaces. It is therefore important that they be used and maintained in accordance with safe operating procedures. Workers should observe and practice the following items when using a ladder in a permit space:

- Choose a ladder that will not react with the substance in the space.
- Make sure the ladder is equipped with a non-slip base and that is tied at the top.
- Place the ladder so that the horizontal distance from the base to the vertical plane is approximately 1/4 the ladder length (for example, place a 12' ladder so that the base is 3' from the wall).
- The preferred pitch for a fixed ladder is 75-90 degrees.
- Extend the ladder at least 3' above the top of the landing.
- When ascending or descending a ladder make sure workers hold on with both hands. Raise or lower tools or equipment with a rope or in a basket or winch.
- The ladder must be maintained in good condition and should be inspected prior to each use. A fixed ladder in a confined space should be checked visually for slippery or corroded rungs

prior to using it.

- If a worker is at risk of falling from a ladder, have the employee wear a full body harness attached to a fall-arresting and retrieval device.
- Fixed ladders exceeding 20' must be equipped with a ladder safety device if a cage is not present.

Boatswain' s chairs are also used for entry and egress. The seat should not be less than 2' long and 1' wide. Swinging (two-point suspension) scaffolds are occasionally used in certain situations in confined space operations. When this equipment is used, it should be suspended by wire or synthetic fiber rope capable of supporting at least six times the maximum intended load. Workers should wear a full body harness attached to a fall-arresting and retrieval device.

Heat Stress

Operations conducted in a confined space may present potential heat stress problems. Factors that might contribute to heat stress disorders include:

- high temperatures,
- radiant heat sources,
- high humidity,
- direct physical contact with hot objects, or
- strenuous physical activity.

Personal characteristics predispose an individual to heat stress problems, these factors include:

- age,
- weight,
- degree of physical fitness,
- degree of acclimatization,
- metabolism,
- use of alcohol and drugs, and
- various existing medical conditions such as hypertension.

Heat Disorders

1) **Heat Stroke**, the most serious health problem for workers in hot environments, is caused by the failure of the body' s internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs include 1) mental confusion, delirium, loss of consciousness, convulsions or coma; 2) a body temperature of 106 degrees F or higher; and 3) hot dry skin which may be red, mottled, or bluish. Victims of heat stroke will die unless treated promptly. While awaiting medical help, the

victim must be removed to a cool area and his or her clothing soaked with cool water. He or she should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

2) **Heat Exhaustion**, results from loss of fluid through sweating when a worker has failed to drink enough fluids or take in enough salt or both. The worker with heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature normal or slightly higher. Treatment is usually simple: the victim should rest in a cool place and drink an electrolyte solution (a beverage used by athletes to quickly restore potassium, calcium, and magnesium salts). Severe cases involving victims who vomit or lost consciousness may require longer treatment under medical supervision.

3) **Heat Cramps**, painful spasms of the muscles, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles -- those used for performing the work -- are usually the ones most susceptible to cramps. Cramps may occur during or after working hours and may be relieved by taking liquids by mouth or saline solutions intravenously for quicker relief, if medically determined to be required.

4) **Fainting**, (heat syncope) may be a problem for the worker unacclimatized to a hot environment who simply stands still in the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather than standing still, will usually reduce the possibility of fainting.

5) **Heat Rash**, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impeded a worker' s performance or even results in temporary total disability. It can be prevented by resting in a cool place and allowing the skin to dry.

6) **Heat Fatigue**, is largely caused by a lack of acclimatization. Symptoms include impaired performance of skilled vigilance tasks. No specific recommendations for treatment are needed unless accompanied by other heat illness. The use of a program acclimatization and training for work in hot environments is advisable.

Sampling methods for determination of Potential Heat Stress and Environmental Heat Stress Areas.

1) Body Temperature Measurements

Instruments such as an ear canal temperature probe or chest surface measurement are available to determine individual body temperature non-invasively.

2) Environmental Measurements

Environmental heat measurements should be made at, or as close as possible to the specific work area where the worker is exposed.

When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat that varies substantially, then measurements should be taken in these areas as well.

3) Testing Methods

- Wet Bulb Globe Temperature Index (WBGTs). Portable heat stress monitor or meter is commercially available. The instrument can determine how long an individual can safely work or remain in a hot environment.
- Effective Temperature Index (ET). The ET index combines the temperature, the humidity of the air, and air velocity to determine comfort ventilation. This method has been used effectively where humidity is high and radiant heat is low, as can be found in many confined spaces.
- Heat Stress Index (HSI). The HSI method considers all the environmental factors and the work rate; however, it is complicated to use and is not always effective in determining the heat stress level on individual workers.

Preventing Heat Stress

Most heat-related health problems can be prevented or the risk of developing them reduced. The following are basic precautions, which can lessen heat stress problems.

1) **Acclimatization** to the heat through short exposure followed by longer periods of work in the hot environment can reduce heat stress. New employees and workers returning from an absence of two weeks or more should have a 5-day period of acclimatization. This period should begin with 50 percent of the normal workload and limited time exposure the first day and gradually building up to 100 percent on the fifth day.

2) A variety of **engineering controls** including general ventilation and spot cooling by local exhaust ventilation at points of high heat production may be helpful. Shielding is required as protection from radiant heat sources. Evaporative cooling and mechanical refrigeration are other ways to reduce heat. Cooling fans can also reduce heat in hot conditions. Eliminating steam leaks will also help. Equipment modifications, the use of power tools to reduce manual labor and using personal cooling devices or protective clothing are other ways to reduce the hazards of heat exposure for workers.

3) **Work practices** such as providing a period of acclimatization for new workers and those

returning from two week absences and making plenty of drinking water--as much as a quart per worker per hour--available at the workplace can help reduce the risk of heat disorders. Training first aid workers to recognize and treat heat stress disorders and making the names of trained staff known to all workers is essential. Employers should also consider an individual worker' s physical condition when determining his or her fitness for working in hot environments. Older workers, obese workers and personnel on some types of medication are at greater risk.

4) Alternating **work and rest** periods with longer rest periods in a cool area can help workers avoid heat stress. If possible, heavy work should be scheduled during the cooler parts of the day and appropriate protective clothing provided. Supervisors should be trained to detect early signs of heat stress and should permit workers to interrupt their work if they are extremely uncomfortable.

5) **Employee education** is vital so that workers are aware of the need to replace fluids and salt lost through sweat and can recognize dehydration, exhaustion, fainting, heat cramps, salt deficiency, heat exhaustion, and heat stroke as heat disorders. Workers should also be informed of the importance of daily weighing before and after work to avoid dehydration.

More Information

A 15-page booklet, *Working in Hot Environments*, is available free from National Institute for Occupational Safety and Health Publications, 4676 Columbia Parkway, Cincinnati, Ohio 45226; telephone 1-800-356-4674.

Hot Work Operations

The definition of hot work includes operations which provide a source of ignition, including:

- welding
- cutting
- burning
- riveting
- grinding (friction)
- spark or arc producing tools
- static discharges
- non-explosion proof lighting

These types of hot work are a normal part of routine maintenance operations, and they are often performed in confined spaces. These operations pose unique hazards within confined spaces, such as:

- fire and explosion hazards in the presence of flammables
- the generation of toxic atmospheres
- the generation of physical hazards, such as noise, vibration, heat stress, non-ionizing radiation, etc.

A combination of engineering controls, work practice controls, and personal protective equipment are required to reduce or eliminate the hazards associated with hot work. These control measures must be coordinated by using a hot worker program, which includes:

- a written hot work permit for every hot work operation.
- evaluation of the existing hazards within a permit space.
- evaluation of potential hazards created from hot work operations.

The employer must properly evaluate hot work operations, and precautions instituted specific to the tasks to be performed. General precautions to keep in mind include:

- use of localized exhaust ventilation
- selecting appropriate tools
- use necessary personal protective equipment
- surface coatings and residues in confined spaces must be evaluated to avoid creating hazardous by-products, i.e., arc welding produces high levels of ultraviolet radiation and in contact with chlorinated solvents can quickly generate toxic gases such as phosgene, chlorine and hydrogen chloride
- pipes, tubes, coils must be purged, flushed, or cleaned of hazardous residues
- be aware that conducting hot work operations in a non-permit space will change the status to that of a permit-space

The following specific procedures in conjunction with a full PRCS program are required when welding is performed in a confined space:

- Welding electrodes must be removed from their holders during suspension of work (e.g., during lunch or overnight). The welding machine must be disconnected from its power source.
- Mechanical ventilation is mandatory.
- Compressed gas cylinders and welding machines must be left outside the confined space.
- Portable equipment on wheels must be secured to prevent accidental movement.
- Gas welding and cutting equipment, such as hoses, connections, torches, etc. must be inspected and tested to ensure their integrity.

- Means must be available for the quick removal of a welder in the event of an emergency. Full body harness or safety belts attached to a lifeline must be used whenever their use will facilitate rescue.
- An attendant with a pre-planned rescue procedure must be stationed outside the space.
- Torch valves must be closed and the fuel, gas and oxygen supply positively shut off at some point outside the confined space when the torch is not to be used for a substantial period of time (e.g., during lunch hour or overnight). Additionally, the torch and hose must also be removed from the confined space where practicable.
- Warning signs or other means of warning workers of hot metal after welding is completed.
- Welders and helpers must use appropriate respiratory protection when ventilation controls are insufficient.
- Never use oxygen to ventilate a confined space.

A copy of a Hot Work Permit can be found in Appendix I.

1.0 POLICY

Company Name _____ committed to provide a safe and healthful work environment for our entire staff. In pursuit of this endeavor, the following written program is in place to first identify any Permit-Required Confined Spaces (PRCS) and to eliminate or control hazards associated with PRCS operations. This program is in accordance with the Occupational Safety and Health Administration' s (OSHA) Permit-Required Confined Spaces Standard, Title 29, Code of Federal Regulations 1910.146.

2.0 RESPONSIBILITIES

2.1 Overall Program Responsibility

Company Representative' s Name _____ is responsible for the overall implementation and maintenance of any written program or any certification concerning the requirements of the Permit-Required Confined Space Standard at our facility. The Permit-Required Confined Space entry program was developed with the help of the affected employees and/or their authorized representatives to ensure their familiarity with the program. This information is available to employees an authorized employee representatives.

2.2 Permit-Required Confined Space Evaluation

Company Representative's Name _____ is responsible for evaluating the workplace to determine if any permit spaces are present.

Note to the Employer: If no permit-required confined spaces are determined to exist at the facility, no further action is needed (refer to subsection 3.0 for additional clarification).

Company Representative's Name _____ will be responsible for determining if a PRCS program is required, or if the permit space can be reclassified as a non-permit space, or if alternative procedures can be used.

2.3 Training

Company Representative's Name _____ is responsible for ensuring that all affected personnel are properly trained and that refresher training is given. Personnel who may be included are any authorized entrants, attendants, entry supervisors, on-site rescue team members, and employees who may potentially enter the space.

2.4 Initial Contacting For Rescue Services

Company Representative's Name _____ will ensure that rescue and emergency services have been informed of any permit-required confined spaces a Company Name _____ drills, training, etc.

Note to the Employer: The completion of 2.4 is not a required entry if the permit space is reclassified as a non permit space or if alternate procedures are used. However, if an entry is required to verify the elimination of the hazard, then a full PRCS program is needed and 2.4 must be completed.

2.5 Equipment

Company Representative's Name _____ will ensure that all equipment needed for safe entry into any permit spaces and non-permit spaces is available and in proper working order.

3.0 PERMIT SPACE IDENTIFICATION

3.1

Company Representative' s Name _____ has evaluated the workplace and determined:

(Check appropriate box)

☐ No Permit-Required Confined Space(s) Exist at the Worksite.

☐ Permit-Required Confined Space(s) Have Been Determined to Exist.

☐ Permit spaces that qualify for alternative entry procedures exist.

☐ Permit spaces that may be re- classified prior, to entry exist.

Note to the Employer: Refer to Appendix C for information to assist in the determination process. As a reminder, a confined space is a space which:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and
- Is not designed for continuous employee occupancy.

A permit space is a confined space, which has one or more of the following characteristics:

- 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 which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard (i.e., electrical, mechanical, etc.).

If no permit spaces are identified, no further action is required.

Note to the Employer: Develop a list of all permit required confined spaces including their locations and identified hazard(s) which qualify it as a permit space. Though not mandated by the standard, it would be wise to develop a second list of all non-permit confined spaces in the event that these spaces are reclassified in the future.

3.2

The location(s) and hazard(s) posed by these permit spaces are listed below:

Location	**Hazard (s)**
_____	_____
	_____
	_____
	_____
	_____
	_____

4.0 PREVENTION OF UNAUTHORIZED ENTRY

4.1

If permit spaces are identified at our worksite Company Representative's Name_____ _____ will inform exposed or potentially exposed employees of their existence and hazards. The method(s) that will be used will be:

(check box(s) for firm' s specific policy)

☐ Posting of danger signs at each permit space reading "Danger -- Permit-Required Confined Space -- Do Not Enter"

☐ _____
_____

Note to the Employer: The standard allows any other equally effective means of informing employees of the presence of any permit spaces. For whatever method is chosen, OSHA will check to ensure that the method is effective.

4.2

It has been determined by Company Representative's Name_____ that the permit spaces identified at our worksite:

☐ will not be entered by our employees.

☐ The following measures have been taken to prevent employees from entering the spaces:
_____
_____
_____

☐ will be entered by employees of our workplace utilizing full permit procedures established in this plan.

☐ Will only enter permit spaces that have been re-classified as a non-permit space, or may be entered using alternate procedures.

Note to the Employer: The measures used to prevent entry could include permanently closing the space; use of barriers; specialized tools, under management' s control, to open the space(s); and supplementing these measure with training and signs. The steps taken by the employer must be effective in preventing employee entry into the permit space(s).

Employers who determine that their employees will enter a permit space must set up procedures to ensure safe entry. Because of the different types of permit spaces found in the work environment, the regulations allow options for employers to use to obtain this goal. Proper evaluation by the employer will determine which procedures can be used. Some permit spaces may be reclassified as non-permit spaces. Others may qualify for alternative procedures. Still others may require a full permit-required confined space program. It is the responsibility of the employer to determine which procedure is acceptable for the particular space of concern.

Permit-Required Confined Space Entry Procedures (Options)
a) Alternative Procedures (Subsection 6.0)
b) Full Permit Space Entry Program (Subsection 5.0)
c) Reclassify as Non-Permit Space (Subsection 7.0)

5.0 PERMIT-REQUIRED CONFINED SPACE (PRCS)

Note to the Employer: A written PRCS program is not required for:

1) Situations where alternative procedures are used for entry. The procedures outlined in paragraph (c)(5)(ii) are mandated and written verification is required by (c) (5)(ii)(H). Appendix D can be used to document that the alternative procedures ensure safe entry.
2) Situations where a permit space is reclassified as a non-permit space and entry is not required to verify elimination of all the hazards. Paragraph (c)(7)(iii) requires employers to document that the hazards have been eliminated. Appendix E can be used for documenting that the reclassification allows for safe entry.

If procedures I or 2 cannot be used and if the employer determines that their employees will enter a permit space, then a written PRCS program (see Appendix F) is needed for each permit space and Section 5.1 must be completed. Keep in mind that a written PRCS program is different than an entry permit (see Appendix Q). A written PRCS program is a guidance document for employers and employees so they can develop and utilize the procedures required for safe entry into a permit space. An entry permit is basically a checklist to ensure all the steps for the safe entry have been taken prior to entry.

The program elements to be considered for a full PRCS are outlined in paragraph (d) of the standard and pages 9-14 of this document. This program must specify the potential hazards of the space and the procedures needed to correct them. These step-by-step procedures must include acceptable entry conditions, isolation methods needed, methods for eliminating or controlling hazardous atmospheres (i.e., purging, cleaning, ventilation), equipment needed, testing protocol, and duties of permit space team members.

Safe entry procedures have been developed for each permit space at our facility. These procedures specify the proper methods and equipment necessary to conduct the entry operation in a safe manner. A Permit Space Entry Procedure Worksheet has been completed for each permit space by Company Representative's Name _____ and they are located at _____.

Note to the Employer: Appendix F contains a Permit-Required Confined Space (PRCS) Program Worksheet which can assist in the development of such a program. Appendix F-1 contains an example of a completed written program.

A written PRCS Program addresses the following elements for each permit space entered:

- The methods used to prevent unauthorized entry.
- Identify and evaluate the specific hazards before entry.
- Establish measures for the safe control of identified hazards such as isolation, purging, inerting, ventilation, barricades, lockout/tagout, etc.
- Procedure to test the permit space and document results.
- Procedure to maintain acceptable conditions in the permit space.
- Identify duties of each employee required and provide training.
- Provide at least one attendant outside the permit space for the duration of the entry operations.
- Implement proper procedures for rescue.
- Establish a written system for preparation, issuance, use and cancellation of permits.
- Coordinate entry operations during multiple employer entries.
- Review entire entry program at least annually, unless previously reviewed at conclusion of a specific entry.

6.0 ALTERNATIVE PROCEDURES

6.1

The OSHA regulations allow permit spaces that have, as their *only hazard*, an actual or potential hazardous atmosphere to use alternative procedures for entry. These alternative procedures as discussed in Section I do not require the implementation of a full PRCS program. The following is a list of permit spaces at our workplace, which currently qualify for alternative procedures:

_____

_____

_____

_____

Note to the Employer: Refer to Appendix D for a Worksheet which can be used to certify that alternative procedures can be used and that the space is safe for entry. For those employers who can demonstrate that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry, only the General Requirements -- paragraph (c)(5) and Training -- paragraph (g) are required. Remember, continuous forced air ventilation controls the hazard -- it does not eliminate it.

7.0 RECLASSIFYING PERMIT SPACE TO NON-PERMIT SPACE

7.1

The OSHA regulations also allow permit spaces to be reclassified as non-permit spaces by the total elimination of all the hazards. A permit space can be reclassified as a non-permit space if there are no actual or potential atmospheric hazards and if all the other hazards within the space are eliminated without entry into the space. Information on reclassifying permit spaces to non-permit spaces is discussed in Section I. The following is a list of permit spaces at our workplace that can be reclassified as non-permit spaces by the elimination of the hazards:

Note to the Employer: Refer to Appendix E for a worksheet which can be used to certify that the hazards have been eliminated and the space is safe for entry. If an entry is needed to eliminate or verify the elimination of a hazard, then a full PRCS program is required. Once it has been determined that all the hazards have been eliminated, then the space can be reclassified.

8.0 PERSONNEL, DUTIES AND TRAINING FOR FULL PERMIT-REQUIRED CONFINED SPACE ENTRY OPERATIONS

Note to the Employer: Subsection 8.0 does not apply if a full PRCS program is not used. Note that subsection 12.0 contains the training requirements needed when reclassifying or alternative procedures are used.

8.1

Entry into any PRCS where a full PRCS program is mandated will require a specially trained and equipped team. Each team will consist of an:

- authorized entrant
- attendant
- entry supervisor
- rescue personnel

8.2

Each member of the team will receive initial and annual refresher training. The training will be specific for the duties of each team member and include the procedures and practices necessary to protect them from the dangers of the permit space.

Note to the Employer: Provide a training program for employees using the information contained in this document, and use any other applicable resources. Make your training program specific to the particular permit space(s) to be entered. This training must give team members the understanding, knowledge and skills necessary for them to safely perform their assigned duties.

8.3

The training program will include the duties of each team member as listed below:

Authorized Entrants

- Know the hazards associated with the permit space and their effects.
- Properly use the equipment required for entry.
- Maintain a continuous means of communication with the attendant.
- Alert the attendant in the event of an emergency.
- Evacuate the space if an emergency occurs.

Attendants

- Know the hazards associated with the permit space and their effects.
- Maintain an accurate account of the authorized entrants.
- Remain at their assigned station until relieved by another attendant or until the permit space entry is complete.
- Monitor conditions in and around the permit space.
- Summon rescue and applicable medical services in the event of an emergency.
- Perform non-entry rescue procedures.
- Perform appropriate measures to prevent unauthorized personnel from entering the permit space.

Entry Supervisors

- Know the hazards associated with the permit space and their effects.
- Verify that the safeguards required by the permit have been implemented.
- Verify that rescue services are available and that means for summoning them are operable.
- Cancel the written permit and terminate the permit space entry when required.
- Remove personnel who are not authorized to enter the permit space during entry operations.
- Periodically, determine that the entry operation is being performed in a manner consistent with the requirements of the permit space entry procedures and that acceptable entry conditions are maintained.

Rescue Personnel

- See Appendix P for information on rescue personnel.

8.4

Permit-Required Confined Space (PRCS) Program Training - If a full permit-required confined space program is required, training is needed on the following topics:

- Types of confined space hazards.
- Components of the written PRCS program.
- Components of the entry permit system.
- Components of the hot work permit.
- The need for prompt guarding of the entrance opening.
- Atmospheric testing equipment including its use, calibration, and maintenance.
- Atmospheric testing protocol:
  - oxygen, combustibles, toxics

  - pre-entry, frequent or continuous testing
  - check all levels of the space
- Methods for the control or elimination of any atmospheric hazards:
  - Inerting
  - Draining and rinsing
  - Purging and cleaning
  - Continuous forced air ventilation
- Procedures the employees must follow if they detect a hazard.
- The evaluation process to be used for reentry if hazards are detected.
- Train employees on the use of entry equipment (e.g., ladders, communication devices, etc.)
- Personal protective equipment required:
  - full body harness
  - respiratory protection
  - chemical protective clothing
  - eye and face protection
- Personnel and their responsibilities:
  - authorized entrant
  - attendant
  - entry supervisor
  - rescue team
- On-site or Off-site rescue:
  - Rescue Plan
  - practice rescues
  - basic first-aid and cardiopulmonary resuscitation certification
  - full body harness with retrieval line attached to mechanical retrieval device
- Procedures for annual review of canceled permits
- Any other information necessary to ensure employee safety during a permit space entry operation.
- Documentation of the training.

Note to the Employer: Again, the training required is dependent on the specific space to be entered and the procedures which are needed to protect entrants. The information provided in this training subsection is a generalization of the topics that must be covered during employee training. Additionally, document employees' training and refresher training. This certification simply requires the employees' names, the signatures or initials of the trainers, and dates of training. Appendix R has been added if additional space is needed to record employee training.

The following is a list of employees who have been equipped and trained to serve as authorized entrants at our facility:

Authorized Entrants	Trainer	Date of Training

8.4.2

The following is a list of employees who have been equipped and trained to serve as attendants:

Attendant	Trainer	Date of Training

8.4.3

The following is a list of employees who have been trained to serve as entry supervisors:

Entry Supervisor	Trainer	Date of Training

Note to the Employer: Remember, training must be provided:

- Before employees are assigned duties involving permit space entry.
- Whenever their assigned duties change.
- Whenever there is a change in a permit space that creates hazards for which they have not been notified.

9.0 HOST EMPLOYER'S RESPONSIBILITIES WITH CONTRACTORS

9.1

When contractors are involved in permit space entry work at our workplace, Company Representative's Name _____ will inform them of the following information and coordinate any entry operations:

- The location of the permit spaces at our facility and that entry into these spaces is only allowed through a permit space program or alternative procedures or space reclassification.
- Our rationale for listing the space as a permit space such as any identified hazards and our experiences with the particular space.
- Precautions that we have implemented to protect employees working in or near the space.
- Company Representative's Name _____ will debrief the contractor at the completion of the entry operation, or during if a need arises, and if any hazards were confronted or created during their work.

