

**Draft Sample Plan**

**CONFINED SPACE IN  
CONSTRUCTION**

**For Compliance With**

**OSHA 1926**

# ACKNOWLEDGMENTS

**The information contained in this document is not considered a substitute for any provision of the standard.**

# CONFINED SPACES IN CONSTRUCTION

OSHA's General Industry Regulation, **§1910.146 *Permit required confined spaces***, contains requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit required confined spaces. This regulation does *not* apply to construction.

OSHA's Construction Safety and Health Regulations Part 1926 do not contain a permit required confined space regulation. Subpart C, **§1926.21 *Safety training and education*** specifies training for personnel who are required to enter confined spaces and defines a "confined or enclosed space." These requirements are shown below.

## **§1926.21 Safety training and education. (Partial)**

(b)(6)(i) All employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. The employer shall comply with any specific regulations that apply to work in dangerous or potentially dangerous areas.

(ii) For purposes of paragraph (b)(6)(i) of this section, "**confined or enclosed space**" means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

OSHA's Construction Regulations also contain requirements dealing with confined space hazards in underground construction (Subpart S), underground electric transmission and distribution work (§1926.956), excavations (Subpart P), and welding and cutting (Subpart J).

Further guidance may be obtained from American National Standard ANSI Z117.11989, *Safety Requirements for Confined Spaces*. This standard provides minimum safety requirements to be followed while entering, exiting and working in confined spaces at normal atmospheric pressure. This standard does not pertain to underground mining, tunneling, caisson work or other similar tasks that have established national consensus standards.

# **ANATOMY OF CONFINED SPACES IN CONSTRUCTION**

## **THE ISSUE**

Fatalities and injuries constantly occur among construction workers who, during the course of their jobs, are required to enter confined spaces. In some circumstances, these workers are exposed to multiple hazards, any of which may cause bodily injury, illness, or death. Newspaper and magazine articles abound with stories of workers injured and killed from a variety of atmospheric factors and physical agents. Throughout the construction job site, contractors and workers encounter both inherent and induced hazards within confined work spaces.

## **INHERENT HAZARDS**

Inherent hazards, such as electrical, thermal, chemical, mechanical, etc., are associated with specific types of equipment and the interactions among them. Examples include high voltage (shock or corona discharge and the resulting burns), radiation generated by equipment, defective design, omission of protective features (no provision for grounding non-current carrying conductive parts), high or low temperatures, high noise levels, and high-pressure vessels and lines (rupturing with resultant release of fragments, fluids, gases, etc.). Inherent hazards usually cannot be eliminated without degrading the system or equipment, or without making them inoperative. Therefore, emphasis must be placed on hazard control methods.

## **INDUCED HAZARDS**

Induced hazards arise and are induced from a multitude of incorrect decisions and actions that occur during the actual construction process. Some examples are: omission of protective features, physical arrangements that may cause unintentional worker contact with electrical energy sources, oxygen deficient atmospheres created at the bottom of pits or shafts, lack of safety factors in structural strength, and flammable atmospheres.

# **EXAMINATION OF TYPICAL CONFINED SPACES**

Following are typical examples of confined workspaces in construction which contain both inherent and induced hazards.

## **Vaults**

A variety of vaults are found on the construction jobsite. On various occasions, workers must enter these vaults to perform a number of functions. The restricted nature of vaults and their frequently below grade location can create an assortment of safety and health problems.

## **Oxygen Deficient Atmosphere**

One of the major problems confronting construction workers while working in vaults is the ever present possibility of an oxygen deficient atmosphere.

## **Explosive or Toxic Gases, Vapors, or Fumes**

While working in an electrical vault, workers may be exposed to the buildup of explosive gases such as those used for heating (propane). Welding and soldering produce toxic fumes which are confined in the limited atmosphere.

## **Electrical Shock**

Electrical shock is often encountered from power tools, line cords, etc. In many instances, such electrical shock results from the fact that the contractor has not provided an approved grounding system or the protection afforded by ground fault circuit interrupters or low voltage systems.

## **Purging**

In some instances, purging agents such as nitrogen and argon may enter the vault from areas adjacent to it. These agents may displace the oxygen in the vault to the extent that it will asphyxiate workers almost immediately.

## **Materials Falling In and On**

A hazard normally considered a problem associated with confined spaces is material or equipment, which may fall into the vault or onto workers as they enter and leave the vault. Vibration could cause the materials on top of the vault to roll off and strike workers. If the manhole covers were removed, or **if** they were not installed in the first place, materials could fall into the vault, causing injury to the workers inside.

## **Condenser Pits**

A common confined space found in the construction of nuclear power plants is the condenser pit. Because of their large size, they are often overlooked as potentially hazardous confined spaces. These below grade areas create large containment areas for the accumulation of toxic fumes, gases, and so forth, or for the creation of oxygen deficient atmospheres when purging with argon, freon, and I other inert gases. Workers above dropping equipment, tools, and materials into the pit will create other hazards.

