



STANDARD CONSTRUCTION OPERATING PROCEDURE

NEW YORK CITY DEPARTMENT OF
DESIGN + CONSTRUCTION
Division of Infrastructure
Bureau of Construction

**SUBJECT: DDC EMPLOYEE CONFINED
SPACE PROTOCOL**

APPROVED:

Associate Commissioner, Richard Zetterlund, P.E.

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Attached please find the DDC Employee Confined Space Protocol, this protocol must be followed when working in a confined space, as defined in the attached documents. The Resident Engineer must ensure that the attached policy and procedures are strictly followed. Please ensure that all DDC field staff are provided with the attached policy and procedures and that it is reviewed at Preconstruction and at Critical Phase meetings.

Attachment: Permit Required Confined Space Policy & Procedures

**PERMIT REQUIRED
CONFINED SPACE
POLICY & PROCEDURES**

**New York City Department of Design & Construction
Infrastructure Division
30-30 Thomson Avenue
Long Island City, NY 11101**

Note: Consult the specific code, rule, regulation, or standard for more detailed information and your supervisor for specific guidelines appropriate for each jobsite. This written plan may not include information as to all safety and health conditions that may be present on your specific jobsite. It is the responsibility of all DDC supervision and each employee to insure compliance with this policy and all appropriate Federal, State, or City safety and health codes, rules, regulations, or standards.

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A. Purpose

The purpose of this procedure is to establish adequate measures to prevent unauthorized entry into permit required confined spaces and to ensure the safety and health of DDC Infrastructure employees entering a permit required confined space.

B. Scope

This procedure will apply to all operations of the DDC Infrastructure Division meeting the following criteria:

- Is large enough for an employee to enter and perform work, and
- Has limited or restricted means of entry and egress, and
- Is not designed for continuous employee occupancy, and
- Has one or more of the following conditions:
 1. Contains or has the potential to contain a hazardous atmosphere.
 2. Contains material that has the potential to engulf the entrant.
 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 small cross section.
 4. Contains any other recognized serious safety or health hazard.

C. Codes and Standards

29 CFR 1910.146 Permit Required Confined Space Standard

29 CFR 1926.20(b) OSHA Construction Standards – General Safety and Health Provisions

ANSI Standard Z117.1-2003 Safety Requirements for Confined Space

DDC Employee Safety, Health, and Environmental Field Reference Guide

D. Definitions

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

Air Monitoring means the sampling for and measuring of pollutants in the atmosphere.

Asphyxia means suffocation from lack of oxygen. A substance such as carbon monoxide that combines with hemoglobin to reduce the blood's capacity to transport oxygen produces chemical asphyxia. Simple asphyxia is the result of exposure to a substance, such as methane, that displaces oxygen.

Asphyxiant means a vapor or gas that causes unconsciousness or death by suffocation (lack of oxygen). They are the major hazard of working in confined spaces.

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 employee'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 that may accumulate in the pipe, line, or duct with no leakage beyond the plate.

Combustible is a term that OSHA, NFPA and DOT use to classify certain materials with low flashpoints that ignite easily. Combustible liquids are those having a flashpoint at or above 100 degrees Fahrenheit but below 200 degrees.

Confined Space means a place 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 (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.

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 the ensuing work activities that will occur 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 the OSHA standard.

Entry Supervisor means the person (such as 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 for each role he or she fills.

Flammable means any solid, liquid, vapor, or gas that ignites easily and burns rapidly. Any liquid with a flashpoint below 100 degrees Fahrenheit is flammable.

Flammable Limit means the range at which materials will ignite. Flammables have a minimum concentration below which propagation of flame does not occur on contact with a source of ignition. This is known as the lower flammable explosive limit (LEL). There is also a maximum concentration of vapor or gas in air above which propagation of flame does not occur. This is known as the upper explosive limit (UEL). These units are expressed in percent of gas or vapor in air by volume.

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:

- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
- Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
- Airborne combustible dust at a concentration that meets or exceeds its LFL;
- Atmospheric concentration of any substance 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 the OSHA standard 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 or ability of self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

- 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, 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.

Isolation means the process by which a permit space is removed from service and completely protected against the release of energy and entry of 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.

Lower Explosive Limit (LEL) means the lower limit of flammability of a gas or vapor at ordinary ambient temperatures expressed in percent of the gas or vapor in air by volume.

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 physical harm.

Oxygen Deficiency means an atmosphere containing less than 19.5% oxygen by volume.