Note to the Employer: Appendix G has been included to assist with the requirements of this subsection.

10.0 CONTRACTOR'S RESPONSIBILITIES WITH HOST EMPLOYERS

Note to the Employer: Subsection 10 is required to be completed by a contractor when he/she is hired to perform work in a permit space.

10.1

When Name of Contracting Company _____ is hired to perform work in a PRCS, Name of Contractor Representative _____ will obtain the following information from the host employer and ensure the following tasks are performed:

- Obtain any information on the hazards of the permit space and information from previous entry operations from the host employer.
- Determine if the host employer' s workers will be working in or near the space.
- If the host employer will have employees working in or near the space during our entry operation, Name of Contractor's Representative _____ will coordinate entry operations with the host employer' s representative.
- Will inform the host employer of the permit space program that will be utilized.
- Hold a debriefing conference at the completion of the entry operation or during the entry operation (if needed) to inform the host employer of any hazards confronted or created.

Note to the Employer: For clarification, refurbishing of the existing equipment and space is considered maintenance; reconfiguration of the space or installation of new equipment (as for a process change) is usually considered construction. Additionally, Appendix H can be used to assist the contractor with the standards requirements.

11.0 RESCUE AND EMERGENCY SERVICES

Note to the Employer: This subsection is not required if the permit space has been reclassified as a non-permit space or if alternative procedures are used.

11.1

The precautions and procedures outlined in our written PRCS program are designed to ensure that our employees are safe while working in permit spaces. Under no circumstances do we expect our employees to enter a permit space where hazards have not been eliminated or effectively controlled.

Additionally, we recognize that unexpected situations might arise that prevent entrants from self-rescue. In response, the following rescue and emergency action plan has been developed and will be strictly enforced:

Name of Company _____ has decided to utilize:

(Check all that apply)

☐ On-site rescue services which include:
- ☐ non-entry rescue procedures
- ☐ entry rescue procedures

☐ off-site entry rescue services.

Note to the Employer: Employers who choose to use off-site rescue services need not complete subsections 11.2, 11.3, and 11.4, but must complete 11.5. Additionally, a non-mandatory letter (Appendix N) has been included to notify off-site rescuers (e.g., local fire department) of the potential hazards associated with the space. This form should be sent well in advance of any entry operation. This advanced information provides outside rescue services with the time to develop appropriate rescue strategies and practice rescue techniques.

Note to the Employer: Each permit space must be individually evaluated to determine whether entry or non-entry rescue procedures can be used to remove incapacitated entrants. Non-entry rescue is the desired method because it is not necessary to place the rescuer at risk to remove the injured employees. Non-entry retrieval systems, such as full body harness with retrieval line, must be used whenever an authorized entrant enters into a permit space, except in situations where the retrieval system would increase the risk of entry or would not contribute to the rescue.

11.2

Company Representative's Name _____ will ensure that each member of the firm' s rescue service is appropriately trained. Refer to Appendix P for rescue plan and training requirements.

11.3

Company Representative's Name _____ will ensure that each member of the rescue service will receive basic first aid and pulmonary resuscitation (CPR). At least one of these members must hold current certification in first aid and CPR.

11.4

Company Representative's Name _____ will ensure that rescue team members will practice rescue techniques at least annually from the actual or similarly configured space(s).

Note to the Employer: Simulated rescue operations must include dummies, manikins, or actual persons from the actual or from representative permit spaces. Actual rescues during the 12month period may also substitute for a practice rescue.

11.5

Company Representative's Name _____ has made arrangements with Name of Rescue Service _____ for off-site rescue and emergency services and they have consented to provide this service.

Company Representative's Name _____ has determined that the Name of Rescue Service _____ has the capability to reach potential victim(s) within an appropriate time frame and is equipped for and proficient in performing the needed rescue services.

Company Representative's Name _____ has informed Name of Off-site Rescue Service _____ of the hazards they may encounter if they are summoned. Company Representative's Name _____ has also provided access to the rescue service so they can evaluate the permit spaces to develop appropriate rescue plans and practice rescue operations. If rescue and emergency services are needed, the following procedures will go into effect:

Note to the Employer: Describe the procedures that will be used for summoning the rescue and emergency services. Include the name, location, and telephone numbers of the rescue services in this program and also on the entry permit. Train employees on the specific procedures for summoning the rescue and emergency services.

Name of Rescue Service _____
Telephone Number _____
Location _____
Approximate Response Time _____

Name of Emergency Medical Service _____
Telephone _____
Location _____
Approximate Response Time _____

The specific procedures for summoning rescue and emergency services for our workplace is outlined as follows:

_____
_____
_____
_____

12.0 TRAINING

12.1

Training must be given to each employee who has access or potential access to a permit space. The amount and type of training needed will depend on the individual' s duty assignment. For example, some employees may only be required to know the existence, location, and danger posed by a permit space. Others would need considerably more training if they are members of a PRCS team. Still others would need training as it pertains to the type of entry procedures used (i.e., alternative procedures or reclassifying to non-permit space procedures). The overall intent of this training is to give employees the understanding, knowledge, and skills necessary for the safe performance of their assigned duties in relation to the permit spaces of concern.

12.2

Four basic categories have been set up to train employees based on duties and potential exposure.

12.2.1

Awareness Training -Awareness training for employees potentially exposed to permit spaces can be satisfied by providing them with the specific information contained in subsection 3 and 4 located on pages 72 and 73.

12.2.2

Training Required for Using Alternative Procedures - If the space qualifies for alternative procedures, training on the following topics is warranted:

- A major point concerning the use of alternative procedures is that these procedures can only be used when a hazardous atmosphere is the only hazard of concern.
- The harm associated with the atmospheric hazards of concern including their acceptable entry levels and symptoms of overexposure.
- Awareness training to recognize other potential hazards in or around the space.
- Any conditions that may make it unsafe to remove the entrance cover.
- The need for prompt guarding of the entrance opening.
- Atmospheric testing equipment including its use, method of calibration, and maintenance.
- Atmospheric testing protocol for oxygen, combustibles, toxics
- Pre-entry, frequent or continuous testing of the permit space.
- Check all levels of the space for atmospheric hazards.
- Atmospheric Controls
  - inerting
  - draining and rinsing
  - purging
  - continuous forced air ventilation including type, proper use and placement, and its limitations
- Procedures the employee must follow if a hazardous atmosphere is detected.
- The evaluation process to be used for reentry if a hazardous atmosphere is detected or the individual vacates the space and returns some time later.
- Train employees on the use of entry equipment used including ladders and intrinsically safe lighting.
- Personal protective equipment (e.g., gloves, hard hats, boots, etc.), its use, limitations, and required maintenance.

- A review of the completed written certification form (Appendix D) with the employee prior to entering the space.
- Any process which may introduce a hazard (e.g., welding, cleaning with chemical solvents, etc.) which would prohibit use of alternative procedures.
- The requirements of paragraph (c)(5) must be reviewed with the employee.
- Any other information needed to ensure the safety of the employee.
- The documentation of the training.

12.2.3

Training Required for Using the Reclassifying Permit Space Procedures - If the permit space can be reclassified as a non-permit space, the following items must be discussed:

- Documentation of the elimination of the hazards. If the elimination of the hazards or verification of elimination requires employees to enter the space, then a full PRCS program is needed.
- Train employee on the hazards associated with the space (i.e., mechanical, chemical, atmospheric) and the methods needed to eliminate the hazards such as:
  - Isolation techniques
  - Lockout/Tagout
  - Disconnection and misalignment of pipes
  - Double block and bleed
  - Blanking and blinding
  - Removal of engulfment hazards
  - Elimination of hazardous atmosphere by draining, inerting, purging, cleaning, venting
- Train employees on the use of entry equipment used including ladders, ground fault circuit interrupters for electrical equipment, etc.
- Personal protective equipment (e.g., gloves, hard hat, boots, etc.) including its use, limitations, and required maintenance.
- A review of the completed written certification form (Appendix E) with the employee entering the space.
- The requirements of paragraph (c)(7) must be reviewed with the employee(s).
- Inform employees that any procedures such as welding, cleaning with a chemical, etc. could negate the reclassification and convert the space back to a permit space.
- Any conditions which may make it unsafe to remove entrance cover.
- The need for prompt guarding of the entrance opening.
- Atmospheric testing equipment including its use, method of calibration, and maintenance.
- Atmospheric testing protocol:
  - oxygen, combustibles, toxics

  - pre-entry, frequent or continuous testing
  - check all levels of the space
- Procedures the employee will follow if a hazard is detected.
- The evaluation process to be used for reentry if a hazard is detected or the individual vacates the space and returns some time later.
- Awareness training to recognize other potential hazards in or around the space.
- The documentation of the training.

12.2.4

Training Required for using full Permit-Required Confined Space Procedures (see subsection 8.4)

Note to the Employer: The training required depends on the specific permit space to be entered and the procedures which are needed to protect entrants. The information provided in this training subsection is a generalization of the topics that must be covered during employee training.

13.0 PERMIT-REQUIRED CONFINED SPACE PROGRAM REVIEW

Note to the Employer: This subsection is not required if the permit space has been reclassified as a non-permit space-or-if alternative procedures are used.

13.1

Within one year of any entry operation, Company Representative's Name_____ will conduct a review of the program using the cancelled entry permits to identify any deficiencies in our program. A review will be conducted sooner if there is reason to believe that the program does not adequately protect our employees. Any corrective measures will be documented by a revision of the program. Employees will be trained on any changes. Additionally, employees who note any inadequacies with the program can contact Company Representative's Name_____.

If no permit space entry operations are conducted during the year, no review is needed.

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

1910.146 Permit-Required Confined Spaces

(a) Scope and application.

This section contains requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit-required confined spaces. This section does not apply to agriculture, to construction, or to shipyard employment (Parts 1925,1926, and 1915 of this chapter, respectively).

(b) Definitions.

Acceptable entry conditions means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with permit-required confined space entry can safely enter into and work within the space.

Attendant means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant' s duties assigned in the employer' s permit space program.

Authorized entrant means an employee who is authorized by the employer to enter a permit space.

Blanking or blinding means 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 means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Double block and bleed means 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 means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) 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 means 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 (permit) means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in paragraph (f) of this section.

Entry supervisor means the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

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. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any sub-stance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(5) 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, §1910.1200 of this part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Hot work permit means the employer' s written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately dangerous to *life or health (IDLH)* means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would 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 means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

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

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

Line breaking means 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 means 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 means an atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

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(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross- section; or

(4) Contains any other recognized serious safety or health hazard.

Permit-required confined space program (permit space program) means the employer' s overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Permit system means the employer' s written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue service means the personnel designated to rescue employees from permit spaces.

Retrieval system means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Testing means 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.

Note: Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to, and during, entry.

(c) General requirements.

(1) The employer shall evaluate the workplace to determine if any spaces are permit-required confined spaces.

Note: Proper application of the decision flow chart in appendix A to §1910.146 would facilitate compliance with this requirement.

(2) If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

Note: A sign reading "DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign.

(3) If the employer decides that its employees will not enter permit spaces, the employer shall take effective measures to prevent its employees from entering the permit spaces and shall comply with paragraphs (c)(1), (c)(2), (c)(6), and (c)(8) of this section.

(4) If the employer decides that its employees will enter permit spaces, the employer shall develop and implement a written permit space program that complies with this section. The written program shall be available for inspection by employees and their authorized repre-sentatives.

(5) An employer may use the alternate procedures specified in paragraph (c)(5)(ii) of this section for entering a permit space under the conditions set forth in paragraph (c)(5)(i) of this section.

(i) An employer whose employees enter a permit space need not comply with paragraphs (d) through (f) and (h) through (k) of this section, provided that:

(A) The employer can demonstrate that the only hazard posed by the permit space is an actual or potential hazardous atmosphere;

(B) The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry;

(C) The employer develops monitoring and inspection data that supports the demonstrations required by paragraphs (c)(5)(i)(A) and (c)(5)(i)(B) of this section;

(D) If an initial entry of the permit space is necessary to obtain the data required by paragraph (c)(5)(i)(C) of this section, the entry is performed in compliance with paragraphs (d) through (k) of this section;

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(E) The determinations and supporting data required by paragraphs (c)(5)(i)(A), (c)(5)(i)(B), and (c)(5)(i)(C) of this section are documented by the employer and are made available to each employee who enters the permit space under the terms of paragraph (c)(5) of this section or to that employee' s authorized repre-sentative; and

(F) Entry into the permit space under the terms of paragraph (c)(5)(i) of this section is performed in accordance with the requirements of paragraph (c)(5)(ii) of this section.

Note: See paragraph (c)(7) of this section for reclassi-fication of a permit space after all hazards within the space have been eliminated.

(ii) The following requirements apply to entry into permit spaces that meet the conditions set forth in paragraph (c)(5)(i) of this section.

(A) Any conditions making it unsafe to remove an entrance cover shall be eliminated before the cover is removed.

(B) When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

(C) Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any employee who enters the space, or that employee' s authorized repre-sentative, shall be provided an opportunity to observe the pre-entry testing required by this paragraph.

(D) There may be no hazardous atmosphere within the space whenever any employee is inside the space.

(E) Continuous forced air venti-lation shall be used, as follows:

(1) An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;

(2) The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;

(3) The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.

(F) The atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere. Any employee who enters the space, or that employee' s authorized representative, shall be provided with an opportunity to observe the periodic testing required by this paragraph.

(G) If a hazardous atmosphere is detected during entry:

(1) Each employee shall leave the space immediately;

(2) The space shall be evaluated to determine how the hazardous atmosphere developed; and

(3) Measures shall be imple-mented to protect employees from the hazardous atmosphere before any sub-sequent entry takes place.

(H) The employer shall verify that the space is safe for entry and that the pre-entry measures required by paragraph (c)(5)(ii) of this section have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification shall be made before entry and shall be made available to each employee entering the space or to that employee' s authorized repre-sentative.

(6) When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the employer shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

(7) A space classified by the employer as a permit-required confined space may be reclassified as a non-permit confined space under the following procedures:

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(i) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed under paragraphs (d) through (k) of this section. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

Note: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards. Paragraph (c)(5) covers permit space entry where the employer can demonstrate that forced air ventilation alone will control all hazards in the space.

(ii) The employer shall document the basis for determining that all hazards in a permit space have been eliminated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space or to that employee' s authorized representative.

(iii) If hazards arise within a permit space that has been declassified to a non-permit space under paragraph (c)(7) of this section, each employee in the space shall exit the space. The employer shall then reevaluate the space and determine whether it must be reclassified as a permit space, in accordance with other applicable provisions of this section.

(8) When an employer (host employer) arranges to have employees of another employer (contractor) perform work that involves permit space entry, the host employer shall:

(i) Inform the contractor that the workplace contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of this section;

(ii) Apprise the contractor of the elements, including the hazards identified and the host employer' s experience with the space, that make the space in question a permit space;

(iii) Apprise the contractor of any precautions or procedures that the host employer has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;

(iv) Coordinate entry operations with the contractor, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by paragraph (d)(11) of this section; and

(v) Debrief the contractor at the conclusion of the entry operations regarding the permit space program followed and regarding any hazards confronted or created in permit spaces during entry operations.

(9) In addition to complying with the permit space requirements that apply to all employers, each contractor who is retained to perform permit space entry operations shall:

(i) Obtain any available information regarding permit space hazards and entry operations from the host employer;

(ii) Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by paragraph (d)(11) of this section; and

(iii) Inform the host employer of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.

(d) Permit-required confined space program (permit space program).

Under the permit space program required by paragraph (c)(4) of this section, the employer shall:

(1) Implement the measures necessary to prevent unauthorized entry;

(2) Identify and evaluate the hazards of permit spaces before employees enter them;

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(3) Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:

(i) Specifying acceptable entry conditions;

(ii) Providing each authorized entrant or that employee' s authorized representative with the opportunity to observe any monitoring or testing of permit spaces;

(iii) Isolating the permit space;

(iv) Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;

(v) Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards; and

(vi) Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.

(4) Provide the following equipment (specified in paragraphs (d)(4)(i) through (d)(4)(ix) of this section) at no cost to employees, maintain that equipment properly, and ensure that employees use that equipment properly:

(i) Testing and monitoring equipment needed to comply with paragraph (d)(5) of this section;

(ii) Ventilating equipment needed to obtain acceptable entry conditions;

(iii) Communications equipment necessary for compliance with paragraphs (h)(3) and (i)(5) of this section;

(iv) Personal protective equipment insofar as feasible engineering and work practice controls do not adequately protect employees;

(v) Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency;

(vi) Barriers and shields as required by paragraph (d)(3)(iv) of this section;

(vii) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;

(viii) Rescue and emergency equipment needed to comply with paragraph (d)(9) of this section, except to the extent that the equipment is provided by rescue services; and

(ix) Any other equipment necessary for safe entry into and rescue from permit spaces.

(5) Evaluate permit space conditions as follows when entry operations are conducted:

(i) Test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin, except that, if isolation of the space is Infeasible because the space is large or is part of a continuous system (such as a sewer), pre-entry testing shall be performed to the extent feasible before entry Is authorized and, if entry is authorized, entry conditions shall be continuously monitored in the areas where authorized entrants are working;

(ii) Test or monitor the permit space as necessary to determine if acceptable entry conditions are being maintained during the course of entry operations; and

(iii) When testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.

(iv) Provide each authorized entrant or that employee' s authorized representative an opportunity to observe the pre-entry and any subsequent testing or monitoring of permit spaces;

(v) Reevaluate the permit space in the presence of any authorized entrant or that employee' s authorized representative who requests that the employer conduct such reevaluation because the entrant or representative has reason to believe that the evaluation of that space may not have been adequate;

Immediately provide each authorized entrant or that employee' s authorized representative with the results of any testing conducted in accord with paragraph (d) of this section.

Note: Atmospheric testing conducted in accordance with appendix B to §1910.146 would be considered as satisfying the requirements of this paragraph. For

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permit space operations in sewers, atmospheric testing conducted in accordance with appendix B, as supplemented by appendix E to §1910.146, would be considered as satisfying the requirements of this paragraph.

(6) Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations;

Note: Attendants may be assigned to monitor more than one permit space provided the duties described in paragraph (1) of this section can be effectively performed for each permit space that is monitored. Likewise, attendants may be stationed at any location outside the permit space to be monitored as long as the duties described in paragraph (1) of this section can be effectively performed for each permit space that is monitored.

(7) If multiple spaces are to be monitored by a single attendant, include in the permit program the means and procedures to enable the attendant to respond to an emergency affecting one or more of the permit spaces being monitored without distraction from the attendant' s responsibilities under paragraph (i) of this section;

(8) Designate the persons who are to have active roles (as, for example, authorized entrants, attendants, entry supervisors, or persons who test or monitor the atmosphere in a permit space) in entry operations, identify the duties of each such employee, and provide each such employee with the training required by paragraph (g) of this section;

(9) Develop and implement procedures for summoning rescue and emergency services, for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized personnel from attempting a rescue;

(10) Develop and implement a system for the preparation, issuance, use, and cancellation of entry permits as required by this section;

(11) Develop and implement procedures to coordinate entry operations when employees of more than one employer are working simultaneously as authorized entrants in a permit space, so that employees of one employer do not endanger the employees of any other employer;

(12) Develop and implement procedures (such as closing off a permit space and canceling the permit) necessary for concluding the entry after entry operations have been completed;

(13) Review entry operations when the employer has reason to believe that the measures taken under the permit space program may not protect employees and revise the program to correct deficiencies found to exist before subsequent entries are authorized; and

Note: Examples of circumstances requiring the review of the permit space program are: any unauthorized entry of a permit space, the detection of a permit space hazard not covered by the permit, the detection of a condition prohibited by the permit, the occurrence of an injury or near-miss during entry, a change in the use or configuration of a permit space, and employee complaints about the effectiveness of the program.

(14) Review the permit space program, using the canceled permits retained under paragraph (e)(6) of this section within 1 year after each entry and revise the program as necessary, to ensure that employees participating in entry operations are protected from permit space hazards.

Note: Employers may perform a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review is necessary. Appendix C to §1910.146 presents examples of permit space programs that are considered to comply with the requirements of paragraph (d) of this section.

(e) Permit system.

(1) Before entry is authorized, the employer shall document the completion of measures required by paragraph (d)(3) of this section by preparing an entry permit.

Note: Appendix D to §1910.146 presents examples of permits whose elements are considered to comply with the requirements of this section.

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(2) Before entry begins, the entry supervisor identified on the permit shall sign the entry permit to authorize entry.

(3) The completed permit shall be made available at the time of entry to all authorized entrants or their authorized representatives, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

(4) The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit in accordance with paragraph (f)(2) of this section.

(5) The entry supervisor shall terminate entry and cancel the entry permit when:

(i) The entry operations covered by the entry permit have been completed; or

(ii) A condition that is not allowed under the entry permit arises in or near the permit space.

(6) The employer shall retain each canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program required by paragraph (d)(14) of this section. Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

(f) Entry permit.

The entry permit that documents compliance with this section and authorizes entry to a permit space shall identify:

(1) The permit space to be entered;

(2) The purpose of the entry;

(3) The date and the authorized duration of the entry permit;

(4) The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

Note: This requirement may be met by inserting a reference on the entry permit as to the means used, such as a roster or tracking system, to keep track of the authorized entrants within the permit space.

(5) The personnel, by name, currently serving as attendants;

(6) The individual, by name, currently serving as entry supervisor, with a space for the signature or initials of the entry supervisor who originally authorized entry;

(7) The hazards of the permit space to be entered;

(8) The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;

Note: Those measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.

(9) The acceptable entry conditions;

(10) The results of initial and periodic tests performed under paragraph (d)(5) of this section, accompanied by the names or initials of the testers and by an indication of when the tests were performed;

(11) The rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;

(12) The communication procedures used by authorized entrants and attendants to maintain contact during the entry;

(13) Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this section;

(14) Any other information whose inclusion is necessary, given the circumstances of the particular confined space, in order to ensure employee safety; and

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(15) Any additional permits, such as for hot work, that have been issued to authorize work in the permit space.

(g) Training.

(1) The employer shall provide training so that all employees whose work is regulated by this section acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this section.

(2) Training shall be provided to each affected employee:

(i) Before the employee is first assigned duties under this section;

(ii) Before there is a change in assigned duties;

(iii) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;

(iv) Whenever the employer has reason to believe either that there are deviations from the permit space entry procedures required by paragraph (d)(3) of this section or that there are inadequacies in the employee' s knowledge or use of these procedures.

(3) The training shall establish employee proficiency in the duties required by this section and shall introduce new or revised procedures, as necessary, for compliance with this section.

(4) The employer shall certify that the training required by paragraphs (g)(1) through (g)(3) of this section has been accomplished. The certification shall contain each employee' s name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees and their authorized representatives.

(h) Duties of authorized entrants.

The employer shall ensure that all authorized entrants:

(1) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Properly use equipment as required by paragraph (d)(4) of this section;

(3) Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by paragraph (i)(6) of this section;

(4) Alert the attendant whenever:

(i) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or

(ii) The entrant detects a prohibited condition; and

(5) Exit from the permit space as quickly as possible whenever:

(i) An order to evacuate is given by the attendant or the entry supervisor,

(ii) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation,

(iii) The entrant detects a prohibited condition, or

(iv) An evacuation alarm is activated.

(i) Duties of attendants.