## **Manholes**

Throughout the construction site, manholes are commonplace. As means of entry into and exit from vaults, tanks, pits, and so forth, manholes perform a necessary function. However, these confined spaces may present serious hazards, which could cause injuries and fatalities. A variety of hazards are associated with manholes. To begin with, the manhole could be a dangerous trap into which the worker could fall. Often covers are removed and not replaced, or else they are not provided in the first place.

## **Pipe Assemblies**

One of the most frequently unrecognized types of confined spaces encountered throughout the construction site is the pipe assembly. Piping of sixteen to thirty-six inches in diameter is commonly used for a variety of purposes. For any number of reasons, workers will enter the pipe. Once inside, they are faced with potential oxygen deficient atmospheres, often caused by purging with argon or another inert gas. Welding fumes generated by the worker in the pipe, or by other workers operating outside the pipe at either end, subject the worker to toxic atmospheres. The generally restricted dimensions of the pipe provide little room for the workers to move about and gain any degree of comfort while performing their tasks. Once inside the pipe, communication is extremely difficult. In situations where the pipe bends, communication and extrication become even more difficult. Electrical shock is another problem to which the worker is exposed. Ungrounded tools and equipment or inadequate line cords are some of the causes. As well, heat within the pipe run may cause the worker to suffer heat prostration.

## **Ventilation Ducts**

Ventilation ducts and pipe runs are very common at the construction site. These sheet metal enclosures create a complex network, which moves heated and cooled air and exhaust fumes to desired locations in the plant. Ventilation ducts may require that workers enter them to cut out access holes, install essential parts of the duct, etc. Depending on where these ducts are located, oxygen deficiency could exist. They usually possess many bends, which create difficult entry and exit and which also make it difficult for workers inside the duct to communicate with those outside it. Electrical shock hazards and heat stress are other problems associated with work inside ventilation ducts.

## **Tanks**

Tanks are another type of confined workspace commonly found in construction. They are used for a variety of purposes, including the storage of water, chemicals, etc. Tanks require entry for cleaning and repairs. Ventilation is always a problem. Oxygen deficient atmospheres, along with toxic and explosive atmospheres created by the substances stored in the tanks, present hazards to workers. Heat, another problem in tanks, may cause heat prostration, particularly on a hot day. Since electrical line cords are often taken into the tank, the hazard of electrical shock is always present. The nature of the tank's structure often dictates that workers must climb ladders to reach high places on the walls of the tank.

## **Sumps**

Sumps are commonplace. They are used as collection places for water and other liquids. Workers entering sumps may encounter an oxygen deficient atmosphere. Also, because of the wet nature of the sump, electrical shock hazards are present when power tools are used inside. Sumps are often poorly illuminated. Inadequate lighting may create an accident situation.

## **Containment Cavities**

Little or no air movement characterizes these large below grade areas. Ventilation is always a problem. In addition, the possibility of oxygen deficiency exists. As well, welding and other gases may easily collect in these areas, creating toxic atmospheres. As these structures near completion, more confined spaces will exist as rooms are built off the existing structure.

## **Electrical Transformers**

Electrical transformers are located on the jobsite. They often contain a nitrogen purge or dry air. Before they are opened, they must be well vented by having air pumped in. Workers, particularly electricians and power plant operators, will enter these transformers through hatches on top for various work related reasons. Testing for oxygen deficiency and for toxic atmospheres is mandatory.

## **Heat Sinks**

These larger pit areas hold cooling water in the event that there is a problem with the pumps located at the water supply to the plant normally a river or lake which would prevent cooling water from reaching the reactor core. When in the pits, workers are exposed to welding fumes and electrical hazards, particularly because water accumulates in the bottom of the sink. Generally, it is difficult to communicate with workers in the heat sink, because the rebar in the walls of the structure deaden radio signals.

# **UNUSUAL CONDITIONS**

## **Confined Space Within a Confined Space**

By the very nature of construction, situations are created which illustrate one of the most hazardous confined spaces of all a confined space within a confined space. This situation appears as tanks within pits, pipe assemblies or vessels within pits, etc. In this situation, not only do the potential hazards associated with the outer confined space require testing, monitoring, and control, but those of the inner space also require similar procedures. Often, only the outer space is evaluated. When workers enter the inner space, they are faced with potentially hazardous conditions. A good example of a confined space within a confined space is a vessel with a nitrogen purge inside a filtering water access pit. Workers entering the pit and/or the vessel should do so only after both spaces have been evaluated and proper control measures established.

## **Hazards In One Space Entering Another Space**

During an examination of confined spaces in construction, one often encounters situations, which are not always easy to evaluate or control. For instance, a room or area, which classifies as a confined space may be relatively safe for work. However, access passages from other areas outside or adjacent to the room could, at some point, allow the transfer of hazardous agents into the "safe" one. One such instance would be a pipe coming through a wall into a containment room. Welding fumes and other toxic materials generated in one room may easily travel through the pipe into another area, causing it to change from a safe to an unsafe workplace. A serious problem with a situation such as this is that workers working in the "safe" area are not aware of the hazards leaking into their area. Thus, they are not prepared to take action to avoid or control it.

## **CONCLUSION**

In this discussion, we have defined inherent and induced hazards in confined spaces. We have examined typical confined spaces on construction sites and we have described representative hazards within these confined spaces.