Oxygen Enriched Atmosphere means an atmosphere containing more than 23.5% oxygen by volume.

PEL - Permissible Explosive Limit means an exposure limit that is published and enforced by OSHA as a legal standard.

PPE - Personal Protective Equipment means devices worn by the employee to protect against hazards in the environment. Respirators, gloves, and hearing protection are examples.

PPM - Parts Per Million means parts per million of air by volume of vapor or gas or other contaminant.

Permit Required Confined Space (permit space) means 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 downward and tapers to a smaller cross-section, or
- 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 to 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.

TLV - Threshold Limit Value means a time weighted average concentration under which most people can work consistently for 8 hours a day, day after day, without any harmful effects. A table of these values and accompanying precautions is published annually by the American Conference of Governmental Industrial Hygienists.

UEL/UFL - Upper Explosive/Flammable Limit means the highest concentration (expressed in percent vapors or gas in the air by volume) of a substance that will burn or explode when an ignition source is present.

Vapor Density means the weight of a gas or vapor compared to the weight of an equal volume of air. It is an expression of the density of the vapor or gas calculated as the ratio of the molecular weight of the gas to the average molecular weight of air, which is 1.0. Materials lighter than air have vapor densities of less than 1.0. Materials heavier than air have vapor densities greater than 1.0. All vapors and gases mix with air, but:

- The lighter materials tend to rise and dissipate (unless confined);
- Heavier vapors and gases are likely to concentrate in low or enclosed places (under floors, in manholes, tanks, ditches, etc.) possibly creating fire, explosion or health hazards.

E. DDC Infrastructure Confined Space Program Element

DDC has developed and implemented this written program to address the mandated requirements of the current OSHA standard:

- Develop a written program to prevent unauthorized entry,
- Identify and evaluate confined space hazards,

- Establish procedures and practices for safe entry including testing and monitoring conditions,
- Station an attendant outside permit spaces during entry,
- Have procedures to summon rescue,
- Prevent unauthorized personnel from attempting rescues,
- Have a system for preparing, issuing, using, and canceling entry permits,
- Require a coordinated entry procedure when more than one employer is to have employees working in the same confined space,
- Training procedures
- PPE
- Hazard control measures
- Have procedures for concluding entry operations and/or canceling entry permits, and
- Have a procedure for the review of permit program at least annually.

F. Evaluation and Identification of Permit Required Confined Spaces

All operations of the DDC Infrastructure Division have been evaluated to identify any spaces which meet the definition of a confined space (see Section B. Scope).

Any space determined to be a confined space and meeting all of the following criteria are considered **non-permit** confined spaces and are not covered by this program and procedure.

- Surrounding areas do not contain hazards which could impact on the confined space such as vapors from vehicles or other sources; and
- Does not contain nor has the potential to contain a hazardous atmosphere; and
- Does not contain material that has the potential to engulf the entrant; and
- Does not have 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 small cross section.

- Does not contain any other recognized serious safety or health hazard.

Any activity conducted in non-permit confined spaces which has the potential to generate a hazardous atmosphere (e.g., welding or burning, use of hazardous chemicals, etc.) requires entry into that space in accordance with this written program for permit required confined spaces.

DDC Infrastructure Division delivers well-built roadway, sewer and water main construction projects in all five boroughs. To accomplish this work, a select group of DDC employees must enter into permit spaces during pre and post construction inspection activities. As part of their work, Infrastructure staff must enter into:

- Sewer mains (connected to active systems)
- Water mains (connected to active systems)
- Catch basins
- Underground vaults
- Large diameter pipe
- All underground systems accessed through manholes

G. Permit System

Before anyone is allowed to enter a permit required confined space, an entry permit must be completed and signed by an entry supervisor. The permit is a guideline to help you safely plan your confined space entry. It puts in writing all the conditions that must be evaluated in order to ensure a safe entry. The entry permit must clearly identify:

- Identification of the permit space,
- Location of the space
- Purpose of entry,
- Date and duration of permit,
- Names of authorized entrants,
- Names of current attendants,
- Name entry supervisor(s),
- Name and signature of the person providing certification,

- List of hazards anticipated to be found in the permit space,
- List the measures to be used to isolate the permit space and/or to eliminate/control hazards,
- State the acceptable entry conditions,
- Indicate the results of entry tests initiated by the persons performing the monitoring,
- Indicate the rescue and emergency procedures, and means to summon and communicate with the rescue teams,
- Communication procedures for attendants/entrants,
- Required equipment (such as personal protective equipment/ clothing, respirators, retrieval systems, etc.),
- Additional permits if necessary such as hot work permits, and
- Any other necessary information.