The employer shall ensure that each attendant:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

(3) Continuously maintains an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants under paragraph (f)(4) of this section accurately identifies who is in the permit space;

(4) Remains outside the permit space during entry operations until relieved by another attendant;

Note: When the employer' s permit entry program allows attendant entry for rescue, attendants may enter a permit space to attempt a rescue if they have

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been trained and equipped for rescue operations as required by paragraph (k)(1) of this section and if they have been relieved as required by paragraph (i)(4) of this section.

(5) Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space under paragraph (i)(6) of this section;

(6) Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

(i) If the attendant detects a prohibited condition;

(ii) If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;

(iii) If the attendant detects a situation outside the space that could endanger the authorized entrants; or

(iv) If the attendant cannot effectively and safely perform all the duties required under paragraph (i) of this section;

(7) Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(8) Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(i) Warn the unauthorized persons that they must stay away from the permit space;

(ii) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and

(iii) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

(9) Performs non-entry rescues as specified by the employer' s rescue procedure; and

(10) Performs no duties that might interfere with the attendant' s primary duty to monitor and protect the authorized entrants.

(j) Duties of entry supervisors.

The employer shall ensure that each entry supervisor:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminates the entry and cancels the permit as required by paragraph (e)(5) of this section;

(4) Verifies that rescue services are available and that the means for summoning them are operable;

(5) Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

(6) Determines, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

(k) Rescue and emergency services.

(1) An employer who designates rescue and emergency services, pursuant to paragraph (d)(9) of this section, shall:

Evaluate a prospective rescuer' s ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified;

Note to paragraph (k)(I)(i): What will be considered timely will vary according to the specific hazards involved in each entry. For example, § 1910.134, Respiratory Protection, requires that employers provide a standby person or persons capable of immediate action to rescue employees) wearing res-

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piratory protection while in work areas defined as IDLH atmospheres.

(i) Evaluate a prospective rescue service' s ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit space or types of permit spaces identified;

(ii) Select a rescue team or service from those evaluated that:

(A) Has the capability to reach the victim(s) within a time frame that is appropriate for the permit space hazard(s) identified;

(B) Is equipped for and proficient in performing the needed rescue services;

(iii) Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site; and

(iv) Provide the rescue team or service selected with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

Note to paragraph (k)(1): Non-mandatory Appendix F contains examples of criteria which employers can use in evaluating prospective rescuers as required by paragraph (k)(l) of this section.

(2) An employer whose employees have been designated to provide permit space rescue and emergency services shall take the following measures:

(i) Provide affected employees with the personal protective equipment (PPE) needed to conduct permit space rescues safely and train affected employees so they are proficient in the use of that PPE, at no cost to those employees;

(ii) Train affected employees to perform assigned rescue duties. The employer must ensure that such employees successfully complete the training required to establish proficiency as an authorized entrant, as provided by paragraphs (g) and (h) of this section;

(iii) Train affected employees in basic first-aid and cardiopulmonary resuscitation (CPR). The employer shall ensure that at least one member of the rescue team or service holding a current certification in first aid and CPR is available; and

(iv) Ensure that affected employees practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

(3) To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would Increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements.

(i) Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant' s back near shoulder level, above the entrant' s head, or at another point which the employer can establish presents a profile small enough for the successful removal of the entrant. Wristlets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

(ii) The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than 5 feet (1.52 m) deep.

(4) 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.

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(l) Employee participation.

(1) Employers shall consult with affected employees and their authorized representatives on the development and implementation of all aspects of the permit space program required by paragraph (c) of this section.

(2) Employers shall make available to affected employees and their authorized representatives all information required to be developed by this section.

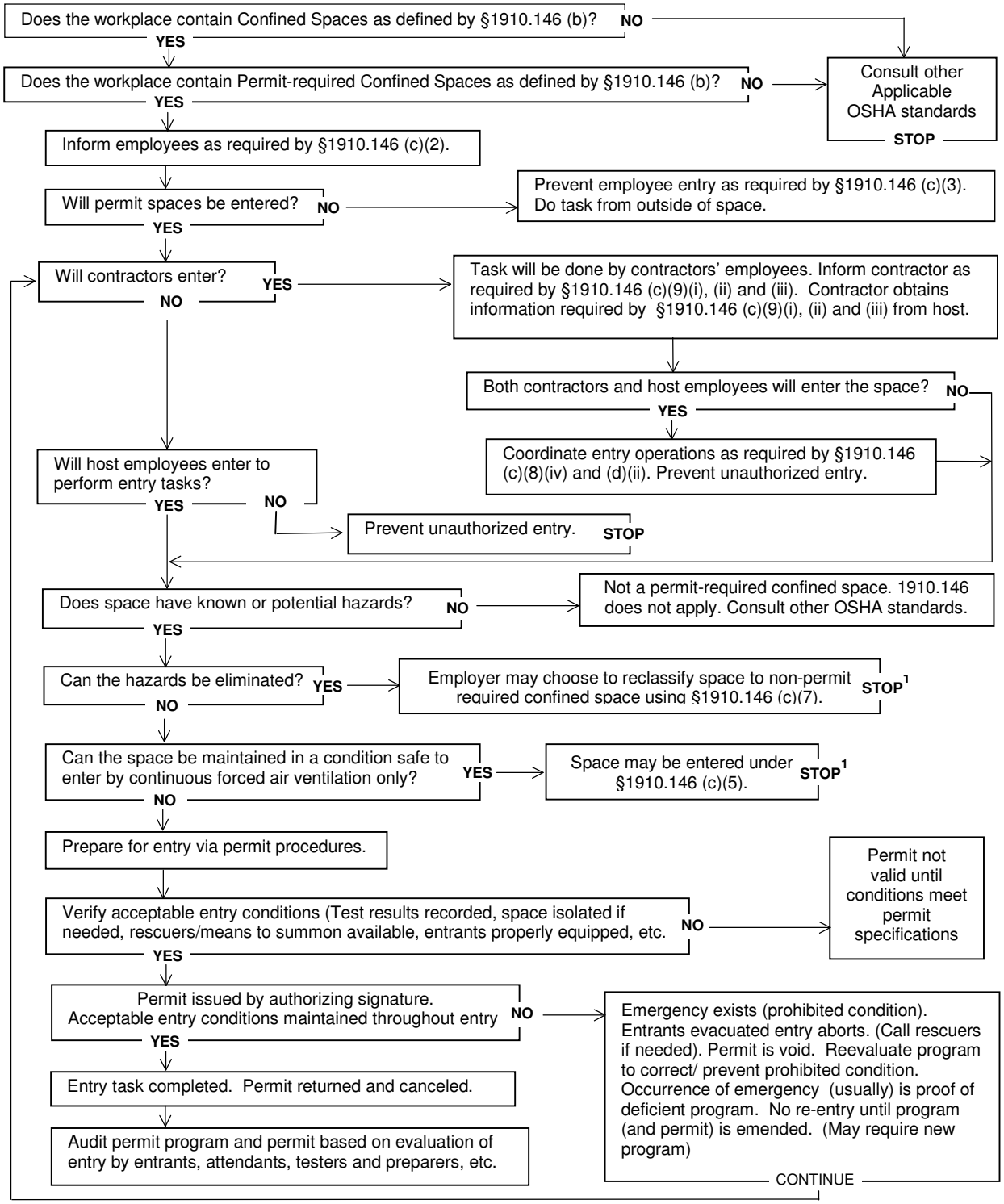
[58 FR 4549, Jan. 14,1993; 58 FR 34885, June 29, 1993, as amended at 59 FR 26114, May 19,1994; 63 FR 66018, December 01, 1998]

APPENDICES TO §1910.146 - PERMIT-REQUIRED CONFINED SPACES

Note: Appendices A through F serve to provide information and non-mandatory guidelines to assist employers and employees in complying with the appropriate requirements of this section.

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

Appendix A to §1910.146 -- Permit-Required Confined Space Decision Flow Chart



[1] Spaces may have to be evacuated and re-evaluated if hazards arise during entry.

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

Appendix B to §1910.146 - Procedures for Atmospheric Testing

Atmospheric testing is required for two distinct purposes: evaluation of the hazards of the permit space and verification that acceptable entry conditions for entry into that space exist.

(1) *Evaluation testing*. The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate permit entry procedures can be developed and acceptable entry conditions stipulated for that space. Evaluation and interpretation of these data, and development of the entry procedure, should be done by, or reviewed by, a technically qualified professional (e.g., OSHA consultation service, or certified industrial hygienist, registered safety engineer, certified safety professional, certified marine chemist, etc.) based on evaluation of all serious hazards.

(2) *Verification testing*. The atmosphere of a permit space which may contain a hazardous atmosphere should be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions. Results of testing (i.e., actual concentration, etc.) should be recorded on the permit in the space provided adjacent to the stipulated acceptable entry condition.

(3) *Duration of testing*. Measurement of values for each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.

(4) *Testing stratified atmospheres*. When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of approximately 4 feet (1.22 m) in the direction of travel and to each side. If a sampling probe is used, the entrant' s rate of progress should be slowed to accommodate the sampling speed and detector response.

(5) *Order of testing*. A test for oxygen is performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere. Combustible gasses are tested for next because the threat of fire or explosion is both more immediate and more life threatening, in most cases, than exposure to toxic gasses and vapors. If tests for toxic gasses and vapors are necessary, they are performed last.

Appendix C to §1910.146 - Examples of Permit-required Confined Space Programs

Example 1.

Workplace. Sewer entry.

Potential hazards. The employees could be exposed to the following:

Engulfment.

Presence of toxic gases. Equal to or more than 10 ppm hydrogen sulfide measured as an 8-hour time-weighted average. If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.

Presence of explosive/flammable gases. Equal to or greater than 10% of the lower flammable limit (LFL).

Oxygen Deficiency. A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.

A. Entry Without Permit/Attendant

Certification. Confined spaces may be entered without the need for a written permit or attendant provided that the space can be maintained in a safe condition for entry by mechanical ventilation alone, as provided in 1910.146(c)(5). All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter an enclosed/confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures. A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The Confined Space Pre-Entry Check List must be completed by the LEAD WORKER before entry into a confined space. This list verifies completion of items listed below. This

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

check list shall be kept at the job site for duration of the job. If circumstances dictate an interruption in the work, the permit space must be reevaluated and a new check list must be completed.

Control of atmospheric and engulfment hazards

Pumps and Lines. All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking. However, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space the provisions for entry into a permit-required confined space must be implemented.

Surveillance. The surrounding area shall be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

Testing. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. Detector tubes, alarm only gas monitors and explosion meters are examples of monitoring equipment that may be used to test permit space atmospheres. Testing shall be performed by the LEAD WORKER who has successfully completed the Gas Detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL, and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the pre-entry testing, that all hazards have been eliminated. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connecting spaces.

Entry Procedures. If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen deficiency within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. Continuous testing of the atmosphere in the immediate vicinity of the workers within the space shall be accomplished. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until a SUPERVISOR who has completed the gas detector training has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

Rescue. Arrangements for rescue services are not required where there is no attendant. See the rescue portion of section B., below, for instructions regarding rescue planning where an entry permit is required.

B. Entry Permit Required

Permits. Confined Space Entry Permit. All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter a permit-required confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures. A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The Confined Space Entry Permit must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of items listed below. This permit shall be kept at the job site for the duration of the job. if circumstances cause an interruption In the work or a change in the alarm conditions for which entry was approved, a new Confined Space Entry Permit must be completed.

Control of atmospheric and engulfment hazards

Surveillance. The surrounding area shall be surveyed to avoid hazards such as drifting vapors from tanks, piping or sewers.

Testing. The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the SUPERVISOR who has successfully completed the gas detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

site for the duration of the job. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connected spaces.

Space Ventilation. Mechanical ventilation systems, where applicable, shall be set at 100% outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

Entry Procedures. The following procedure shall be observed under any of the following conditions: 1.) Testing demonstrates the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels; 2.) The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop; 3.) It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or 4.) An emergency exists and it is not feasible to wait for preentry procedures to take effect.

All personnel must be trained. A self contained breathing apparatus shall be worn by any person entering the space. At least one worker shall stand by the outside of the space ready to give assistance in case of emergency. The standby worker shall have a self contained breathing apparatus available for immediate use. There shall be at least one additional worker within sight or call of the standby worker. Continuous powered communications shall be maintained between the worker within the confined space and standby personnel.

If at any time there is any questionable action or nonmovement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life. Local fire department rescue personnel shall be notified immediately. The standby worker may only enter the confined space in case of an emergency (wearing the self contained breathing apparatus) and only after being relieved by another worker. Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker shall attempt to remove a disabled worker via his lifeline before entering the space.

When practical, these spaces shall be entered through side openings-those within 31/2 feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the space.

In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued.

When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division I rated per National Electrical Code and no ignition sources shall be introduced into the area.

Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new confined space permit issued.

Rescue. Call the fire department services for rescue. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

Example 2.

Workplace. Meat and poultry rendering plants.

Cookers and dryers are either batch or continuous in their operation. Multiple batch cookers are operated in parallel. When one unit of a multiple set is shut down for repairs, means are available to isolate that unit from the others which remain in operation.

Cookers and dryers are horizontal, cylindrical vessels equipped with a center, rotating shaft and agitator paddles or discs. If the inner shell is jacketed, it is usually heated with steam at pressures up to 150 psig (1034.25 kPa). The rotating shaft assembly of the continuous cooker or dryer is also steam heated.

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

Potential Hazards. The recognized hazards associated with cookers and dryers are the risk that employees could be:

1. Struck or caught by rotating agitator;

2. Engulfed in raw material or hot, recycled fat;

3. Burned by steam from leaks into the cooker/dryer steam jacket or the condenser duct system if steam valves are not properly closed and locked out;

4. Burned by contact with hot metal surfaces, such as the agitator shaft assembly, or inner shell of the cooker/dryer;

5. Heat stress caused by warm atmosphere inside cooker/dryer;

6. Slipping and falling on grease in the cooker/dryer;

7. Electrically shocked by faulty equipment taken into the cooker/dryer;

8. Burned or overcome by fire or products of combustion; or

9. Overcome by fumes generated by welding or cutting done on grease covered surfaces.

Permits. The supervisor in this case is always present at the cooker/dryer or other permit entry confined space when entry is made. The supervisor must follow the pre-entry isolation procedures described in the entry permit in preparing for entry, and ensure that the protective clothing, ventilating equipment and any other equipment required by the permit are at the entry site.

Control of hazards. Mechanical. Lock out main power switch to agitator motor at main power panel. Affix tag to the lock to inform others that a permit entry confined space entry is in progress.

Engulfment. Close all valves in the raw material blow line. Secure each valve in its closed position using chain and lock. Attach a tag to the valve and chain warning that a permit entry confined space entry is in progress. The same procedure shall be used for securing the fat recycle valve.

Burns and heat stress. Close steam supply valves to jacket and secure with chains and tags. Insert solid blank at flange in cooker vent line to condenser manifold duct system. Vent cooker/dryer by opening access door at discharge end and top center door to allow natural ventilation throughout the entry. If faster cooling is needed, use an portable ventilation fan to increase ventilation. Cooling water may be circulated through the jacket to reduce both outer and inner surface temperatures of cooker/dryers faster. Check air and inner surface temperatures in cooker/dryer to assure they are within acceptable limits before entering, or use proper protective clothing.

Fire and fume hazards. Careful site preparation, such as cleaning the area within 4 inches (10.16 cm) of all welding or torch cutting operations, and proper ventilation are the preferred controls. All welding and cutting operations shall be done in accordance with the requirements of 29 CFR Part 1910, Subpart 0, OSHA' s welding standard. Proper ventilation may be achieved by local exhaust ventilation, or the use of portable ventilation fans, or a combination of the two practices.

Electrical shock. Electrical equipment used in cooker/dryers shall be in serviceable condition.

Slips and falls. Remove residual grease before entering cooker/dryer.

Attendant. The supervisor shall be the attendant for employees entering cooker/dryers.
Permit. The permit shall specify how isolation shall be done and any other preparations needed before making entry. This is especially important in parallel arrangements of cooker/dryers so that the entire operation need not be shut down to allow safe entry into one unit.

Rescue. When necessary, the attendant shall call the fire department as previously arranged.

Example 3.

Workplace. Workplaces where tank cars, trucks, and trailers, dry bulk tanks and trailers, railroad tank cars, and similar portable tanks are fabricated or serviced.

During fabrication these tanks and dry-bulk carriers are entered repeatedly throughout the fabrication pro-

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cess. These products are not configured identically, but the manufacturing processes by which they are made are very similar.

Sources of hazards. In addition to the mechanical hazards arising from the risks that an entrant would be Injured due to contact with components of the tank or the tools being used, there is also the risk that a worker could be injured by breathing fumes from welding materials or mists or vapors from materials used to coat the tank interior. In addition, many of these vapors and mists are flammable, so the failure to properly ventilate a tank could lead to a fire or explosion.

Control of hazards

Welding. Local exhaust ventilation shall be used to remove welding fumes once the tank or carrier is completed to the point that workers may enter and exit only through a manhole. (Follow the requirements of 29 CFR 1910, Subpart 0, OSHA' s welding standard, at all times.) Welding gas tanks may never be brought into a tank or carrier that is a permit entry confined space.

Application of interior coatings/linings. Atmospheric hazards shall be controlled by forced air ventilation sufficient to keep the atmospheric concentration of flammable materials below 10% of the lower flammable limit (LFL) (or lower explosive limit (LED, whichever term is used locally). The appropriate respirators are provided and shall be used in addition to providing forced ventilation if the forced ventilation does not maintain acceptable respiratory conditions.

Permits. Because of the repetitive nature of the entries in these operations, an “Area Entry Permit" will be issued for a 1 month period to cover those production areas where tanks are fabricated to the point that entry and exit are made using manholes.

Authorization. Only the area supervisor may authorize an employee to enter a tank within the permit area. The area supervisor must determine that conditions in the tank trailer, dry bulk trailer or truck, etc. meet permit requirements before authorizing entry.

Attendant. The area supervisor shall designate an employee to maintain communication by employer specified means with employees working in tanks to ensure their safety. The attendant may not enter any permit entry confined space to rescue an entrant or for any other reason, unless authorized by the rescue procedure and, and even then, only after calling the rescue team and being relieved by as attendant by another worker.

Communications and observation. Communications between attendant and entrant(s) shall be maintained throughout entry. Methods of communication that may be specified by the permit include voice, voice powered radio, tapping or rapping codes on tank walls, signaling tugs on a rope, and the attendant' s observation that work activities such as chipping, grinding, welding, spraying, etc., which require deliberate operator control continue normally. These activities often generate so much noise that the necessary hearing protection makes communication by voice difficult.

Rescue procedures. Acceptable rescue procedures include entry by a team of employee-rescuers, use of public emergency services, and procedures for breaching the tank. The area permit specifies which procedures are available, but the area supervisor makes the final decision based on circumstances. (Certain injuries may make it necessary to breach the tank to remove a person rather than risk additional injury by removal through an existing manhole. However, the supervisor must ensure that no breaching procedure used for rescue would violate terms of the entry permit. For instance, if the tank must be breached by cutting with a torch, the tank surfaces to be cut must be free of volatile or combustible coatings within 4 inches (10.16 cm) of the cutting line and the atmosphere within the tank must be below the LFL.

Retrieval line and harnesses. The retrieval lines and harnesses generally required under this standard are usually impractical for use in tanks because the internal configuration of the tanks and their interior baffles and other structures would prevent rescuers from hauling out injured entrants. However, unless the rescue procedure calls for breaching the tank for rescue, the rescue team shall be trained in the use of retrieval lines and harnesses for removing injured employees through manholes.

Repair or service of "used" tanks and bulk trailers

Sources of hazards. In addition to facing the potential hazards encountered in fabrication or manufacturing,

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tanks or trailers which have been in service may contain residues of dangerous materials, whether left over from the transportation of hazardous cargoes or generated by chemical or bacterial action on residues of non-hazardous cargoes.

Control of atmospheric hazards. A "used" tank shall be brought into areas where tank entry is authorized only after the tank has been emptied, cleansed (without employee entry) of any residues, and purged of any potential atmospheric hazards.

Welding. In addition to tank cleaning for control of atmospheric hazards, coating and surface materials shall be removed 4 inches (10.16 cm) or more from any surface area where welding or other torch work will be done and care taken that the atmosphere within the tank remains well below the LFL. (Follow the requirements of 29 CFR 1910, Subpart 0, OSHA' s welding standard, at all times.)

Permits. An entry permit valid for up to 1 year shall be issued prior to authorization of entry into used tank trailers, dry bulk trailers or trucks. In addition to the pre-entry cleaning requirement, this permit shall require the employee safeguards specified for new tank fabrication or construction permit areas.

Authorization. Only the area supervisor may authorize an employee to enter a tank trailer, dry bulk trailer or truck within the permit area. The area supervisor must determine that the entry permit requirements have been met before authorizing entry.

Appendix D - 1
Confined Space Entry Permit

Date & Time Issued:_____ Date and Time Expires: _____
Job site/Space I.D.: _____ Job Supervisor _____
Equipment to be worked on: _____ Work to be performed: _____

Stand-by personnel _____ _____ _____

1. Atmospheric Checks: Time _____
   Oxygen _____ %
   Explosive _____ % L.F.L.
   Toxic _____ PPM

2. Tester's signature _____

3. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded,	( )	( )	( )
disconnected, or blocked	( )	( )	( )

4. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	( )	( )
Natural Ventilation only	( )	( )	( )

5. Atmospheric check after isolation and Ventilation:

Oxygen _____	%	>	19.5	%
Explosive _____	% L.F.L.	<	10	%
Toxic _____	PPM	<	10	PPM H_2S

   Time _____
   Tester's signature _____

6. Communication procedures: _____
   _____

7. Rescue procedures: _____
   _____
   _____
   _____
   _____

8. Entry, standby, and back up persons:

	Yes	No
Sucessfully completed required training?		
Is it current?	( )	( )

9. Equipment

	N/A	Yes	No
Direct reading gas monitor - tested	( )	( )	( )
Safety harnesses and lifelines for entry and standby persons	( )	( )	( )
Hoisted equipment	( )	( )	( )
Powered communications	( )	( )	( )
SCBA's for entry and standby persons	( )	( )	( )
Protective Clothing	( )	( )	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	( )	( )	( )

10. Periodic atmospheric tests:

Oxygen	____%	Time____	Oxygen	____%	Time____
Oxygen	____%	Time____	Oxygen	____%	Time____
Explosive	____%	Time____	Explosive	____%	Time____
Explosive	____%	Time____	Explosive	____%	Time____
Toxic	____%	Time____	Toxic	____%	Time____
Toxic	____%	Time____	Toxic	____%	Time____

We have reviewed the work authorized by this permit and the information contained herein. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit Prepared By: (Supervisor) _____ _____
Approved By: (Unit Supervisor) _____ _____
Reviewed By: (Cs Operations Personnel) _____ _____
(printed name) (signature)

This permit to be kept at job site. Return job site copy to Safety Office following job completion.
Copies: White Original (Safety Office) Yellow (Unit Supervisor) Hard (Job site)

BILLING CODE 4510-26-C

Appendix D - 2

ENTRY PERMIT

PERMIT VALID FOR 8 HOURS ONLY. ALL PERMIT COPIES REMAIN AT SITE UNTIL JOB COMPLETED

DATE: - - SITE LOCATION/DESCRIPTION _____

PURPOSE OF ENTRY _____

SUPERVISOR(S) in charge of crews Type of Crew Phone #

_____

_____

COMMUNICATION PROCEDURES _____

RESCUE PROCEDURES (PHONE NUMBERS AT BOTTOM) _____

_____

*** BOLD DENOTES MINIMUM REQUIREMENTS TO BE COMPLETED AND REVIEWED PRIOR TO ENTRY ***

REQUIREMENTS COMPLETED	DATE	TIME	REQUIREMENTS COMPLETED	DATE	TIME
Lock Out/De-energize/Try-Out	_____	_____	**Full Body Harness w/"D" ring**	_____	_____
Line(s) Broken-Capped-Blank	_____	_____	**Emergency Escape Retrieval Eq**	_____	_____
Purge-Flush and Vent	_____	_____	**Lifelines**	_____	_____
Ventilation	_____	_____	Fire Extinquishers	_____	_____
Secure Area (Post and Flag)	_____	_____	Lighting (Explosive Proof)	_____	_____
Breathing Apparatus	_____	_____	Protective Clothing	_____	_____
Resuscitator - Inhalator	_____	_____	Respirator(s) (Air Purifying)	_____	_____
Standby Safety Personnel	_____	_____	Burning and Welding Permit	_____	_____

Note: Items that do not apply enter N/A in the blank.

** RECORD CONTINUOUS MONITORING RESULTS EVERY 2 HOURS **

CONTINUOUS MONITORING**	Permissible									
TEST(S) TO BE TAKEN	Entry Level									
PERCENT OF OXYGEN	**19.5% to 23.5%**	____	____	____	____	____	____	____	____	____
LOWER FLAMMABLE LIMIT	**Under 10%**	____	____	____	____	____	____	____	____	____
CARBON MONOXIDE	**+35 PPM**	____	____	____	____	____	____	____	____	____
Aromatic Hydrocarbon	+ 1 PPM * 5PPM	____	____	____	____	____	____	____	____	____
Hydrogen Cyanide	(Skin) * 4PPM	____	____	____	____	____	____	____	____	____
Hydrogen Sulfide	+ 10 PPM * 15PPM	____	____	____	____	____	____	____	____	____
Sulfer Dioxide	+ 2 PPM * 5PPM	____	____	____	____	____	____	____	____	____
Ammonia	* 35PPM	____	____	____	____	____	____	____	____	____

* Short-term exposure limit: Employee can work in the area up to 15 minutes.

\+ 8 hr. Time Weighted Avg.: Employee can work in area 8 hrs (longer with appropriate respiratory protection).

Remarks: _____

GAS TESTER NAME & CHECK #	INSTRUMENT(S) USED	MODEL &/OR TYPE	SERIAL &/OR UNIT #
_____	_____	_____	_____
_____	_____	_____	_____

SAFETY STANDBY PERSON IS REQUIRED FOR ALL CONFINED SPACE WORK

SAFETY STANDBY PERSON(S)	CHECK #	CONFINED SPACE ENTRANT(S)	CHECK #	CONFINED SPACE ENTRANT(S)	CHECK #
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

SUPERVISOR AUTHORIZATION -- ALL CONDITIONS SATISFIED _____ DEPARTMENT/PHONE _____

AMBULANCE 2800 FIRE 2900 Safety 4901 Gas Coordinator 4529/5387

BILLING CODE 4510-26-C

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

Appendix E to §1910.146 - Sewer System Entry

Sewer entry differs in three vital respects from other permit entries; first, there rarely exists any way to completely isolate the space (a section of a continuous system) to be entered; second, because isolation is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer, and third, experienced sewer workers are especially knowledgeable in entry and work in their permit spaces because of their frequent entries. Unlike other employments where permit space entry is a rare and exceptional event, sewer workers' usual work environment is a permit space.

(1) Adherence to procedure. The employer should designate as entrants only employees who are thoroughly trained in the employer' s sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries.

(2) Atmospheric monitoring. Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions are encountered: Oxygen concentration less than 19.5 percent; flammable gas or vapor at 10 percent or more of the lower flammable limit (LFL); or hydrogen sulfide or carbon monoxide at or above 10 ppm or 35 ppm, respectively, measured as an 8-hour time-weighted average. Atmospheric monitoring equipment needs to be calibrated according to the manufacturer' s instructions. The oxygen sensor/broad range sensor is best suited for initial use in situations where the actual or potential contaminants have not been identified, because broad range sensors, unlike substance-specific sensors, enable employers to obtain an overall reading of the hydrocarbons (flammables) present in the space. However, such sensors only indicate that a hazardous threshold of a class of chemicals has been exceeded. They do not measure the levels of contamination of specific substances. Therefore, substance-specific devices, which measure the actual levels of specific substances, are best suited for use where actual and potential contaminants have been identified. The measurements obtained with substance-specific devices are of vital importance to the employer when decisions are made concerning the measures necessary to protect entrants (such as ventilation or personal protective equipment) and the setting and attainment of appropriate entry conditions. However, the sewer environment may suddenly and unpredictably change, and the substance-specific devices may not detect the potentially lethal atmospheric hazards which may enter the sewer environment.

Although OSHA considers the information and guidance provided above to be appropriate and useful In most sewer entry situations, the Agency emphasizes that each employer must consider the unique circumstances, including the predictability of the atmosphere, of the sewer permit spaces in the employer' s workplace in preparing for entry. Only the employer can decide, based upon his or her knowledge of, and experience with permit spaces in sewer systems, what the best type of testing instrument may be for any specific entry operation.

The selected testing instrument should be carried and used by the entrant in sewer line work to monitor the atmosphere in the entrant' s environment and in advance of the entrant' s direction of movement, to warn the entrant of any deterioration in atmospheric conditions. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.

(3) Surge flow and flooding. Sewer crews should develop and maintain liaison, to the extent possible, with the local weather bureau and fire and emergency services in their area so that sewer work may be delayed or interrupted and entrants withdrawn whenever sewer lines might be suddenly flooded by rain or fire suppression activities, or whenever flammable or other hazardous materials are released into sewers during emergencies by industrial or transportation accidents.

(4) Special Equipment. Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as atmosphere monitoring devices with automatic audible alarms, escape self-contained breathing apparatus (ESCBA) with at least 10 minute air supply (or other NIOSH approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

Non-Mandatory Appendix F to §1910.146 - Rescue Team or Rescue Service Evaluation Criteria

(1) This appendix provides guidance to employers in choosing an appropriate rescue service. It contains criteria that may be used to evaluate the capabilities both of prospective and current rescue teams. Before a rescue team can be trained or chosen, however, a satisfactory permit program, including an analysis of all permit-required confined spaces to identify all potential hazards in those spaces, must be completed. OSHA believes that compliance with all the provisions of § 1910.146 will enable employers to conduct permit space operations without recourse to rescue services In nearly all cases. However, experience Indicates that circumstances will arise where entrants will need to be rescued from permit spaces. It is therefore Important for employers to select rescue services or teams, either on-site or off-site, that are equipped and capable of minimizing harm to both entrants and rescuers if the need arises.

(2) For all rescue teams or services, the employer' s evaluation should consist of two components: an initial evaluation, in which employers decide whether a potential rescue service or team is adequately trained and equipped to perform permit space rescues of the kind needed at the facility and whether such rescuers can respond in a timely manner, and a performance evaluation, in which employers measure the performance of the team or service during an actual or practice rescue. For example, based on the initial evaluation, an employer may determine that maintaining an on-site rescue team will be more expensive than obtaining the services of an off-site team, without being significantly more effective, and decide to hire a rescue service. During a performance evaluation, the employer could decide, after observing the rescue service perform a practice rescue, that the service' s training or preparedness was not adequate to effect a timely or effective rescue at his or her facility and decide to select another rescue service, or to form an internal rescue team.

A. Initial Evaluation

i. The employer should meet with the prospective rescue service to facilitate the evaluations required by § 1910.146(k)(1)(1) and § 1910.146(k)(1)(ii). At a minimum, if an off-site rescue service is being considered, the employer must contact the service to plan and coordinate the evaluations required by the standard. Merely posting the service' s number or planning to rely on the 911 emergency phone number to obtain these services at the time of a permit space emergency would not comply with paragraph (k)(1) of the standard.

ii. The capabilities required of a rescue service vary with the type of permit spaces from which rescue may be necessary and the hazards likely to be encountered in those spaces. Answering the questions below will assist employers in determining whether the rescue service is capable of performing rescues in the permit spaces present at the employer' s workplace.

1. What are the needs of the employer with regard to response time (time for the rescue service to receive notification, arrive at the scene, and set up and be ready for entry)? For example, if entry is to be made into an IDLH atmosphere, or into a space that can quickly develop an IDLH atmosphere (if ventilation fails or for other reasons), the rescue team or service would need to be standing by at the permit space. On the other hand, if the danger to entrants is restricted to mechanical hazards that would cause injuries (e.g., broken bones, abrasions) a response time of 10 or 15 minutes might be adequate.

2. How quickly can the rescue team or service get from its location to the permit spaces from which rescue may be necessary? Relevant factors to consider would include: the location of the rescue team or service relative to the employer' s workplace, the quality of roads and highways to be traveled, potential bottlenecks or traffic congestion that might be encountered in transit, the reliability of the rescuer' s vehicles, and the training and skill of its drivers.

3. What is the availability of the rescue service? Is it unavailable at certain times of the day or in certain situations? What is the likelihood that key personnel of the rescue service might be unavailable at times? If the rescue service becomes unavailable while an entry is underway, does it have the capability of notifying the employer so that the employer can instruct the attendant to abort the entry immediately?

4. Does the rescue service meet all the requirements of paragraph (k)(2) of the standard? If not, has it developed a plan that will enable it to meet those

requirements in the future? If so, how soon can the plan be implemented?

5. For off-site services, is the service willing to perform rescues at the employer's workplace? (An employer may not rely on a rescuer who declines, for whatever reason, to provide rescue services.)

6. Is an adequate method for communications between the attendant, employer and prospective rescuer available so that a rescue request can be transmitted to the rescuer without delay? How soon after notification can a prospective rescuer dispatch a rescue team to the entry site?

7. For rescues into spaces that may pose significant atmospheric hazards and from which rescue entry, patient packaging and retrieval cannot be safely accomplished in a relatively short time (15-20 minutes), employers should consider using airline respirators (with escape bottles) for the rescuers and to supply rescue air to the patient If the employer decides to use SCBA, does the prospective rescue service have an ample supply of replacement cylinders and procedures for rescuers to enter and exit (or be retrieved) well within the SCBA's air supply limits?

8. If the space has a vertical entry over 5 feet in depth, can the prospective rescue service properly perform entry rescues? Does the service have the technical knowledge and equipment to perform rope work or elevated rescue, if needed?

9. Does the rescue service have the necessary skills in medical evaluation, patient packaging and emergency response?

10. Does the rescue service have the necessary equipment to perform rescues, or must the equipment be provided by the employer or another source?

B. Performance Evaluation

Rescue services are required by paragraph (k)(2)(iv) of the standard to practice rescues at least once every 12 months, provided that the team or service has not successfully performed a permit space rescue within that time. As part of each practice session, the service should perform a critique of the practice rescue, or have another qualified party perform the critique, so that deficiencies in procedures, equipment, training, or number of personnel can be identified and corrected. The results of the critique, and the corrections made to respond to the deficiencies identified, should be given to the employer to enable it to determine whether the rescue service can quickly be upgraded to meet the employer's rescue needs or whether another service must be selected. The following questions will assist employers and rescue teams and services evaluate their performance.

1. Have all members of the service been trained as permit space entrants, at a minimum, Including training in the potential hazards of all permit spaces, or of representative permit spaces, from which rescue may be needed? Can team members recognize the signs, symptoms, and consequences of exposure to any hazardous atmospheres that may be present in those permit spaces?

2. Is every team member provided with, and properly trained in, the use and need for PPE, such as SCBA or fall arrest equipment, which may be required to perform permit space rescues in the facility? Is every team member properly trained to perform his or her functions and make rescues, and to use any rescue equipment, such as ropes and backboards, that may be needed in a rescue attempt?

3. Are team members trained in the first aid and medical skills needed to treat victims overcome or injured by the types of hazards that may be encountered in the permit spaces at the facility?

4. Do all team members perform their functions safely and efficiently? Do rescue service personnel focus on their own safety before considering the safety of the victim?

5. If necessary, can the rescue service properly test the atmosphere to determine if it is IDLH?

6. Can the rescue personnel identify information pertinent to the rescue from entry permits, hot work permits, and MSDSs?

7. Has the rescue service been informed of any hazards to personnel that may arise from outside the space, such as those that may be caused by future work near the space?

8. If necessary, can the rescue service properly package and retrieve victims from a permit space that has a limited size opening (less than 24 inches (60.9 cm)

APPENDIX A – FEDERAL REGISTER - PERMIT-REQUIRED CONFINED SPACES

in diameter), limited internal space, or internal obstacles or hazards?

9. If necessary, can the rescue service safely perform an elevated (high angle) rescue?

10. Does the rescue service have a plan for each of the kinds of permit space rescue operations at the facility? Is the plan adequate for all types of rescue operations that may be needed at the facility? Teams may practice in representative spaces, or in spaces that are "worst-case" or most restrictive with respect to internal configuration, elevation, and portal size. The following characteristics of a practice space should be considered when deciding whether a space is truly representative of an actual permit space:

(1) Internal configuration.

(a) Open - there are no obstacles, barriers, or obstructions within the space. One example is a water tank.

(b) Obstructed - the permit space contains some type of obstruction that a rescuer would need to maneuver around. An example would be a baffle or mixing blade. Large equipment, such as a ladder or scaffold, brought into a space for work purposes would be considered an obstruction if the positioning or size of the equipment would make rescue more difficult.

(2) Elevation.

(a) Elevated - a permit space where the entrance portal or opening is above grade by 4 feet or more. This type of space usually requires knowledge of high angle rescue procedures because of the difficulty in packaging and transporting a patient to the ground from the portal.

(b) Non-elevated - a permit space with the entrance portal located less than 4 feet above grade. This type of space will allow the rescue team to transport an injured employee normally.

(3) Portal size.

(a) Restricted - A portal of 24 inches or less in the least dimension. Portals of this size are too small to allow a rescuer to simply enter the space while using SCBA. The portal size is also too small to allow normal spinal immobilization of an injured employee.

(b) Unrestricted - A portal of greater than 24 inches in the least dimension. These portals allow relatively free movement into and out of the permit space.

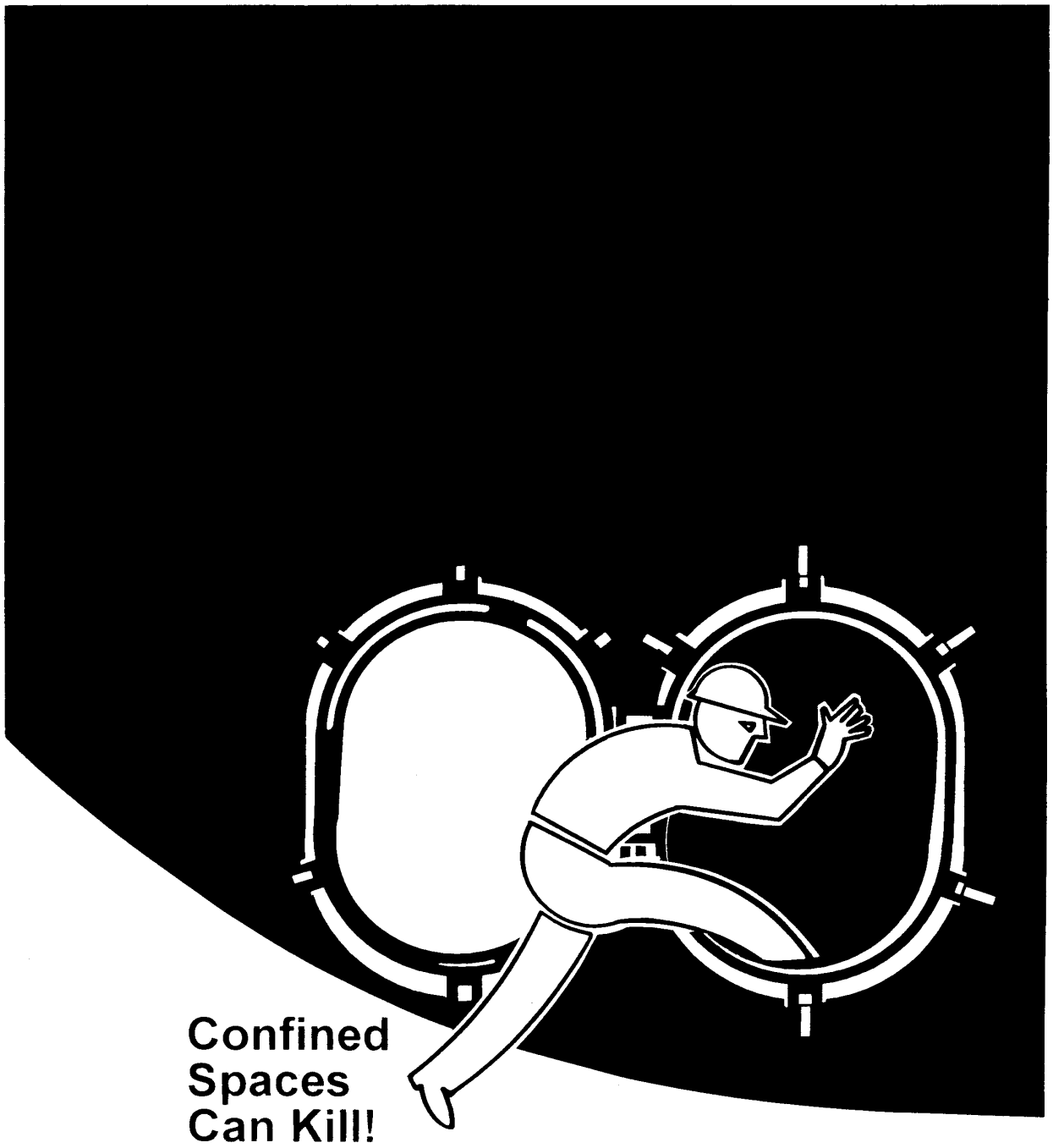
4) Space access.

(a) Horizontal - The portal is located on the side of the permit space. Use of retrieval lines could be difficult.

(b) Vertical - The portal is located on the top of the permit space, so that rescuers must climb down, or the bottom of the permit space, so that rescuers must climb up to enter the space. Vertical portals may require knowledge of rope techniques, or special patient packaging to safely retrieve a downed entrant.

[58 FR 4549, Jan. 14, 1993; 58 FR 34845, June 29, 1993, as amended at 59 FR 26114, May 19,1994; 63 FR 66018, December 01, 1998]

APPENDIX B - "PERMIT-REQUIRED CONFINED SPACE" POSTER



A copy of this poster can be obtained by contacting the nearest DOSH office listed on page viii.

APPENDIX C - CONFINED SPACE AND PERMIT-REQUIRED CONFINED SPACE RECOGNITION FORM

Part I		**Yes**	**No**
1	Is the space large enough so an employee can bodily enter and perform work?		
2	Does the space have limited or restricted means for entry and exit?		
3	Is the space designed for occupancy?		

Refer to Section II, pages 32-46, for additional clarification and assistance. If the answers to items 1 and 2 are yes and item 3 is no, then you have identified the space as a confined space. If this criteria has not been met, then the space is not considered a confined space and no further action is needed. Continue to Part II if a confined space has been identified to determine if it is a permit-required confined space.

Part II		**Yes**	**No**
1	Does the space contain or potentially contain a hazardous atmosphere?		
2	Does the space contain any chemicals or chemical residues?		
3	Does the space contain any flammable/combustible substances?		
4	Does the space contain or potentially contain any decomposing organic matter?		
5	Does the space have any materials that can trap or potentially trap, engulf, or drown an entrant? Does the space have any pipes that bring chemicals into it?		

APPENDIX C - CONFINED SPACE AND PERMIT-REQUIRED CONFINED SPACE RECOGNITION FORM

		Yes	No
6	Is vision obscured by dust at 5 feet or less? Does the space have any materials that can trap or potentially trap, engulf, or drown an entrant?		
7	Does the space contain any mechanical equipment servicing the space? Is vision obscured by dust at 5 feet or less?		
8	Does the space have converging walls, sloped floors or tapered floor to smaller cross-sections which could trap or asphyxiate an entrant (Entrapment Hazard)? Does the space contain any mechanical equipment servicing the space?		
9	Does the space have converging walls, sloped floors or tapered floor to smaller cross-sections, which could trap or asphyxiate an entrant (Entrapment Hazard)?		
10	Does the tank or vessel contain rusted interior surfaces?		
11	Does the space contain thermal hazards (e.g., extreme hot or cold)?		
12	Does the space contain excessive noise levels that could interfere with communication with an attendant?		
13	Does the space present any slip, trip, or fall hazards?		
14	Are there any operations conducted near the space opening which could present a hazard to entrants?		
15	Are there any hazards from falling objects?		
16	Are cleaning solvents or paints going to be used in the space?		

APPENDIX C - CONFINED SPACE AND PERMIT-REQUIRED CONFINED SPACE RECOGNITION FORM

		Yes	No
17	Is welding, cutting, brazing, riveting, scraping, or sanding going to be performed in the space?		
18	Does the space have poor natural ventilation that would allow an atmospheric hazard to develop? Is electrical equipment located in or required to be used in the space?		
19	Are there any corrosives which could irritate the eyes in the space? Does the space have poor natural ventilation that would allow an atmospheric hazard to develop?		
20	Are there any conditions which could prevent any entrants' self rescue from the space? Are there any corrosives which could irritate the eyes in the space?		
21	Are there any substances used in the space which have acute hazards? Are there any conditions which could prevent any entrants' self rescue from the space?		
22	Is mechanical ventilation needed to maintain a safe environment? Are there any substances used in the space which have acute hazards?		
23	Is air monitoring necessary to ensure the space is safe for entry due to a potential hazardous atmosphere? Is mechanical ventilation needed to maintain a safe environment?		
24	Are residues going to be scraped off the interior surfaces of the vessel? Will entry be made into a diked area where the dike is 5 feet or more in height? Is air monitoring necessary to ensure the space is safe for entry due to a potential hazardous atmosphere?		
25	Are non-sparking tools required to remove residues? Are residues going to be scraped off the interior surfaces of the vessel? Will entry be made into a diked area where the dike is 5 feet or more in height?		

APPENDIX C - CONFINED SPACE AND PERMIT-REQUIRED CONFINED SPACE RECOGNITION FORM

		Yes	No
26	Does the space restrict mobility to the extent that it could trap an entrant? Are non-sparking tools required to remove residues? Are residues going to be scraped off the interior surfaces of the vessel?		
27	Is respiratory protection required because of a hazardous atmosphere? Does the space restrict mobility to the extent that it could trap an entrant? Are non-sparking tools required to remove residues?		
28	Does the space present a hazard other than those noted above which would make it a permit space? Is respiratory protection required because of a hazardous atmosphere? Does the space restrict mobility to the extent that it could trap an entrant?		
29	Does the space present a hazard other than those noted above which would make it a permit space? Is respiratory protection required because of a hazardous atmosphere?		
30	Does the space present a hazard other than those noted above which would make it a permit space?		

Note to the Employer: If any of the questions in Part II have been checked yes, the confined space is a permit-required confined space. As such, entry into these spaces must be performed under the protection of a full permit-required confined space program. Note that in some situations, alternative procedures or reclassifying to a non-permit space may be possible in lieu of a full permit-required confined space.

APPENDIX D - ALTERNATIVE PROCEDURE WORKSHEET

Note to the Employer: This work sheet is intended to provide written certification that the permit space qualifies for alternative procedures and verified that the space is safe for entry. This checklist should be augmented with any relevant information for this certification process.

1) a) Permit Space Location _____

b) What is the size (volume) and configuration of the space? _____

2) a) Have employees received permit space training? Yes ___ No ___

b) Has the certifier received permit space training? Yes ___ No ___

3) a) What tasks are to be performed during the entry operation? _____
_____

b) Is a hazardous atmosphere the only hazard of concern? Yes ___ No ___
If no, alternative procedures cannot be used.

4) Does the atmospheric hazard in the space have the potential to create high temperatures or high pressures? Yes ___ No ___
If yes, take appropriate action before removing cover.

5) Are conditions safe to remove cover? Yes ___ No ___
If no, cover removal is prohibited.

6) After cover removal, is opening properly guarded? Yes ___ No ___
List guarding methods.

7) a) Continuous forced air ventilation provided? Yes ___ No ___
If no, explain why _____
_____
If yes, explain capacity (CFM) air exchange rate _____
_____

b) Minimum ventilation duration prior to allowing entry _____
_____

Note: Refer to Section III for information on ventilation systems and appropriate calculations. Conduct pre-entry atmospheric testing and continue to ventilate the space during the entire entry operation.

APPENDIX D - ALTERNATIVE PROCEDURE WORKSHEET

8) Atmospheric Testing Record

Substance	Acceptable Level	Readings						
Oxygen	19.5% - 23.5%							
Explosive (Gas/Vapor)	<10%LFL							
Explosive Dust	<LFL (5 ft. Visibility)							
Carbon Monoxide	50 ppm							
Hydrogen Sulfide	10 ppm							

9) Is atmospheric testing equipment calibrated? Yes ___ No ___
Date of calibration _____

10) Does inspection of interior have to be conducted to see if hazards exist? Yes ___ No ___
If yes, full entry program is required.

11) a) Is frequent or periodic testing performed? Yes ___ No ___
If no, explain why _____
_____

b) Who is to perform frequent or periodic monitoring?_____

12) a) If a hazardous atmosphere is detected during entry, have employees been instructed to evacuate immediately? Yes ___ No ___

b) Is there a procedure to reevaluate the space if a hazardous atmosphere does develop? Yes ___ No ___
Describe procedure. _____
_____

c) Have steps been taken to prevent employees from re-entering the space until it is proven to be safe? Yes ___ No ___
List steps:_____
_____

APPENDIX D - ALTERNATIVE PROCEDURE WORKSHEET

13) Have employees or their authorized representatives had the opportunity to review the data to support use of alternative procedures? Yes ___ No ___

_____ _____

Signature of Certifying Individual Date

APPENDIX E - RECLASSIFY PERMIT SPACE WORKSHEET

1) Permit Space Location _____

2) Have employees received permit space training? Yes ___ No ___

3) a. Are any hazardous atmospheres present or potentially present? Yes ___ No ___

b. Is continuous forced air ventilation needed to maintain acceptable levels? Yes ___ No ___

c. Is air monitoring required? If yes, record test results. Yes ___ No ___

ATMOSPHERIC TESTING RECORD

SUBSTANCE	ACCEPTABLE LEVEL	READINGS						
Oxygen	19.5% - 23.5%							
Explosive (Gas/Vapor)	<10% LFL							
Explosive Dust	<LFL (5 ft. Visibility)							
Carbon Monoxide	50 ppm							
Hydrogen Sulfide	10 ppm							

d. Is atmospheric testing equipment calibrated? Yes ___ No ___
Date of calibration _____

Note to the Employer #1: If hazardous atmospheres are present or ventilation is needed to control levels, then reclassifying the space is not possible. It is necessary to eliminate the atmospheric hazard to reclassify (See Note to the Employer #2).

4) Is an engulfment hazard present? Yes ___ No ___
If yes, what control measure is used to eliminate the engulfment hazard? _____
_____

APPENDIX E - RECLASSIFY PERMIT SPACE WORKSHEET

5) Is there an entrapment hazard? Yes ___ No ___
If yes, then list the steps to be taken to eliminate the hazard. _____
_____

6) Have all hazardous energy sources (including chemical and physical hazards) been eliminated? Yes ___ No ___
Check isolating methods used to eliminate the hazard(s).

- ☐ de-energize equipment
- ☐ locking out electrical circuits and related training provided
- ☐ tagging out electrical circuits and related training provided
- ☐ physically block machinery so it cannot move
- ☐ blank or blinds
- ☐ double block and bleed
- ☐ locking and/or tagging valves
- ☐ disconnecting lines
- ☐ other procedures, be specific

Note to the Employer: The above listed isolation techniques are generally used in combination to ensure elimination of the hazard(s).

Is it necessary to enter the permit space to determine if the hazard has been eliminated? Yes ___ No ___
If yes, then the entry must be performed in accordance with a full PRCS program, paragraphs (d) through (k).

Note to the Employer #2: Permit spaces that contain or have the potential to contain hazardous atmospheres may also be reclassified as non-permit spaces if the source of the hazardous atmosphere can be eliminated during the entire entry operation. After the space is isolated, purged, and ventilated from outside, if it must be entered to test the atmosphere and inspect conditions within the space in order to ensure that the hazards have indeed been eliminated. This entry must be conducted in accordance with the full permit space program requirements given in paragraphs (d) through (k). (Once again, control of a hazardous atmosphere is not the same as its elimination.) This reclassification would also be valid only as long as the hazards remain eliminated.

APPENDIX E - RECLASSIFY PERMIT SPACE WORKSHEET

7) Have all employees who will enter the declassified space been instructed to immediately evacuate the space if a hazard is detected? Yes ___ No ___
If no, instruct employees of this safety precaution measure.

8) Has a procedure been instituted to re-evaluate the space and reclassify it back to a permit space if the need arises? Yes ___ No ___
If no, then institute steps to properly re-evaluate the space, prohibit entry, and if necessary, reclassify it back to a permit space.
If yes, describe procedure. _____

9) Have all employees participating in the entry operation, or their authorized representatives had an opportunity to review this safe entry certification form? Yes ___ No ___

_____ _____
Signature of Certifying Individual Date

APPENDIX F - PERMIT-REQUIRED CONFINED SPACE (PRCS) PROGRAM WORKSHEET

Permit Space Location: _____

HAZARDS	ACCEPTABLE ENTRY CONDITIONS

EQUIPMENT	REQUIRED?	TYPE
Air Testing Monitor	Yes _ No _	
Forced Air Ventilation	Yes _ No _	
Communication	Yes X	
Lighting	Yes _ No _	
Barriers	Yes _ No _	
Entry/Egress (e.g., ladders)	Yes _ No _	
Rescue Equipment	Yes _ No _	
Respirator	Yes _ No _	
Other Equipment	Yes _ No _	

APPENDIX F - PERMIT-REQUIRED CONFINED SPACE (PRCS) PROGRAM WORKSHEET

Methods to Prevent Unauthorized Entry: _____
_____
_____

Specific Space Entry Procedures: _____
_____
_____

Designate Required Personnel

Authorized Entrant' s Name(s): _____
_____
_____

Duties: _____
_____
_____

Attendant' s Name(s): _____
_____

Duties: _____
_____
_____

Is one attendant monitoring multi-spaces at the same time? Yes ___ No ___

If yes, 1) list method(s) to monitor multi-spaces:
_____
_____

2) Provide procedure(s) to respond to an emergency and still be able to ensure the safety of other spaces:
_____
_____

Entry Supervisor' s Name(s): _____
_____

Duties: _____
_____
_____

APPENDIX F - PERMIT-REQUIRED CONFINED SPACE (PRCS) PROGRAM WORKSHEET

Air Monitor' s Name: _____

Duties: _____
_____
_____

Entry Permit: Company Representative's Name _____ will provide entry permits for PRCS operations. All entry permits will be completed by the entry supervisor authorizing entry. Upon cancellation of the entry permit by the entry supervisor, the entry permit will be returned to Company Representative's Name _____.

Procedures for Summoning Rescue and Emergency Services:
_____
_____
_____
_____

Multi-Employer Permit Space Entry Operation? Yes ___ No ___
If yes, develop procedures to coordinate entry operations.
_____
_____

List measures taken to close entry portal and return the space to normal operating conditions.
_____
_____
_____

Company Representative's Name _____ will review entry operations if measures taken did not fully protect employees (see 1910.146(d)(13)).

Company Representative's Name _____ will conduct a review of the permit program at least annually utilizing cancelled entry permits. Any inadequacies will be corrected.

APPENDIX F-1 -- SAMPLE COPY OF A PERMIT-REQUIRED CONFINED SPACE PROGRAM WORK SHEET

Permit Space Location: Reactor Vessel #1, Production Department, Main Building

Hazards:		**Acceptable Entry Conditions:**
Oxygen Deficiency		19.5-23.5%
Flammable Substances	--Toluene	Toluene (LEL 1.3%)<10%
	--Acetone	Cleaning Solvent (Acetone) (LEL 2.6%)<10%
Toxic Substances	--Toluene	<150 ppm-15 min. STEL <100 ppm-8 hour PEL
	-- Acetone	<1000 ppm-15 min. STEL <750 ppm-8 hour PEL
Mechanical/Engulfment-Mixer	-- Isolate Space	Lockout/Tagout/Block
Raw Product Line	-- Isolate Space	Disconnect Lines
Toluene	-- Isolate Space	Purge, Clean, Ventilate

Required Equipment:

- 0_2 and Combustible Gas Meter
- Detector Tubes (toluene, acetone)
- Explosion-Proof Fan for Forced-Air Ventilation
- Adequate Length of Hose for Ventilation
- Retrieval System (full body harness, tripod, winch)
- Isolation Equipment-locks, tags
- Air-Purifying Respirator with organic vapor Cartridges
- Self-Contained Breathing Apparatus
- Personal Protective Equipment (splash-proof goggles, Viton gloves, chemical-resistant clothing)
- Radios for Communication
- High-Pressure Steam Cleaner

Specific Space Entry Procedures:

1) Have entry supervisor obtain and complete entry permit items as necessary. Refer to this written entry program for procedures to follow. Have entry supervisor contact onsite rescue service at 7-1111 to notify them of confined space entry operation in progress.

APPENDIX F-1 -- SAMPLE COPY OF A PERMIT-REQUIRED CONFINED SPACE PROGRAM WORK SHEET

2) Isolation Procedures

a) Raw Product Line-Have employees wear chemical protective clothing, gloves, splash-proof goggles, air-purifying respirators with organic vapor cartridges. Close, lock, and tag upstream/downstream valves to the vessel. Bleed raw product residue from between valve. Misalign or remove section of pipe and cap. Use calibrated air-monitoring equipment to test valve or cap for any leaks.

b) Mixer--Lockout/Tagout mixer' s electrical source at the control box number one, switch number two. Verify that all stored energy has been dissipated from the mixer and it is disengaged by attempting to activate mixer.

c) Drain residual material from vessel.

3) Rinse space with acetone-containing solvent applied from grounded and bonded low-pressure steam cleaner then allow material to drain from the vessel. Make sure affluent line is open.

4) Allow vessel to cool, then rinse vessel with grounded and bonded high-pressure steam cleaner using soap and water solution. Allow material to drain from the vessel and allow it to cool.

5) Make sure it is safe to remove entrance cover, and use only spark-proof tools.

6) Have attendant conduct air monitoring using calibrated equipment. Test vessel after opening for:

a) Oxygen
b) LFL
c) Toluene
d) Acetone

7) Purge vessel with forced air ventilation for 30 minutes.

8) Retest atmospheric conditions. If hazardous atmosphere exists, repeat cleaning and purging procedures.

9) Perform continuous forced air ventilation for duration of entry operation.

10) Check and set up equipment. Have authorized entrant wear personal protective equipment and full-body harness with retrieval line attached.

APPENDIX F-1 -- SAMPLE COPY OF A PERMIT-REQUIRED CONFINED SPACE PROGRAM WORK SHEET

11) Have entry supervisor inspect operation and provide authorization for entry. Post completed and signed entry permit near entrance for employees to review.

12) Conduct additional pre-entry test and have attendant conduct continuous monitoring for duration of entry operation.

13) Complete work inside the vessel and ensure all authorized entrants have exited from the space.

14) Notify entry supervisor for cancellation of the entry permit.

15) Return space to normal operation.

16) Return cancelled permit to Safety Manager.

Designate Required Personnel

Authorized Entrant' s Name(s): Individual' s Name
Duties: Know hazards, use equipment properly, communicate with attendant, and alert attendant of any hazards, exit quickly if ordered to do so.

Attendant' s Name(s): Individual' s Name
Duties: Know hazards of space, behavioral effects of hazards, keep tract of number of entrants, remain outside of space during entry, communicate with entrants, monitor activities outside space, summon rescue and emergency medical services, take actions to keep unauthorized entrants away from space, perform non-entry rescues, and do no other duties while monitoring entrants.

Entry Supervisor' s Name(s): Individual' s Name
Duties: Know hazards of the space, verify that acceptable entry conditions exist, terminate entry operations, verify that rescue service is available, remove unauthorized persons from area, and ensure acceptable entry conditions are maintained at appropriate intervals.

APPENDIX F-1 -- SAMPLE COPY OF A PERMIT-REQUIRED CONFINED SPACE PROGRAM WORK SHEET

Air Monitor' s Name(s): Individual' s Name

Duties: Know hazards of the space, know acceptable entry conditions, know how to properly calibrate, use, maintain, and understand limitations of the air sampling device, know how to properly interpret the results obtained from the device.

Entry Permit: Company Representative's Name _____ will provide entry permits for PRCS operations. All entry permits will be completed by the entry supervisor authorizing entry. Upon cancellation of the entry permit by the entry supervisor, the entry permit will be returned to Company Representative's Name _____.

Procedures for Summoning Rescue and Emergency Services: Rescue services will be on-site for the duration of the entry operation. Attendant will use walkie-talkie radio to contact security officer, who will contact on-site emergency services at 7-1111.

Multi-Employer Permit Space Entry Operation? Yes ___ No ___
If yes, develop procedures to coordinate entry operation.
_____
_____

List measures taken to close entry portal and return the space to normal operating conditions:

Attendant will ensure all entrants have vacated the space by checking their names off the entry permit.

The entry supervisor will verify that the entry operation is complete and terminate the entry permit. The entry supervisor will also check to ensure that the entry portal is replaced properly and that the vessel is returned to normal operating conditions. The entry supervisor will also notify the on-site rescue services that the confined space entry operation has been completed.

Mr. Jones, Safety Manager, will review entry operations if measures taken did not fully protect employees.

Mr. Jones, Safety Manager, will conduct a review of the permit program at least annually utilizing cancelled entry permits. Any inadequacies will be corrected.

APPENDIX F-1 -- SAMPLE COPY OF A PERMIT-REQUIRED CONFINED SPACE PROGRAM WORK SHEET

Note to the Employer: This sample copy of a completed Permit-Required Confined Space Program Work Sheet is intended to give employers an idea of what types of information is helpful in completing this form. The procedures outlined are merely examples and should not be expected to be the correct protocol for each permit space entry operation. The employer is reminded that the information provided in their program should be as specific as possible to be beneficial to entry team members. For example, more specific list of duties for PRCS team members is likely needed to be appropriate.

APPENDIX G - HOST EMPLOYER' S RESPONSIBILITIES WITH CONTRACTOR - WORKSHEET

In accordance with the requirements of the OSHA Permit-Required Confined Space Standard 1910.146, this information is being made available to Name of Contracting Company so they can take appropriate precautions to protect their employees during a PRCS operation. The following is a list of permit space locations, their identified hazards, and any precautions taken by our firm.

LOCATION	HAZARD	PRECAUTIONS TAKEN

Other applicable information concerning the permit space which may be of assistance:

Note to the Employer: A PRCS program is required for these spaces, unless alternative procedures or reclassification procedures can be utilized and certified to allow safe entry.

During the contractor' s PRCS operation our employees

___ Will
___ Will not

be involved in entry into or work near the permit space.

If our employees will be involved with entry into or near the permit space, then Host Employer Representative' s Name will coordinate the entry operations with the contractor.

APPENDIX G - HOST EMPLOYER' S RESPONSIBILITIES WITH CONTRACTOR - WORKSHEET

List whose permit space program will be used for entry into the space:

_____
Host Employer' s

OR

_____
Contractor's

Note to the Employer: This coordination should include a determination of whose permit program is to be used. The standard does not prohibit the host employer from requiring a contractor to use the host employer' s permit program, nor does it requir the contractor to use the host' s program. The employer may choose to condition it contract on the contractor' s compliance with the host' s program.

Debriefing conference will be held with Host Employer's Representative _____ and Contractor's Representative _____ at the completion of the entry operation. At a minimum, the following items must be covered:

Was the PRCS program adequate? Yes ___ No ___
If no, what deficiencies were noted?_____
_____
_____

Were there any hazards confronted or created *by* the entry operation (e.g., hazardous atmosphere, ventilation or testing equipment failure, unauthorized entry, etc.)? Yes ___ No ___
If yes, list circumstances and actions to be taken to prevent reoccurrence.
_____
_____
_____

APPENDIX H - CONTRACTOR' S RESPONSIBILITIES WITH HOST EMPLOYERS -- WORKSHEET

In accordance with the OSHA PRCS Standard (1910.146), Name of Contracting Company is requesting that the host employer, Name of Host Employer, provide any available PRCS hazard information for the space to be entered. Additionally, please notify Name of Contractor's Representative if you plan to have your employees work in or near the PRCS during our entry operation.

Name of Contractor' s Representative will inform you, the host employer, of the PRCS program our employees will follow during the PRCS operation. Additionally, Name of Contractor's Representative will notify you of any hazards confronted or created during our PRCS operation.

The following is a list of the hazard(s) confronted or created by the PRCS operation and the action(s) taken to correct the condition.

CONDITION	CORRECTIVE ACTION TAKEN

Note to the Contractor: List any hazards confronted by your employees during the PRCS operation. Conditions to be considered include a hazardous atmosphere, ventilation or testing equipment failure, unauthorized entry, etc.

APPENDIX I - HOT WORK PERMIT

Permit No. _____ Permit Space No. _____

Permit Valid For _____ _____ AM/PM _____ _____ AM/PM
Date Time Date Time

Location of Space

1) Hot Work to be performed:

%	Hot work to be Performed	%	Hot Work to be Performed
	Grinding		Cutting
	Heating		Brazing or Soldering
	Electrical Spark-Producing Equipment/Specify Type:		Welding/Type of Welding (Locate Cylinders outside the Permit Space)
	Space Heater (Note: Space Heaters must not be taken into spaces. Fresh warm air should be blown in when needed.)		Other Sources of ignition

2) Specify nature of work to be performed. _____

3) Pre-Entry atmospheric testing? Yes ___ No ___

Note: Frequent or continuous monitoring is required. Use Entry Permit to record results.

4) Flammable/combustible gas or liquid present? Yes ___ No ___

Flammable/combustible residue present? Yes ___ No ___

Combustible dust present? Yes ___ No ___

Note: If any item in Number 4 is marked yes, then appropriate steps must be taken to ensure no flammable or explosive hazards exist. Refer to the entry permit to record the control methods needed.

APPENDIX I - HOT WORK PERMIT

5) Is ventilation provided? Yes ___ No ___
_____ General Mechanical
_____ Localized Exhaust
Is the ventilation equipment intrinsically safe? Yes ___ No ___

6) Has the space been isolated? Yes ___ No ___

Note: Refer to entry permit for specific entry procedures that are required to be in place.

7) Is Fire-fighting equipment available? Yes ___ No ___

Type of equipment available _____
_____ Located Inside Space
_____ Located Outside Space

Have employees receive training on how to use Fire Fighting Equipment? Yes ___ No ___

Have authorized entrant(s), attendant(s), and entry supervisor(s) been given training on the potential hazards associated with performing these "Hot Work" duties? Yes ___ No ___

8) If welding in a confined space, ensure the following:
a) Have welding electrodes been removed from holders during suspension of welding? Yes ___ No ___

b) Have welders been instructed to never allow gas cylinders or welding machines into the space and are they complying? Yes ___ No ___

c) Portable equipment secured? Yes ___ No ___

d) Emergency procedures in place (e.g., lifelines, rescue procedures, etc.)? Yes ___ No ___

e) Torch removed from space during suspension of welding? Yes ___ No ___

An evaluation of the permit space operation has been conducted with respect to performing "Hot Work" activities. Conditions are acceptable for the "Hot Work" to be conducted.

_____

Signature of Certifying Individual Date Time

APPENDIX J - COMMON COMBUSTIBLE SUBSTANCES

MATERIAL	L.E.L. (%/Vol.)	U.E.L. (%/Vol.)	P.E.L. (ppm)	I.D.L.H. (ppm)
Acetone	2.5	12.8	1,000	2,500
Acetylene	2.5	100.0	-A-	-A
Ammonia	15	28	50	300
Benzene	1.2	7.8	1.0	500(c)
N-Butyl Acetate	1.7	7.6	150	1,700
Cyclohexene	U	U	300	2,000
Ethanol	3.3	19.0	1,000	3,300
Ethyl Acetate	2.0	11.5	400	2,000
Ethyl Ether	1.9	36.0	400	1,900
Ethylene Oxide	3.0	100.0	1	800(C)
Gasoline (100 Octane)	1.4	7.6	300*	-U
Heptane	1.05	6.7	500	750
Hexane	1.1	7.5	500	1,100
Isopropyl Alcohol	2.0	12.7	400	2,000
Methanol	6.0	36.0	200	6,000
Methyl Ethyl Ketone (MEK)	1.4	11.4	200	3,000
Pentane	1.5	7.8	1000	1,500
Propane	2.1	9.5	1000	2,100
Styrene	0.9	6.8	100	700
Toluene	1.1	7.1	200	500
Turpentine	0.8	-U-	100	800
Vinyl Chloride	3.6	33.0	1	-C,U
Xylene	1.1	7.0	100	900

L.E.L. = Lower Explosive Limit
U.E.L. = Upper Explosive Limit
PPM = Parts Per Million

P.E.L. = Permissible Exposure Limit (OSHA)
I.D.L.H. = Immediately Dangerous to Life & Health

>1.0 = heavier than air
-A- = Asphyxiant
-C- = Carcinogen
-U- = Data not Available
= ACGIH TLV

Data from NIOSH "Pocket Guide to Chemical Hazards (1997)"

APPENDIX K - COMMON TOXIC SUBSTANCES

CARBON MONOXIDE

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Carbonic Oxide; CAS 630-08-0.

Trade Names: Flue gas, Exhaust gas and others.

Uses: Carbon monoxide is used in metallurgical operations, in organic syntheses, and in the manufacture of metal carbonyls.

PHYSICAL INFORMATION:

Appearance: Colorless gas, may be a liquid at low temperature or high pressure.

Odor: None.

Evaporation: Liquid carbon monoxide will evaporate rapidly.

HEALTH HAZARD INFORMATION:

OSHA Standard: Average 8-hour exposure -- 50 ppm

NIOSH Recommended Limit: Average 10-Hour day/40 hour week -- 35 ppm

ACGIH Recommended Limit: Average 8-hour exposure -- 25 ppm.

Short Term Exposure:

Inhalation: Progressively increasing exposure will lead to headache, easy fatigue, irritability, impairment of judgment, confusion, fainting, unconsciousness and respiratory failure. Death has occurred after exposure to 4000 ppm for 30 minutes.

Skin: Contact with liquid carbon monoxide may cause frostbite and freezing of the skin.

Eyes: Contact with liquid carbon monoxide may cause frostbite.

Ingestion: Liquid carbon monoxide will cause frostbite and freezing.

APPENDIX K - COMMON TOXIC SUBSTANCES

Long Term Exposure:

The effects of long term exposure to low levels of carbon monoxide are not well defined. However, heart disease and nervous system damage are associated with long term exposure. Levels up to 100 ppm are considered to produce no adverse effects.

Carbon monoxide combines with the red blood cells so they cannot carry oxygen. This results in increased stress on the heart and circulatory system. Alcoholics, smokers, obese individuals and those with heart disease are more sensitive to the effects of carbon monoxide than a healthy person.

* Prepared by the Bureau of Toxic Substance Assessment, NYS Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS:

Inhalation: Get to fresh air immediately; give oxygen and artificial respiration if necessary. Seek medical attention. Do not give stimulants.

Skin: Remove soaked clothing after allowing to thaw. Seek medical attention if necessary.

Eyes: Open eyes to allow evaporation of carbon monoxide. Seek medical attention.

Ingestion: Seek medical attention.

Note to Physician: Carboxy hemoglobin levels are reliable indicators of exposure.

FIRE AND EXPLOSION INFORMATION:

General: Carbon monoxide is a flammable gas.

Explosive Limits: Upper -- 74%, Lower -- 12.5%

Extinguisher: Carbon dioxide.

REACTIVITY:

Materials to Avoid: Strong oxidizing agents such as permanganates, dichromates.

Conditions to Avoid: Sources of ignition.

APPENDIX K - COMMON TOXIC SUBSTANCES

PROTECTIVE MEASURES:

Storage and Handling: Carbon monoxide is stored in tanks under pressure. The material in the tank may be liquid or gaseous. Storage should be in a well-ventilated area away from possible sources of ignition.

Engineering Controls: Provide adequate ventilation to maintain below standard levels.

Protective Clothing (Should not be substituted for proper handling and engineering controls): If contact with liquid carbon monoxide is possible, protective coveralls, gloves and splash-proof goggles should be worn.

Protective Equipment: *For levels up to 350 ppm* use a supplied-air respirator or a self-contained breathing apparatus. *For levels up to 875 ppm* use a supplied-air respirator operated in continuous-flow mode. *For up to 1,200 ppm* use the above with a full facepiece or a gas mask with a canister providing protection against carbon monoxide. *For levels above 1,200 ppm or use in areas of unknown concentrations* use a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a combination Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. *For escape from a contaminated area* use an escape self-contained breathing apparatus or a gas mask with a canister providing protection against carbon monoxide.

PROCEDURES FOR SPILLS AND LEAKS:

Get all workers out of the area. Put on respirator and other protective clothing as needed. Using forced ventilation, maintain concentration of gas below the range of explosive mixture. Remove the tank or cylinder to an open area. Leave to bleed off into the atmosphere.

APPENDIX K - COMMON TOXIC SUBSTANCES

HYDROGEN SULFIDE

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Hydrosulfuric acid, sulfuretted hydrogen, hepatic gas; CAS 7783-06-4.

Trade Names: None found.

Occurrence: In the manufacture of chemicals, metallurgy, analytical reagent; may be by-product of certain commercial biological fermentations, such as liquid-manure systems; may occur naturally in sewers, wells and underground tanks.

PHYSICAL INFORMATION:

Appearance: Colorless gas; may be shipped or stored as a gas or liquid in compressed gas cylinders.

Odor: Similar to rotten eggs at concentrations below 30 ppm; from 30-100 ppm sickeningly sweet; many people rapidly lose the ability to detect the smell so odor is not a good warning of excess levels.

Minimum Detectable by Odor: 0.02 ppm

Evaporation: Rapid from liquid. Vapors generally sink.

HEALTH HAZARD INFORMATION:

OSHA Standard: 20 ppm.

NIOSH Recommended Limit: 10 ppm.

ACGIH Recommended Limit: Average 8-hour exposure -- 10 ppm.

Short Term Exposure: 15 ppm (ACGIH)

Inhalation: Levels of 20 ppm may cause headache, loss of appetite and dizziness. 50 ppm may cause muscle fatigue. 300 ppm may cause muscle cramps, low blood pressure, and unconsciousness after 20 minutes. Levels of 500 ppm can cause immediate loss of consciousness, slowed respiration and death in 30 to 60 minutes. At levels of 700 ppm and above respiratory paralysis and death can occur in seconds. Non-fatal cases may recover fully or may

APPENDIX K - COMMON TOXIC SUBSTANCES

experience abnormal reflexes, dizziness, sleep disturbances and loss of appetite that last for months or years.

Skin: Readily absorbed. May cause irritation, reddening and swelling. Contact with liquid can cause freezing burns.

Eyes: Irritation may be felt at levels as low as 0.1 ppm. Levels of 10 ppm and above can cause irritation, pain, tearing, and increased light sensitivity. Liquid may cause freezing burns.

Ingestion: No reported cases. Liquid may cause freezing burns.

Long Term Exposure: No effects reported.

* Prepared by the Bureau of Toxic Substance Assessment, NYS Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS:

Inhalation: Move person to fresh air. Give oxygen or artificial respiration as required. Seek medical attention, if necessary.

Skin: Remove soaked clothing. Wash affected area immediately with water for 10 minutes. Seek medical attention, if necessary.

Eyes: Flush with water for at least 15 minutes. One drop of olive oil may relieve pain. Seek medical attention, if necessary.

Ingestion: Seek medical attention, if necessary.

Note to Physician: Supportive measures for pulmonary edema may be required. Nitrites are specific antidotes but dosage must be monitored carefully.

FIRE AND EXPLOSION INFORMATION:

General: Fire and explosion hazard. Ignition temperature 260EC (500E F). Vapor may spread a great distance and flash back.

Explosive Limits: Upper -- 45.5%, Lower -- 4.5%.

Extinguisher: Use extinguisher appropriate to other burning materials. Wear proper protective equipment to shut off flow of gas.

APPENDIX K - COMMON TOXIC SUBSTANCES

REACTIVITY:

Materials to Avoid: Reacts explosively with fuming or concentrated nitric acid. Reacts strongly with most oxidizing agents, such as chlorine or permanganate. Tarnishes most metals.

Conditions to Avoid: Heat, flame and sources of ignition.

PROTECTIVE MEASURES:

Storage and Handling: Protect from physical damage. Outside or detached storage preferred. Inside storage only in cool, dry, well-ventilated area. Avoid storage with other combustibles.

Engineering Controls: Provide local exhaust ventilation as required. Sinks, showers and eyewash stations should be easily available.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Wear eye goggles, gloves and coveralls if contact is possible.

Protective Equipment: *For levels up to 100 ppm* use a supplied-air respirator or a self-contained breathing apparatus. *For levels above 100 ppm or entry into area of unknown concentration* use a self-contained breathing apparatus with full facepiece operated in a positive pressure mode or a combination Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. *For escape from a contaminated area* use an escape self-contained breathing apparatus or a gas mask providing protection against hydrogen sulfide.

PROCEDURES FOR SPILLS AND LEAKS:

Warn other workers of spill or leaks. Put on proper protective equipment. Establish ventilation. Liquid will evaporate rapidly. Take leaking cylinders to safe place out of doors. Remove all possible sources of ignition. for final disposal contact you regional office of the New York State Department of Environmental Conservation.

APPENDIX K - COMMON TOXIC SUBSTANCES

METHANE

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Methyl hydride; CAS 74-82-2.

Common Names: Marsh gas, sewer gas, fire damp, natural gas.

Uses: Constituent of illuminating and cooking gas; in the manufacture of hydrogen, hydrogen cyanide, ammonia, acetylene and formaldehyde; in organic syntheses, and others.

PHYSICAL INFORMATION:

Appearance: Colorless gas; may be a liquid under pressure or refrigeration.

Odor: None.

Behavior in Water: Slightly soluble.

HEALTH HAZARD INFORMATION:

OSHA Standard: None established.

NIOSH Recommended Limit: None established.

ACGIH Recommended Limit: None established.

Short Term Exposure:

Inhalation: Symptoms are due to a decrease in the concentration of oxygen available for breathing and include dizziness, difficult breathing, bluish color of the skin and loss of consciousness.

Skin: Contact with liquid can cause freezing burns.

Eyes: Contact with liquid can cause freezing burns.

Ingestion: Contact with liquid can cause freezing burns of mouth and throat.

Long Term Exposure: No effects reported.

APPENDIX K - COMMON TOXIC SUBSTANCES

EMERGENCY AND FIRST AIR INSTRUCTIONS:

Inhalation: Move victim to fresh air. give artificial respiration or oxygen as required. Seek medical attention if necessary.

Skin: Wash with plenty of water. do not rub affected areas. Seek medical attention if necessary.

Eyes: Wash with large amounts of water for 15 minutes. Seek medical attention if necessary.

Ingestion: Seek medical attention, if necessary.

FIRE AND EXPLOSION INFORMATION:

General: Flammable and explosive. Ignites at -306EF (-188EC). Gas can spread a considerable distance and flash back.

Explosive Limits: Upper - 15%, Lower - 5.3%. Mixture of methane and air (1:10) especially explosive.

Extinguisher: Stop flow of gas. Use dry chemical or carbon dioxide.

REACTIVITY:

Conditions to Avoid: Contact with flame or spark may cause fire or explosion.

Materials to Avoid: Reacts violently with bromine pentafluoride, chlorine dioxide, nitrogen trifluoride, liquid oxygen and oxygen difluoride.

PROTECTIVE MEASURES:

Storage and Handling: Protect against physical damage. Avoid direct sunlight. Outdoor or detached storage preferred. Store in cool, well-ventilated area away from oxidizing agents such as dichromates or permanganates.

Engineering Controls: Local exhaust ventilation. Sinks, showers and eyewash stations should be readily available.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Overalls and faceshields.

Protective Equipment: At high concentrations wear a self-contained breathing apparatus or supplied-air respirator. A personal monitor may be used.

APPENDIX K - COMMON TOXIC SUBSTANCES

PROCEDURES FOR LEAKS AND SPILLS:

Warn other workers of spill or leak. Put on proper protective clothing and equipment. By forced ventilation maintain concentration of gas below the range of explosive mixture. Remove tank or cylinder to an open area. Allow to bleed off slowly into atmosphere.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

PERMIT REQUIRED CONFINED SPACES

29 CFR 1910.146

Chronology

- ANPR for General Industry July 24, 1975 and October 19, 1979
- ANPR for Construction Industry March 25, 1980
- Public Meetings held May, 1980 in Houston, Denver, and Washington, D.C.
- General Industry Proposed Standard June 5, 1989
- Hearings held November 14 and 15, 1989 in Washington, D.C., December 5 and 6, 1989 in Houston, and January 30 - February 1, 1990 in Chicago
- Public Record closed November 9, 1990
- Final Rule published January 14, 1993; effective April 15, 1993
- Final Rule updated 12/1/98

Elements

- Scope and Application
- Definitions
- General Requirements
- Permit Space Entry Program
- Permit System
- Entry Permit
- Employee Training
- Employee Duties
- Rescue Services

Scope and Application

- Contains requirements for practices and procedures to protect employees in general Industry from the hazards of entry into permit - required confined spaces (PRCS).
- Does not apply to agriculture, construction, or shipyard employment.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

DEFINITIONS

Oxygen-Enriched Atmosphere

An atmosphere containing more than 23.5 percent oxygen by volume.

Confined Space

A space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits); and
- Is not designed for continuous employee occupancy.

Permit Required Confined Space (Permit Space)

A confined space that has one or more of the following characteristics:

- 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 which slopes and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazards.

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 to causing death or serious physical harm.

Inerting

Displacement of the atmosphere in a permit space by a non-combustible gas (such as nitrogen) to such an extent that the resulting atmosphere is non combustible.

Note: This procedure produces an IDLH oxygen deficient atmosphere.

Engulfment

The surrounding and effective capture of a person by a liquid or finely divided (flowable) 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.

Immediately Dangerous to Life or Health (IDLH)

Any condition that:

- Poses an immediate or delayed threat to life (Note: Effects of some toxic materials may be delayed 12-72 hours); or
- Would cause irreversible adverse health effects; or
- Would interfere with an individual' s ability to escape unaided from a permit space.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

Hazardous Atmosphere

An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit (LFL).
- Airborne combustible dust at a concentration that meets or exceeds its LFL.; (NOTE: Approximate condition where the dust obscures vision at a distance of 5 feet or less*);
- Oxygen concentration below 19.5% or above 23.5%;
- Concentration of any substance published in Subpart G, Occupational Health and Environmental Control, or Subpart Z, Toxic and Hazardous Substances, in excess of its dose or PEL. (Note: A concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.);
- Any other atmospheric condition that is IDLH.

_____

* "Rule-of-Thumb" criteria for informational purposes only

Entry

- The action by which a person passes through an opening into a permit-required confined space, and includes ensuing work activities in that space.
- 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 provided by the employer to allow and control entry into a permit space.
- Content of each permit is based on the employer's identification and evaluation of each hazard of that permit space, or class of spaces, and all procedures the employer requires for protecting entrants from those hazards during entry.
- Each permit contains the information specified in paragraph (f) ("Entry Permit") of this standard.

Prohibited Condition

Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

GENERAL REQUIREMENTS

- Employer decides if workplace contains a PRCS.
- If the workplace contains permit spaces, employer must inform employees of their existence and location and that they are dangerous.
- If employer decides employees will not enter permit spaces, employer must positively ensure they do not.
- If employer decides employees will enter permit spaces, employer shall develop and implement a written entry program. (Employer may use alternate entry procedures provided certain conditions and requirements are met).
- When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, employer shall, if necessary, reclassify as a permit space.

A permit space may be reclassified as a non-permit space:

- If there are no actual or potential atmospheric hazards and if all hazards within permit space are eliminated without entry, space may be reclassified for as long as the non-atmospheric hazards remain eliminated.
- If entry is required to eliminate hazards, it shall be according to regulations and space may be reclassified for as long as the hazards remain eliminated.
- Employer shall certify in writing that all hazards in permit space have been eliminated and make this document available to each entrant.
- If hazards arise in declassified permit space, employees shall exit and employer shall determine whether to reclassify space.

When host employer arranges for contractor to perform permit space work, host employer shall:

- Inform contractor of permit space entry program.
- Apprise contractor of hazards of particular permit spaces and precautions and procedures implemented for protection of employees in or near permit spaces.
- Coordinate entry operations with contractor when both will be working in or near permit spaces and debrief contractor after entries.
- Contractor shall inform the host employer of the permit program to be followed and coordinate multiple entry operations.

ALTERNATE ENTRY PROCEDURES

- Employer may use alternate entry procedures as specified in the regulation under certain conditions. If alternate entry procedures are used:

- No formal written program [requirements in paragraph (c)(5)(ii) act as a substitute written program].

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

- No permit system or permits [a written certification is required]
- No attendant or supervisor
- No rescue provisions
- Training is required

Alternate Entry Procedures Conditions

- Employer demonstrates that only hazard posed by permit space is actual or potential hazardous atmosphere.
- Employer demonstrates that continuous forced air ventilation alone is sufficient to maintain safe permit space.
- Employer develops monitoring and inspection data that supports above demonstrations.
- If initial entry necessary to obtain data, it shall be performed in accordance with this regulation.
- Determinations and supporting data shall be documented by employer and made available to entrants.
- Entry must be in accordance with requirements that follow.

Alternate Entry Procedures Requirements

- Any conditions making it unsafe to remove an entrance cover shall be eliminated before removing cover.
- When entrance covers are removed, opening shall be promptly and effectively guarded.
- Before entry, internal atmosphere shall be tested with a calibrated direct-reading instrument, for the following conditions in the order given:
  - Oxygen content
  - Flammable gases and vapors
  - Potential toxic air contaminants.
- There may be no hazardous atmosphere within the space whenever any employee is inside the space.
- Continuous forced air ventilation shall be used as follows:

– Entry not permitted until hazardous atmosphere is eliminated;

– Ventilation shall be directed to immediate areas where employees are or will be present and continue until all employees have left space;

– Air supply shall be from a clean source and may not increase hazards in space.

- Atmosphere within space shall be periodically tested as necessary to ensure that ventilation is adequate.
- If hazardous atmosphere is detected during entry:

– Each employee shall leave space immediately;

– Space shall be evaluated to determine how hazardous atmosphere developed; and

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

- Measures taken to protect employees from hazardous atmosphere before subsequent entry.
- Employer shall certify in writing that space is safe for entry and that all of the above requirements have been met.
- Certification to be available to each employee before entry.

PERMIT SPACE ENTRY PROGRAM

Permit Space Entry Program

- Prevent unauthorized entry
- Identify and evaluate hazards before entry
- Establish safe practices, such as isolation, purging, inerting, ventilation, barricades, lockout/tagout, etc.
- Provide and maintain equipment necessary for safe entry, including testing and monitoring, ventilation, communications, personal protection, lighting, barriers, ingress and egress, and rescue
- Test permit space and document results. Allow entering employee or their authorized representative the opportunity to observe the atmospheric testing.
- Maintain permit space and document results
- Provide at least one attendant outside permit space for duration of entry operations
- Identify duties of each employee and provide training
- Implement proper procedures for rescue.
- Establish written system for preparation, issuance, use and cancellation of permits.
- Coordinate entry operations during multiple employer entries.
- Review entire entry program at least annually, unless previously reviewed at conclusion of a specific entry.

PERMIT SYSTEM

Permit System

- The employer, through the permit system, shall:
- Complete and document all steps necessary for entry;
- Require initials or signature of persons completing the steps;
- Post permit at entry portal, or otherwise make available to all entrants at time of entry; and
- Ensure permit is signed by entry supervisor.
- Duration of permit may not exceed time required to complete assigned task.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

- Permit must be cancelled if a prohibited condition arises, or the work has been completed.
- Each cancelled entry permit must be retained for one year to facilitate program review.

ENTRY PERMIT

Entry Permit

Identifies:

- Permit space(s) to be entered
- Purpose of entry
- Date and authorized duration of entry permit
- Authorized entrant(s)
- Entry supervisors, by printed name and signature
- Hazards of the permit space
- Measures required to control hazards of the space
- Acceptable entry conditions
- Test results with signature or initials of tester(s)
- Rescue services, and the means to summon them
- Communication procedures and equipment
- All special equipment and procedures, including PPE and rescue equipment
- Any other information needed to ensure safe entry
- Any additional permits needed (such as for hot work)

EMPLOYEE TRAINING

Training

Employer shall provide and certify completion of training so that all affected employees acquire the understanding, knowledge, and skill necessary for the safe performance of assigned duties:

- Before employee is assigned duties under this regulation;
- Before there is a change in assigned duties;
- Whenever employer has reason to believe either that there are deviations from permit space entry procedures or inadequacies in the employee' s knowledge or use of these procedures.

EMPLOYEE DUTIES

Duties of Authorized Entrants

Employer shall ensure that all authorized entrants:

- Know the hazards that may be faced during entry, including mode, signs or symptoms, and consequences of exposure;
- Properly use all required equipment;

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

- Communicate with attendant as necessary to enable attendant to monitor status and alert entrants of need to evacuate.
- Alert attendant whenever any warning sign or symptom of exposure to a dangerous situation or a prohibited condition is detected.
- Exit from permit space as quickly as possible whenever:
  - Order to evacuate is given by attendant or entry supervisor;
  - Entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
  - Entrant detects a prohibited condition; or
  - Evacuation alarm is activated.

Duties of Attendants

Employer shall ensure that each attendant:

- Knows hazards that may be faced during entry;
- Knows possible behavioral effects of hazards;
- Continuously maintains accurate count of entrants;
- Remains outside permit space during entry operations until relieved by another attendant;
- Communicates with entrants as necessary to monitor status and alert of need to evacuate space;
- Monitors activities inside and outside space to determine if safe for entrants to remain in space and orders evacuation when necessary.
- Summons rescue and emergency services when emergency exit from permit space is necessary.
- Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:
  - Warns them to stay away;
  - Advises them to exit immediately if they have entered; and
  - Informs authorized entrants and entry supervisor if unauthorized persons enter space.
- Performs non-entry rescues per employer' s procedure;
- Performs no duties that might interfere with their primary duty to monitor and protect authorized entrants.

Duties of Entry Supervisors

Employer shall ensure that each supervisor:

- Knows hazards that may be faced during entry;
- Verifies that acceptable conditions for entry exist;
- Terminates entry when operations are completed or a prohibited condition arises.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

- Verifies that rescue services are available;
- Removes unauthorized persons who enter or attempt to enter permit space during operations;
- Determines, whenever responsible and at appropriate Intervals, that acceptable entry conditions are maintained.

RESCUE SERVICES

Rescue Services

Employers who designate rescue services must:

- Evaluate the prospective rescue service's ability to respond in a timely manner considering the hazards.
- Evaluate the prospective rescue service's ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while performing a rescue.
- Select a rescue service from those evaluated that can reach the victim(s) in an appropriate time frame and is equipped and proficient in rescue procedures.
- Inform the rescue service of the hazards they may confront;
- Provide the rescue service with access to all permit spaces so they can develop appropriate rescue plans and practice rescue operations.
- If injured entrant is exposed to substance with a required MSDS or similar document, it shall be made available to medical facility treating entrant.
- Employer may elect to use on-site or off-site team.
- An employer who's employees have been selected to provide rescue services must ensure that the affected employees:
- Must be properly trained in entry procedures, rescue procedures and PPE requirements;
- Permit space rescues must be practiced at least annually from similarly configured spaces;
- Must be trained in basic first-aid and CPR, and have at least one member currently certified.

Non-Entry Rescue

- Retrieval systems or methods shall be used whenever entry is made, unless the retrieval equipment would increase overall risk of entry or would not be of value.
- Each entrant shall use a chest or full body harness, with retrieval line attached at the center of their back near shoulder level, or above their head.

APPENDIX L - HIGHLIGHTS OF THE PERMIT-REQUIRED CONFINED SPACE STANDARD AND TRAINING GUIDES

- Wristlets may be used in lieu of the chest or full body harness if employer can show use of chest or body harness is infeasible or creates a greater hazard and that use of wristlets safest and most effective alternative.
- Other end of retrieval line shall be attached to a mechanical device or fixed point outside permit space for immediate use.
- Mechanical device shall be used to retrieve personnel from vertical type permit spaces more than 5 feet deep.

APPENDICES

Appendices
(Non-Mandatory)

Appendix A: PRCS Decision Flow Chart

Appendix B: Recommended Procedures for Atmospheric Testing

Appendix C: Examples of Acceptable Permit Space Entry Programs

Appendix D: Samples of Acceptable Permits

Appendix E: Recommended Procedures for Sewer Entry

Appendix F: Rescue Team or Rescue Service Evaluation Criteria

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

RESPIRATORY PROTECTION PROGRAM

I. PURPOSE:

A. Name of Organization _____ has established this respiratory protection program to ensure that employees are protected from exposure to respiratory hazards in the workplace, and to ensure compliance with OSHA' s Respiratory Protection Standard.

B. Engineering and administrative controls are the preferred methods of controlling hazards; however, respirators will be used under the following conditions:

1) When other controls cannot adequately control hazards;

2) Where other controls are infeasible;

3) While other controls are being implemented;

4) During emergencies.

C. Employees who are not required to wear respirators, but wish to do so:

(Check whichever apply)

☐ Will be permitted to voluntarily wear respirators if wearing a respirator will not create a hazard.

☐ Will be permitted to voluntarily wear filtering facepieces (dust masks) if their use will not create a hazard.

☐ Will not be permitted to voluntarily wear respirators.

II. SCOPE AND APPLICATION:

A. This program applies to all employees who are required to wear respirators during normal operations, during non-routine tasks, or during emergencies.

B. Name of Organization _____ will provide respirators, training, and medical (Name of organization) evaluations as required at no cost to the employees.

C. Check whichever apply:

☐ Employees who voluntarily wear respirators when respirators are not required, are covered by the medical evaluation, and cleaning, maintenance, and storage elements of the program. They will also be provided with the information in Appendix D of the OSHA standard.

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

☐ Employees who voluntarily wear filtering facepieces (dust masks) will be provided with the information in Appendix D of the OSHA standard.

III. PROGRAM ADMINISTRATOR:

_____ is responsible for administering the respiratory protection program.

IV. RESPONSIBILITIES:

A. Program administrator:

The program administrator has overall responsibility for the respiratory protection program. Duties include the following:

1) Evaluating the workplace to identify areas, processes, and tasks that require workers to wear respiratory protection;

2) Selecting the appropriate respirators;

3) Conducting training;

4) Conducting fit testing;

5) Ensuring that employees properly clean, maintain, and store respirators; 6. Ensuring that employees properly use respirators;

6) Administering the medical surveillance program;

7) Maintaining records required by the respiratory protection program; 9. Evaluating the program and its effectiveness;

8) Updating the program as necessary to reflect changes in workplace conditions that affect respirator use.

B. Supervisors:

Supervisors are responsible for ensuring that the respirator program is implemented in their departments. Supervisors' duties include the following:

1) Knowing which tasks require the use of respiratory protection;

2) Ensuring that the appropriate respirators and accessories are available for use;

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

3) Ensuring that employees receive the required training, fit-testing and medical evaluations;

4) Ensuring that employees wear the required respirators;

5) Ensuring that respirators are properly cleaned, maintained, and stored;

6) Monitoring areas, tasks and operations to identify respiratory hazards.

C. Employees:

Employees are responsible for properly wearing respirators when and where required. Employees' duties include:

1) Putting on, fit-checking, wearing, and removing respirators according to the training received;

2) Cleaning and maintaining respirators as instructed;

3) Storing respirators in a clean and sanitary location;

4) Reporting to their supervisors if their respirators no longer fit well, or if they experience any problems or difficulties while using and wearing respirators;

5) Reporting any respiratory hazards that they feel are not adequately addressed, as well as any other concerns they may have about the program.

V. RESPIRATOR SELECTION

The program administrator will select respirators based on the hazards to which workers are exposed. A hazard evaluation will be completed for each operation, process, or work area where employees may be exposed to airborne contaminants under routine or emergency conditions. (See "Worksheet for Selection of Respirator".) Only NIOSH-approved respirators will be used.

VI. MEDICAL EVALUATION

A. Before being permitted to wear a respirator, each employee who is required to wear one [or voluntarily wears a respirator other than a filtering facepiece] will be given a confidential medical evaluation to establish that s/he is able to do the work while wearing the respirator.

B. _____ will provide the medical evaluations.
(*Insert name of physician or other licensed health-care professional--PLHCP*)

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

C. The initial medical evaluation will consist of the questionnaire provided in Appendix C of the respiratory protection standard. Employees will be permitted to fill out the questionnaire on company time. As far as possible, the company will provide help in reading the questionnaire to employees who have difficulty doing so on their own. The questionnaire will be translated orally or in writing for non-English-speaking employees. If this is not possible, the employee will be sent directly to the PLHCP for medical evaluation.

D. The medical exams will be provided to employees as required by the standard, and/or as deemed necessary by the PLHCP.

E. Any employee who asks to speak to the PLHCP about his/her medical evaluation will be given an opportunity to do so.

F. The program administrator will provide the physician with the following information:

1) A list of hazardous substances found in the workplace;

2) The employee' s work area or job title;

3) Type and weight of respirator(s) the employee will be wearing;

4) Length of time the employee will wear the respirator per day;

5) Expected physical workload;

6) Potential temperature/humidity extremes;

7) Type of protective clothing to be worn.

8) A copy of this respirator program;

9) A copy of the respiratory protection standard.

G. An employee who has passed the medical evaluation will be provided with a further evaluation under the following circumstances:

1) The employee reports signs and /or symptoms related to the ability to use a respirator, such as shortness of breath, dizziness, chest pains, or wheezing;

2) The PLHCP or the employee' s supervisor informs the program administrator that the employee needs to be evaluated;

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

3) Information from this respiratory protection program, including observations made during fit-testing and program evaluation, indicates the need for re-evaluation;

4) Change occurs in workplace conditions, such as physical effort, temperature, or personal protective equipment, which may increase the physiological burden on the employee.

H. The examinations and questionnaires will remain confidential between the employee and the physician.

VII. FIT TESTING

A. Employees who are required to wear respirators will be fit tested before being allowed to wear the respirators in the workplace. The fit testing will be repeated annually, as well as any time an employee experiences a change in physical condition that could affect the respirator's fit (for example obvious change in body weight, facial scarring, or dentures.)

B. Each employee will be tested with the make, model, and size of respirator that s/he will actually wear. Employees will be provided with several models and sizes of respirators to find the best fit. Powered air purified respirators (PAPR) will be fit tested in the negative pressure mode.

C. The following fit-test protocol(s) will be used:

Type of Respirator	Fit-Test Protocol(s)
_____	_____
_____	_____
_____	_____

D. Testing records will documents the type, model, and size of respirator for which each employee has been tested, as well as the fit test protocol used.

VIII. RESPIRATOR USE

A. The following personnel require respiratory protection:

Name	Department	Operation/Task	Respirator
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

B. General use procedures

1) Employees will use respirators of under the conditions specified in the program, according to training that they receive. Respirators shall not be used in any manner for which they are not certified by NIOSH.

2) Each employee shall conduct positive and/or negative pressure user seal checks each time s/he puts on a respirator. The seal checks are specified in Appendix B-1 of the Respiratory Protection Standard.

3) Employees shall be permitted to leave the work area to wash their faces and perform limited respirator maintenance (clean or inspect the respirator, change filters or cartridges, or replace parts) in an area that is free of respiratory hazards. The following are examples of acceptable reasons for leaving the work area:

   a. to prevent eye or skin irritation;
   b. the respirator is interfering with the employee' s ability to work;
   c. the respirator is not functioning properly;
   d. the respirator is damaged.

   Employees must notify their supervisors before leaving the work area.

4) No employee may wear a tight-fitting respirator if any condition, such as facial scarring, facial hair or missing dentures, prevent him/for from achieving a good face-to-facepiece seal.

5) Employees may not wear any articles or styles that interfere with the face-tofacepiece seal.

C. Emergency procedures

Note to the Employer: insert your emergency respirator procedures.

_____
_____
_____
_____
_____
_____
_____

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

IX. RESPIRATOR MAINTENANCE AND CARE

A. _____ will ensure that employees properly clean and maintain respirators. Employees will be permitted to leave their work areas to perform limited cleaning and the maintenance in area free of respiratory hazards.

B. Cleaning:

1) Respirators are to be regularly cleaned and disinfected.

2) Respirators issued for the exclusive use of an individual employee shall be cleaned at the end of each day of use, or more often if necessary.

3) Respirators which may be used by more than one person (for example, atmosphere supplying and emergency use respirators) shall be cleaned and disinfected between users, and the end of each day of use.

4) The following procedure will be used for cleaning and disinfecting respirators:

a. Completely disassemble the respirator, removing any filters, canisters, or cartridges.

b. Closely inspect each of the components for signs of wear or damage, such as stretching, and distortion, cracking, stickiness, brittleness, or corrosion.

c. Immerse the facepiece and all components (except filters, canisters, or cartridges) in warm water (120-130 degrees Fahrenheit) with mild soap or detergent. Do not use organic solvents.

d. Gently scrub components with a soft scrubber or bristle brush. Do not use wire brushes.

e. Rinse all components in clean warm water.

f. If disinfection is required, wipe with 70% isopropyl alcohol or immerse all components in the following solution:

_____

_____

_____

(Insert the disinfection formula that you will use, for example, one-ounce household bleach in one quart of water, or one packet of a name brand disinfectant solution in the specified volume of water.)

g. Air dry in a clean area.

h. Reassemble the respirator. Replace any defective or worn-out parts.

i. Place in a clean, dry plastic bag or other airtight container. Store away from excessive heat, cold, sunlight and chemicals. Do not place any items on top of the respirator.

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

C. Inspection

1) Respirators used for routine and other non-emergency tasks shall be inspected by the wearer at the time of cleaning and immediately before use.

2) Respirators to be used emergencies shall be inspected monthly by the program administrator or designee. (See attached respirator inspection record sheet.)

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

Respirator Inspection Checklist

Facepiece:
- cracks, tears, holes _____
- distortion _____
- cracked, cloudy or loose lenses/face shields _____
- sticky, tacky, brittle _____
- dirty _____

Head straps or harness:
- broken, torn, stretched out _____
- buckles broken, missing? _____

Valves:
- cracked, torn, _____
- sticky, tacky, brittle _____
- missing _____
- dirty _____

Filters/cartridges/canisters:
- approved for the hazardous atmosphere? _____
- approval matches facepiece? _____
- housing cracked or dented _____
- gaskets missing or defective _____
- dirty _____

Air supply systems and self-contained breathing apparatus:
- breathing air quality/grade _____
- hoses _____
- connectors _____
- regulators and valve settings _____
- alarms _____

Self-contained breathing apparatus (SCBA):
- cylinder pressure _____

Miscellaneous:
- end of service life indicators _____

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

D. Change schedules

1) Employees shall leave the work area to change the air-purifying elements (filters) of respirators used for protection against dusts whenever the wearer feels increased resistance to breathing, and/or when the filters are visibly dirty or damaged.

2) The following measures apply to air purifying respirators used for protection against gases and vapors:

a. If the respirator cartridge has an end of service life indicator (ESLI), the cartridge will be changed as soon as the device so indicates (e.g. changes color).

b. Unless a more stringent schedule is developed, respirators used for protection against the following compounds will be changed according to the schedule specified in the relevant standards: acrylonitrile, benzene, butadiene, formaldehyde, vinyl chloride, methylene chloride.

c. Manufacturer' s recommendation: if the respirator manufacturer recommends an acceptable change schedule, that schedule will be followed.

(Insert the manufacturer' s specific recommendations based upon the conditions of use in your facility.)

Note to the Employer: Manufacturer' s recommendations are acceptable if th manufacturer has sufficient data covering the contaminants and conditions existing in your workplace. Manufacturers usually have data for single-contaminant environments only.

If the manufacturer' s recommendations for organic vapor cartridges do not address th specific conditions existing in your workplace, the following approximations may be used to adjust the recommended change schedule:

- Service life is inversely proportional to work rate. Therefore, if the work rate doubles, cartridges should be replaced after half the recommended use time.
- Humidity above 85% reduces service life by 50%. Therefore, when the humidity is an 85% or above, cartridges should be replaced after half the recommended use time.
- Reducing the airborne concentration to one-tenth of its original level will increase the service life five times. Thus, if the manufacturer states that a cartridge may be used for one hour at 100 ppm, it may be used for five hours at 10 ppm.

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

d. Employer-determined schedule:

(Enter the change schedule you have planned. Attach documentation of how this schedule was developed, including physical and chemical data, exposure data, work rate, temperature and humidity, and the safety factor used to compensate for uncertainty.)

Note to the Employer: Acceptable ways to estimate service life include mathematical models and experimental testing.

- Mathematical models are usually less accurate than experimental data, but are quick and inexpensive to use. OSHA has posted an "Advisor Genius" which estimates breakthrough times for activated carbon cartridges for contaminants that are liquids at workplace temperatures. The "Advisor Genius" is located at *http://www.OSHA-slc.gov/SLTC/respirator_genius_wood/advisor_genius.html*. The table of precalculated breakthrough times for individual chemicals under specified standard conditions is located at *http://www.OSHA-sic.gov/SLTC/respiratory_advisor/wood_table/wood_table.html.*

Most change schedule calculations assume that only a single contaminant is present. If your employees are exposed to the mixture of contaminants *with similar chemical properties,* it may be appropriate to calculate a change schedule based on the assumption that the total concentration of contaminants in the air is made up of the contaminant with the shortest breakthrough time.
For example, if the work environment contains 50 ppm chloroform, 100 ppm methyl chloroform, and 50 ppm 1,1,2-trichloroethane, calculate based on an assumption of 200 ppm chloroform, which has the shortest breakthrough time.

- Experimental testing can account for multiple contaminants and may provide more accurate projections of the cartridge' s service life. While a standar protocol for service life testing does not yet exist, the US Environmental Protection Agency has published draft interim recommendations for cartridge testing. A method for field testing respirators is also published in the American Industrial Hygiene Association Journal (1991), pp. 263-270. Respirators should be tested under worst-case conditions.
- If you do not have the facilities to conduct experimental testing, commercial analytical labs may be able to the testing for you.

e. Many compounds migrate through the cartridge during storage. Therefore, any cartridge that has been stored for a period of time (for example, overnight) after use must be changed sooner than the usual recommendations.

(Insert your after-storage change requirement.)

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

f. If reliable information for establishing change schedules is not available, atmosphere-supplying respirators will be used instead of air-purifying respirators.

3) Any employee who detects chemical breakthrough (i.e. tastes or smells contaminants, or senses mouth, throat, or lung irritation) or begins to experience signs and symptoms of exposure, shall immediately notify the supervisor and leave the work area to inspect the respirator . If the respirator is not damaged, and the change schedule does not indicate that the cartridge is due to be replaced, the supervisor shall investigate the work area to determine whether or not a change in conditions (e.g. a leak, spill, or other uncontrolled chemical release) has occurred. The employee shall return to the work area only after the reason for the breakthrough has been identified and corrected, or after donning a respirator appropriate to an environment in which the concentration of contaminants is not known.

E. Storage

All respirators will be stored in a clean, dry location, away from sunlight, chemicals, or temperature extremes.

(Insert the location where employees will store respirators, e.g., in their lockers or in a central storage area.)

F. Defective respirators

1) An employee who discovers a defective respirator must immediately notify his or her supervisor.

2) Respirators that are defective or have defective parts that cannot be replaced by the employee shall be immediately taken out of service.

3) Supervisors will give defective respirators to the program administrator, will decide whether to repair the respirators or to discard them.

X. BREATHING AIR QUALITY AND USE *(for atmosphere-supplying respirators)*

A. Breathing air used in atmosphere-supplying respirators shall meet the minimum requirements for grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.11989.

B. The program administrator shall ensure the following:

1) Purchased air has a certificate of analysis;

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

2) Cylinders are tested and maintained in accordance with DOT regulations (49 CFR parts 173 and 178);

3) Oxygen or air containing more than 23.5% oxygen is not used in compressed air systems;

4) Contaminated air does not enter the compressor;

5) The compressor are fitted with suitable air purifying sorbent beds and filters;

6) The compressor are marked with tag indicating the most recent change or servicing of the compressor and sorbent beds, signed by the person who performed the service;

7) Oil lubricated compressors have high temperature alarms or carbon monoxide monitors or both;

8) Air fittings are incompatible with all other gas fittings.

XI. TRAINING AND INFORMATION

A. Employees will receive training and information before being assigned to any task requiring the use of respiratory protection. Training will be repeated at least annually, and when the following -- situations occur:

1) Changes in the workplace or the type of respirator used make earlier training obsolete or inadequate;

2) The employee' s use of, or knowledge about, the respirator indicates insufficient understanding or skill;

3) Any other situation occurs in which retraining appears necessary.

B. Training will include at least the following topics:

1) Why the respirator is necessary (the type of hazard and potential health effects of exposure as a result of non-use or improper use of the respirator).

2) Engineering and administrative controls, if any, being used in addition to the respirator

3) How improper fit, use, or maintenance can compromise the respirator' s protection;

4) The purpose of fit testing

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

5) The limitations and capabilities of the respirator, as well as reasons for selecting the particular type of respirator;

6) How to effectively use the respirator in emergency situations, including procedures to follow if the respirator malfunctions;

7) How to inspect, put on, check the seals of, wear, and remove the respirator;

8) How to maintain and store the respirator

9) Medical signs and symptoms that may limit or prevent effective use of a respirator;

10) General requirements of the respirator standard.

C. Training records will include the dates of training, employee names, the trainer' s name and the type of training conducted.

D. Basic advisory information on respirators (appendix D of the respiratory protection standard) will be provided to employees who choose to wear respirators when respirator use is not required.

XII. PROGRAM EVALUATION

A. _____ will conduct periodic evaluations of the workplace to ensure that the provisions of the current written respiratory protection program are being effectively carried out, and that the program itself continues to be effective.

B. _____ will regularly consult employees who are required to wear respirators to solicit their opinions of the program' s effectiveness and to identify any problems. Factors to be assessed include the following:

1) Respirator fit, including the effects of respirator use on workplace performance;

2) The appropriateness of the respirators for the hazards to which the employees are exposed;

3) Proper use of the respirators under the various conditions encountered in the workplace;

4) Proper respirator maintenance;

5) Any other factors that the program administrator considers necessary.

Attach a copy of the standard and appendices A through D.

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

XIII. RECORDKEEPING

A. The Program Administrator will maintain the following records:

1) Training and fit test records. These will be updated as necessary, and will be kept at:
_____
_____
_____

2) Copies of the PLHCP' s written opinion as to each employee' s ability to wear a respirator. These records will be maintained at:
_____
_____
_____

3) A written copy of this respirator program and the OSHA respiratory protection standard will be maintained at:
_____
_____
_____

B. The evaluating PLHCP will maintain records of the completed medical questionnaire and any documented findings. These records will remain confidential and will be maintained at:
_____
_____
_____

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

Medical Evaluation Results

Employee' s name: _____

Date questionnaire given: _____

Date evaluated by PLHCP: _____

Date referred for medical exam:_____

Evaluation results:

[ ] Pass (can wear respirator)

[ ] Failed (cannot wear respirator)

Name of PLHCP: _____

Program administrator:_____

Date: _____

APPENDIX M - RESPIRATORY PROTECTION PROGRAM

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RESPIRATORY PROTECTION PROGRAM EVALUATION

Date(s) of program review: _____

Name of program administrator: _____

Results of program review:

[ ] Program is effective.

[ ] Program requires revision.

(Describe revisions below)

_____

Signature of Program Administrator

APPENDIX M - RESPIRATORY PROTECTION

RESPIRATOR INSPECTION RECORD I

SELF-CONTAINED BREATHING APPARATUS MONTHLY CHECKLIST												
RESPIRATOR TYPE:				S.N. AND MODEL NO:								
YEAR:				INSPECTED BY:								
LOCATION:				USER:								
ITEMS CHECKED	J	F	M	A	M	J	J	A	S	0	N	D
RUBBER FACEPIECE												
RUBBER HEAD HARNESS												
RUBBER HOSE												
"0" RING CONNECTOR												
EXHALATION VALVE												
INHALATION VALVE												
FACEPIECE LENS												
HARNESS												
BACKPACK												
CLEANLINESS												
INSTRUCTION SHEET												
FOG PROOF												
AIR CYLINDER PRESSURE												
CYLINDER VALVE												
BYPASS VALVE												
MAINLINE VALVE												
LOW PRESSURE ALARM												
REGULATOR DIAPHRAGM												
REGULATOR FUNCTION												
DEMAND												
PRESSURE DEMAND												
STORAGE BOX												

Comments:

APPENDIX M - RESPIRATORY PROTECTION

I. Storage

ACCEPTABLE **NOT ACCEPTABLE**

All respirators must be properly stored to protect them from damage due to environmental factors (sunlight, temperature extremes, etc.) and chemicals.

APPENDIX M - RESPIRATORY PROTECTION

RESPIRATOR INSPECTION RECORD II

CARTRIDGE TYPE RESPIRATOR MONTHLY CHECKLIST												
RESPIRATOR TYPE:					S.N. AND MODEL NO.:							
YEAR:					INSPECTED BY:							
LOCATION:					USER:							
ITEMS CHECKED	J	F	M	A	M	J	J	A	S	0	N	D
RUBBER FACEPIECE												
RUBBER HEAD HARNESS												
RUBBER HOSE PAPR												
"0" RING CONNECTOR PAPR												
EXHALATION VALVE												
INHALATION VALVE												
FACEPIECE LENS												
CARTRIDGE HOLDER												
CARTRIDGE GASKETS												
CLEANLINESS												
FOGPROOF												
BLOWER MOTOR/PAPR												
BATTERY BACK/PAPR												
STORAGE BOX												

Comments:

APPENDIX M - RESPIRATORY PROTECTION

II. Storage

ACCEPTABLE **NOT ACCEPTABLE**

All respirator' s must be properly stored to protect them from damage due to environmental factors (sunlight, temperature extremes, etc.) and chemicals. When respirators are not in use, they must be placed in a plastic bag and stored in a clean area. Respirators should be stored with the facepiece and exhalation valve in a normal position to prevent it from taking a permanent distorted shape. Respirators should not be stored in work benches, tool boxes, or lockers unless they are protected against airborne contaminants, distortions, and any damage.

APPENDIX M - RESPIRATORY PROTECTION

APPENDIX M - RESPIRATORY PROTECTION

Training Record

NAME	TYPE OF RESPIRATOR	DATE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

TRAINER' S NAME: _____

DATE: _____

APPENDIX M - RESPIRATORY PROTECTION

RESPIRATOR FIT TEST RECORD

A) Employee: _____

Employee Job Title/Description: _____

B) Respirator Selected: _____

Manufacturer: _____

NIOSH Approval Number: _____

Model: _____

Date of Purchase _____

C) Conditions which could Affect Respirator Fit: (Check all that apply):

Clean Shaven	YES	NO	
Beard Growth	YES	NO	if beard growth is below sealing area, fit testing is not permitted
Moustache	YES	NO	
Dentures	YES	NO	
Weight Loss or Gain	YES	NO	
Facial Scar	YES	NO	
Dentures Absent	YES	NO	
Glasses	YES	NO	

If any of the above interfere with the function or seal of the respirator, fit testing is not permitted unless the condition is corrected.

Comments: _____

D) Qualitative Fit Testing (Check all methods used)

Isoamyl Acetate	PASS	FAIL
Irritant Smoke	PASS	FAIL
Bitrex Solution	PASS	FAIL
Saccharin Test	PASS	FAIL
Qualitative Fit Testing	PASS	FAIL

Quantitative Fit Testing

Instrument Used: _____

Make: _____

Model: _____

Serial Number: _____

Fit Factor: _____	PASS	FAIL
Instrument printout: _____	YES	NO

NOTE: If box is checked yes, attach instrument printout to back of page.

Comments: _____

Test Conducted By: _____ Date: _____

APPENDIX M - RESPIRATORY PROTECTION

APPENDIX M - RESPIRATORY PROTECTION

WORKSHEET FOR SELECTION OF RESPIRATOR

Location: _____

Process/Operation:_____

Reason for requesting respirator evaluation: _____
_____

Requested by: _____

I. Employee exposure evaluation:

Contaminant(s) or other respiratory hazard(s):

Estimated concentration(s):
(Reference sampling reports or show calculations as appropriate)

Chemical state of contaminant(s):

Physical form (including particle size distribution) of contaminant(s):

Appropriate exposure limit(s):

II. Respirator Determination

Exposure is documented to be below the exposure limits and use by employees is voluntary.

Respirator use is "not required" under the standard. Respirator may be used if desired. Go to Section III a.

Exposure is documented to be below the exposure limits and use by employees is required by a job rule or procedure.

Respirator use is required under the standard. Go to Section III b.

Exposure may exceed exposure limit and maximum concentration is known.

Respirator use is required under the standard. Go to Section III b.

Exposure is not characterized ("cannot identify or reasonably estimate the employee exposure").

Exposure is considered IDLH. Go to Section III C.

APPENDIX M - RESPIRATORY PROTECTION

Worksheet for Selection of Respirator - III a

III. Respirator Selection

a. Voluntary use of respirator. Indicate make, model, and approval number of respirator selected and indicate any limitations on its use. If respirator is a chemical cartridge or filter type respirator, indicate the frequency required for cartridge or filter replacement.

Type of Respirator: _____

Manufacturer: _____

Model No.: _____

Approval No.:_____

Limitations:_____

Cartridge/filter change schedule (if applicable):

Prepared By: _____
(Print Name)

Signature: _____

Date: _____

APPENDIX M - RESPIRATORY PROTECTION

Worksheet for Selection of Respirator - III b.

III. Respirator Selection

b. Respirator use is required by the standard. Indicate make, model, and approval number of respirator selected and indicate any limitations on its use. If respirator is a chemical cartridge or filter type respirator, indicate the frequency required for cartridge or filter replacement.

Type of Respirator: _____

Manufacturer: _____

Model No.: _____

Approval No.:_____

Limitations:_____

Cartridge/filter change schedule (if applicable):

Basis for determining cartridge change schedule:

Include all calculations and assumptions. Indicate basis for assumptions and references to published literature where appropriate.

Prepared By: _____
(Print Name)

Signature: _____

Date: _____

APPENDIX M - RESPIRATORY PROTECTION

Worksheet for Selection of Respirator - III c.

III. Respirator Selection

c. Atmosphere is considered to be Immediately Dangerous to Life or Health (IDLH). Respirators for IDLH atmospheres are limited to: Indicate make, model, and approval number of respirator selected and indicate any limitations on its use.

NOTE: Only self-contained breathing apparatus (SCBA) with a minimum 30 minute air supply or a full facepiece positive pressure supplied air respirator with an auxiliary air supply is acceptable.

Type of Respirator: _____

Manufacturer: _____

Model No.: _____

Approval No.:_____TC13F-_____

Limitations:_____

Cartridge/filter change schedule (if applicable):

Procedures to be used for accountability (reference appropriate section of written respiratory protection program and/or confined space entry program and give brief description here, or attach accountability procedures).

Prepared By: _____
(Print Name)

Signature: _____

Date: _____

APPENDIX N - SAMPLE LETTER FROM EMPLOYER TO OUTSIDE RESCUE SERVICE - NOW MANDATORY

Dear Name of Rescue Organizer:

We are currently developing a permit-required confined space program as required under the Federal OSHA regulation, 29 CFR 1910.146, that will allow our employees to safely enter and work in permit-required confined spaces in our workplace. Although our existing program is intended to prevent employee exposure to health and safety hazards in the space, extraordinary circumstances could appear without warning that would cause an emergency situation where the employee(s) in the space may need rescue and/or emergency medical assistance. Therefore, a very important element of our program is to develop and implement procedures for summoning rescue and emergency services. we are requesting that Name of Rescue Organizer be available to provide rescue and emergency services, in the event of an emergency.

Enclosed is a listing of the permit-required confined space(s) in my workplace(s), as well as a description of the hazard(s) associated with the space(s). I am providing this information to you so that you can adequately develop a rescue plan appropriate for the space(s). You may also have access to this space(s) as a part of your planning.

Name of Company will be contacting you shortly to confirm your willingness to participate in our permit-required confined space program and to discuss adequate notification procedures (e.g., communication contact method(s) at the time of scheduling the entry operation) for a timely response. At that time we can also discuss the rescue plan provisions in more detail and offer you our assistance in working together to safeguard both your employees as well as ours.

Thank you for your cooperation. We look forward to meeting with you soon.

Sincerely,

Employer Representative

APPENDIX N - CONFINED SPACE LOCATIONS

Name and Location of Facility

The following is a list of permit-required confined spaces located at our facility:

SPACE	LOCATION	HAZARDS

Prepared By:

Date:

Phone Number:

APPENDIX 0 - SAMPLE LETTER FROM RESCUE AND EMERGENCY SERVICE PROVIDER TO HOST EMPLOYER - NON-MANDATORY

Dear Name of Employer:

This is to confirm that the Rescue Organization can provide the following rescue and emergency services in the event it is needed during confined space entries at your facility. Our organization can provide the following services:

*Make a listing of services you can provide.

In order for us to properly develop a rescue plan, we must be informed of the hazards associated with the space and we must have access to these spaces. Please provide for us a list of your permit-required confined spaces, their locations, and the hazards. I have enclosed a form you may use. In addition, we must conduct annual practice rescue entries in your confined space(s) or in some other similarly configured space(s). We would like to know if and when this could be arranged in your workplace.

Please contact Rescue Organization Representative at phone # so at we can discuss this in more detail and-make arrangements to visit you ace before any confined space entry operations are scheduled. Thank you for your cooperation.

Sincerely,

_____

Rescue Organization' s Representative

APPENDIX 0 - CONFINED SPACE LOCATIONS

_____

_____

Name and Location of Facility

The following is a list of permit-required confined spaces located at our facility:

SPACE	LOCATION	HAZARDS

Prepared By:

Date:

Phone Number:

APPENDIX P - RESCUE AND EMERGENCY SERVICES

Confined space rescues are extremely dangerous operations that must only be performed by properly trained and equipped individuals. It has been well documented that the majority of fatalities that occur in confined spaces are would-be rescuers who have not been properly trained or equipped. For rescue operations to be conducted safely, there must be a systematic approach by the rescue service. In response, the OSHA Permit-Required Confined Space Standard (1910.146) mandates requirements which must be addressed for all on-site and off-site rescue personnel who will enter PRCS to perform rescue or retrieval operations.

As previously mentioned, fire departments and other rescue service organizations are not required to have a full PRCS program in place for performing rescue operations. However, the performance-oriented elements stated in paragraph (g) and (k) of the standard are required so rescuers can prepare themselves for emergency PRCS operations. Paragraph (k) also requires rescue service organizations to develop a rescue plan for each PRCS they must enter.

This appendix is provided as a guide that uses a systematic approach covering the general topics and procedures rescuers may need to know or need to consider when developing rescue plans.

The standard states that when a host employer arranges for rescue services, the host employer must perform the following:

1) Inform the rescue service of the hazard(s) of the PRCS.

2) Provide access to the space so the rescue organization can develop a rescue plan and practice rescue operations.

3) Evaluate the prospective rescuer' s ability to respond to a summons in a timely manner.

4) Evaluate the prospective rescuer' s ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit spaces or types of permit spaces identified.

For rescue service organizations that choose to use this appendix, a Rescue Plan Checklist (RPC) has been provided to assist them in developing a rescue plan(s) for the PRCS they may have to enter. The RPC is designed so a rescue service organization can develop specific entry procedures with the participation of the host employer.

It is also realistic to assume that some rescue organizations, particularly fire departments, may not be given an opportunity for advance preparation with a host employer. This RPC is also designed to assist rescue organizations during these situations as well. Rescue personnel who are properly trained on PRCS operations can utilize the RPC to help identify any hazards and address any control procedures and equipment needed.

APPENDIX P - RESCUE AND EMERGENCY SERVICES

Before proceeding to use the RPC, it is necessary that rescue personnel receive appropriate training. To assist with this task, the following general Standard Operating Procedures and training are suggested. Rescue organizations should modify their training and rescue plans accordingly to meet their specific situations. The elements of this program are arranged in the following manner:

Preplanning
Training
Standard Operating Procedures (SOPS)

Preplanning

- Determine the various types of permit spaces which are or likely to be encountered by rescue team members.

Note to the Rescue Service: Appendix 0 provides a sample of a non-mandatory letter which can be sent to employers by the rescue service to determine the presence of any permit spaces and their particular hazards.

- Designate on-site command and control structure. Designate rescue team members' duties.
- Develop SOP for the permit spaces likely to be entered.
- Determine availability of appropriate rescue equipment, for example:
  - Combination oxygen and combustible gas monitors
  - Full-body harnesses
  - Mechanical winch
  - Reeves (collapsible) stretcher
  - Stokes stretcher
  - Communication equipment
  - SCBAS/SAR
  - Ladders
  - Personal Protection Equipment
  - Explosion-Proof Lighting

Training

- All members of the rescue team must receive training covering the following elements:
  - Permit Space Recognition
  - Permit Space Hazards

APPENDIX P - RESCUE AND EMERGENCY SERVICES

- Control of Permit Space Hazards
- Atmospheric Monitoring Equipment and Testing Protocol
- Use and Maintenance of Personal Protective Equipment
- Rescue Equipment
- Simulate Permit Space Rescues and Required Rescue Techniques
- Basic First Aid and Cardiopulmonary Resuscitation (CPR), one member of the rescue team must have a current certification for CPR and First Aid.
- Requirements stated in paragraph (k) and (g) of 1910.146
- Train personnel on how to use rescue plan checklist (RPC)

Standard Operating Procedures (SOPS)

- These SOPS are merely examples. Rescue organizations may use this information to develop their own SOPs.

  - Initiate on-site command system
  - Utilize rescue plan checklist
  - If available, review entry permit
  - Determine number and condition of occupants in the permit space.
  - If possible, attempt rescue without rescuers entering the permit space - If entry is necessary, institute entry procedures
  - Utilize rescue entry checklist, institute appropriate procedures and use required equipment
  - Secure area outside space and remove or control any potential hazards - Retrieving victim(s)
  - Victim packaging-type required is indicated by the victim' s injuries and size of the opening
  - Determine victim' s immediate needs, if possible remove victim promptly
  - Rescuer must never remove their respirator face piece to administer fresh air to the victim
  - If victim is trapped and cannot be moved promptly:

    1. Provide air to the victim with SCBA or SAR

    2. Oxygen cylinders must not be taken into a permit space if the oxygen could react with any substances in the space and create an additional hazard
  - Provide necessary first aid/CPR and transport. Obtain material safety data sheets (MSD' s), if available, for the chemical the victim(s) was exposed to and provide this information to the hospital treating the individual(s).

APPENDIX P - RESCUE AND EMERGENCY SERVICES

Name of Trainer and Date of Training			
Rescue Practice Date & Practice Session			
Currently Certified in First Aid & CPR No			
Yes			
Trained In CPR No			
Yes			
Trained in CPR No			
Yes			
Rescue Equipment & PPE Authorized for use			
Rescue Duties			
Name			

Rescue Plan Checklist

General Information

Location of Rescue _____

Entry Permit available Yes ____ No ____

No. of occupants in space _____

Condition of occupants _____

Approx. time Incapacitated _____

No. of rescuers in space _____

Rescue on-site Commander _____

Control Procedures and Equipment

Note: The control procedures and equipment needed will depend on the specific confined space rescue situation. It is the responsibility of the rescue personnel to determine the appropriate action needed. Listed are the items that may need to be considered.

Permit Space Hazards	Test Atmosphere	Determine Cause	Ventilate Space	SCBA/SAR	Standby person with SCBA	Control/Eliminate Ignition Sources	Use non-sparking tools	Full Body Harness, Lifeline, Mechanical Winch, Tripod, Fall Arresting Device	Fire Suppression Equipment	Lockout Energy Sources and Dissipate Stored Energy	Rescue Ropes Appropriate Stretcher for Victim	Lockout valve/break line /misalignment of pipe/etc.	Chemical Protective Clothing	Constant Communication	Explosion-proof Lighting	Appropriate PPE
☐ Oxygen less than 19.5%	•	•	•	•	•	•		•			•			•		•
☐ Oxygen more than 23.5%	•	•	•	3	•	•	•	•	•	•	•			•	•	•
☐ Explosive gases/vapors	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•
☐ Explosive dust	•	•	•	3	•	•	•	•	•	•	•	•	•	•	•	•
☐ Toxic gases/vapors	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
☐ Engulfment		•		•	•			•		•	•	•	•	•	•	•
☐ Entrapment		•			•			•			•			•		•
☐ Mechanical		•			•			•		•	•			•		•
☐ Electrical		•			•			•	•	•	•			•		•
☐ Chemicals	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•
☐ Heat Stress		•	•		•			•			•			•		•
☐ Noise		•			•			•			•			•		•
☐ Falls/Slippery Surfaces		•			•			•			•			•		•

Specific Entry Procedures

Note: Rescue services may use the following space to list the specific entry procedures for safe entry based on advanced preparation with the employer.

• = Control Procedure and Equipment Suggested

3 = Note, entry must not be made until explosive atmosphere Is removed.

Atmospheric Testing Record							
Substance	**Acceptable Level**	**Readings**					
Oxygen	19.5%-23.5%						
Explosive(Gas/Vapor)	<10% LFL						
Explosive Dust	<LFL(5 ft. Visibility)						
Carbon Monoxide	50 ppm						
Hydrogen Sulfide	10 ppm						

Testing Equipment calibrated Yes ___ No ___ Name or initials of tester _____

ENTRY PERMIT

GENERAL INFORMATION			**CONTROLS/EQUIPMENT** (Check all that apply)	
Permit Space Location:			☐ ISOLATION	☐ LOCKOUT/TAGOUT
Purpose of Entry:				☐ BLANKING/BLINDING
Entry Permit Valid for:	Date: to Date:			☐ DOUBLE BLOCK AND BLEED
	Time: to Time:			☐ LINE BREAKING/MISALIGNMENT
PERMIT SPACE HAZARDS				☐ OTHER
ATMOSPHERIC	YES	NO	☐ INERTING	
Oxygen Deficiency			☐ PURGE/CLEAN	
Oxygen Enrichment			☐ METHODS FOR SAFE COVER REMOVAL AND SECURING AREA	
Explosive (Gas/Vapor)			☐ ATMOSPHERIC TESTING	
Explosive Dust				☐ Periodic (Give Interval)
Carbon Monoxide				☐ Continuous
Hydrogen Sulfide			☐ VENTILATION	
Other Toxic Gases/Vapors				☐ Natural
ENGULFMENT				☐ Continuous Forced Air
CONFIGURATION (Entrapment)				☐ Local Exhaust
MECHANICAL			☐ ENTRY EQUIPMENT	
ELECTRICAL				☐ Ladders
SUBSTANCE HAZARDOUS TO SKIN OR EYES				☐ Other
HEAT STRESS			☐ PERSONAL PROTECTIVE EQUIPMENT	
OTHER POTENTIAL HAZARDS (e.g., RADIATION, NOISE, ETC.)			☐ RESPIRATORY	

ENTRY PERMIT, continued

				☐ SCBA
				☐ SAR
				☐ Air Purifying
PERSONNEL			☐ PROTECTIVE CLOTHING (SPECIFY)	
ENTRANT(S)	TIME IN	TIME OUT	☐ EYE AND FACE PROTECTION	
			☐ HEARING PROTECTION	
			☐ RESCUE AND RETRIEVAL EQUIPMENT	
				☐ Full Body Harness
ATTENDANT(S)				☐ Lifeline
				☐ Tripod w/Mechanical Winch
ENTRY SUPERVISOR(S)				☐ Explosion Proof Lighting
			☐ NON-SPARKING TOOLS	
COMMUNICATION PROCEDURES USED BY ENTRANT(S) AND ATTENDANT(S) Check all that apply			☐ INTRINSICALLY SAFE ELECTRICAL EQUIPMENT & GFCI	
☐ VISUAL	☐ ROPE		COMMUNICATION EQUIPMENT	
☐ VOICE	☐ RADIO			☐ Radio
☐ OTHER (SPECIFY)				☐ Phone
				☐ Other
			☐ HOT WORK PERMIT	
			☐ FIRE EXTINGUISHERS	
RESCUE and EMERGENCY SERVICES			**RESCUE PROCEDURES**	
Names	Phone Nos.			
Summoning Procedure:				

ENTRY PERMIT, continued

ATMOSPHERIC TESTING RECORD									
CONDITION	**ACCEPTABLE LEVEL**	**PRE-ENTRY READINGS**				**ENTRY READINGS**			
		(Reading)	**(Time)**	**(Reading)**	**(Time)**	**(Reading)**	**(Time)**	**(Reading)**	**(Time)**
OXYGEN	19.5% - 23.5%								
EXPLOSIVE (GAS/VAPOR)	< 10% LFL								
EXPLOSIVE DUST	< LFL (5 FT. Visibility)								
CARBON MONOXIDE	50 PPM								
HYDROGEN SULFIDE	10 PPM								
OTHER HAZARDS									
(e.g., HEAT STRESS)									
NAME(S) or INITIALS OF TESTER									
TESTING EQUIPMENT USED	TYPE:	SERIAL NO.	TYPE:	SERIAL NO.					

ENTRY AUTHORIZATION

ENTRY AUTHORIZED BY:	
NAME:	TIME:
SIGNATURE:	DATE:

APPENDIX Q - ENTRY PERMIT FORM

POST ENTRY PERMIT AT ENTRANCE TO PERMIT SPACE

ENTRY CANCELLATION		
ENTRY CANCELLED BY:		
NAME:	TIME:	
SIGNATURE:	DATE:	
REASON FOR CANCELLATION:		
☐ ENTRY OPERATION COMPLETED		
☐ PROHIBITED CONDITION AROSE (SPECIFY)		

APPENDIX R – EMPLOYEE TRAINING LOG

EMPLOYEE NAME	ASSIGNED DUTY(S)

_____ _____

Date of Training Signature of Trainer(s)

APPENDIX S - EVALUATION AND SELECTION OF RESCUE SERVICES

In accordance with the requirements of the OSHA Permit-Required Confined Space Standard 1910.146, employers who designate rescue and emergency services to respond to a rescue summons must ensure that the rescuer can perform their duties in ce safe, timely and proficient manner. Answering the following questions will assist you in determining whether the rescuer is capable of performing a rescue in the permit spaces at your worksite.

A. Evaluation

1) What are your needs in regards to response time? For example, if entry is to be made into an IDLH atmosphere, or into a space that can quickly develop an IDLH atmosphere, the rescue team or servic(would have to be standing by at the permit space. On other hand, if the danger to entrants is restricted to mechanical hazards that would cause injuries (e.g. broken bones, abrasions) a response time of 10-15 minutes might be adequate.

2) How quickly can the rescue team or service get from its location to the permit spaces from which rescue may be necessary? Relevant factors to consider would include: the location of the rescue team or service relative to the employer' s workplace, the quality of the roads and highways to be traveled, potential bottlenecks or traffic congestion that might be encountered in transit, the reliability of the rescuer' s vehicles, and the training and skill of its drivers.

3) What is the availability of the rescue service? Is it unavailable at certain times of the day or in certain situations? What is the likely hood that key personnel of the rescue service might become unavailable at times? If the rescue service becomes unavailable while an entry is underway, does it have the capability of notifying the employer so that the employer can instruct the attendant to abort the entry immediately?

4) Does the rescue service meet all the requirements of paragraph (k)(2) of the standard? If not, has it developed a plan that will enable it to meet those requirements in the future? If so, how soon can the plan be implemented?

5) Is the service willing to perform rescues at the employer' s workplace?

6) Is an adequate method for communications between the attendant, employer and prospective rescuer available so that a rescue request can be transmitted to the rescuer without delay? How soon after notification can a prospective rescuer dispatch a rescue team to the entry site?

7) For rescues into spaces that may pose significant atmospheric hazards and from which rescue entry patient packaging and retrieval cannot be safely accomplished in a relatively short time (15-20 minutes), employers should consider using airline respirators (with escape bottles) for the rescuers and to supply rescue air to the patient. If the employer decides to use SCBA does the prospective rescue service have an ample supply of

APPENDIX S - EVALUATION AND SELECTION OF RESCUE SERVICES

replacement cylinders and procedures for rescuers to enter and exit (or be retrieved) well within the SCBA' s air supply limits?

8) If the space has a vertical entry over 5 feet in depth, can the prospective rescue service perform entry rescues? Does the service properly perform entry rescues? Does the service have the technical knowledge and equipment to perform rope work or elevated rescue, if needed?

9) Does the rescue service have the necessary skills in medical evaluation, patient packaging and emergency response?

10) Does the rescue service have the necessary equipment to perform rescues, or must the equipment be provided by the employer or another source?

Service Evaluated: _____ Date of Evaluation _____

Evaluator _____

B. Selection

1. Can the service respond in a timely manner considering the potential hazards identified? Yes ___ No ___

2. Can the service perform proficiently with rescue-related tasks and equipment while rescuing entrants from the types of permit spaces identified? Yes ___ No ___

** If the answers to the two questions above are "Yes," the rescue service may be selected. If there is a "No" answer, the rescue service shall not be selected until the deficiency is identified and eliminated.

REFERENCES AND PERTINENT STANDARDS

ANSI Z88.2 - 1980, Practices for Respirator Protection[1]

ANSI Z88.2 - 1992, Respiratory Protection[1]

ANSI Z117.7 - 1989, Safety Requirements for Confined Spaces[1]

Federal Register, Thursday, January 14,1993, OSHA, 29 CFR Parts 1910, Permit Required Confined Spaces for General Industry; Final Rule (3)[3]

Occupational Safety and Health Administration (OSHA), US Department of Labor, Code of Federal Regulations, Title 29, Part 1910, General Industry Safety and Health Standards[2]

OSHA, Permit-Required Confined Space Training Material, March 1993. Office of Training and Education, Des Plains, IL 60018[2]

OSHA, Pamphlet 3079 - Respiratory Protection [2]

OSHA, Pamphlet 3080 - Hand and Power Tools[2]

OSHA, Pamphlet 3120 - Control of Hazardous Energy (LOCkout/Tagout)[2]

OSHA 3140 - Confined Space Can Kill Poster

OSHA 3141 - Confined Spaces Pocket Card

OSHA 3075 - Controlling Electrical Hazards

OSHA 3138 - Permit-Required Confined Spaces

National Institute for Occupational Safety and Health (NIOSH) - A Guide to Safety in Confined Spaces, Publication No. 87-113[3]

NIOSH Abstract - Request for Assistance in Preventing Occupational Fatalities in Confined Spaces, January 1986[3]

NIOSH - Pocket Guide to Chemical Hazards, Publication No. 97-140[3]

NIOSH - Safety and Health in Confined Workspaces for the Construction Industry -1985[3]

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[1] Available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036 / www.a nsi.org

[2] Available from OSHA Publications Office, 200 Constitution Avenue, N.W., Room N-3101, Washington, DC 20210 / www.osha.gov

[3] Available from Publication Dissemination, DSDTT, National Institute for Occupational Safety and Health, L Department of Health and Human Services, 4676 Columbia Parkway, Cincinnati, OH 45226 / www.cdc.gov/niosh/homepage.html

[4] Illustrations on pages 32 and 63 courtesy of ERM Northeast - Environmental, Safety and Health Consultants - A Division of ERM Northeast Inc., New Karner Road, Albany, NY 12205