Before entering a confined space, the entry supervisor must preplan the operation. The entry supervisor must know the hazards present and the manner by which the hazards will be assessed and controlled. Before signing the permit, the entry supervisor must verify that all appropriate information on the permit is completed and is correct, that all the specified tests have been conducted, and that all the necessary procedures and equipment are in place. The completed permit must be posted as close to the entrance to the permit required confined space as practical, so the attendants and entrants can review the permit to confirm that pre-entry preparations have been completed. Upon completion of the operation, the permit is cancelled by the entry supervisor and kept on file for at least one year. Any problems that occur during the entry must be noted on the permit.

The entrants and attendants must be aware of the hazards and know the signs and symptoms of exposure. The entrants and attendants also must know the consequences of overexposure to these hazards. They must be aware of acceptable environmental conditions that must be maintained during entry. These conditions may vary according to the hazards at the particular location and the work procedures being performed. Prior to entry, the work methods to be used in the space should be discussed. Good safety procedures require the entry supervisor, the entrants and the attendants to have a pre-entry meeting to ensure that all personnel understand their responsibilities and the hazards found in a particular space. Procedures such as welding, purging and cleaning can affect the confined space environment. The

permit system must also explain the work tasks in detail as well as the practices to maintain safe working conditions while the job is being performed.

H. Confined Space Hazards

Preplanning confined space entries includes identification and evaluation of potential hazards. The hazard identification process includes a review of the previous and current uses of the space that can adversely affect the atmosphere therein. Both the inherent atmospheric hazards and any introduced by the project must be identified and reviewed. The means of entry and exit, as well as the hazards posed by adjacent spaces, operations and conditions also need to be reviewed.

a) Atmospheric Hazards

The most serious threat to the safety and health of the entrant is the atmosphere of the confined space. Atmospheric hazards, as mentioned, are by far the leading cause of death and serious injury.

The OSHA 1910.146 Standard breaks down atmospheric hazards into three different categories: oxygen deficient, flammable, and toxic. The following conditions are hazardous atmospheres which employees can encounter in a confined space:

- **An oxygen concentration below 19.5% (oxygen deficient) or above 23.5% (oxygen enriched);**
- **A flammable or explosive atmosphere that has a gas, vapor or dust present at a concentration greater than 10% of their lower explosive limit (LEL);**
- **An atmospheric concentration of any toxic contaminant above the OSHA permissible exposure limit (PEL) or any other recommended standard;**
- **An airborne combustible dust at a concentration that obscures vision at a distance of 5 feet or greater;**
- **Any immediately dangerous to life or health (IDLH) atmosphere.**

Although some airborne dusts or particles may be easy to see, and some hazardous chemicals are easy to smell, there are other hazards such as oxygen deficiency and odorless atmospheric hazards (e.g. carbon monoxide) which cannot be detected by any of your senses. Therefore, appropriate and reliable instrumentation is necessary to protect workers from atmospheric hazards encountered in a confined space. The instrumentation is discussed in Section I., "Testing and Monitoring of

Atmospheric Conditions ", of this manual.

The types of atmospheric hazards, which are likely to be found in confined spaces, are briefly discussed below:

I. Oxygen Deficiency

A normal concentration of oxygen in air is 20.9%. An oxygen deficient atmosphere contains less than 19.5% of oxygen by volume. As the level of oxygen decreases, the adverse physiological effects increase. The effects of oxygen deficiency can be sudden or gradual depending on the oxygen concentration, levels of other gases in the atmosphere and physical work activity.

The following chart describes the symptoms.

<u>% Oxygen</u>	<u>Effects & Symptoms</u>
>23.5	O ₂ enriched, increased chance of fire and combustion
20.9	Normal percentage in air
19.5	OSHA/NIOSH minimal requirement
16-12	Increased pulse and respiration, impaired judgment and coordination
14-10	Fatigue, disturbed breathing, very faulty judgment
10-6	Nausea, vomiting, inability to move freely, unconsciousness followed by death
<6	Convulsion, death

Oxygen deficient atmospheres may be caused by oxygen being displaced by other gases such as nitrogen, which can result in a dangerous or immediately dangerous to life condition.

Oxygen deficiency could also be the result of natural processes such as rust, corrosion, or other forms of oxidation. An example of this type of oxygen deficiency could be caused by decomposing organic matter, such as domestic waste and plant life. As materials decompose, oxygen is drawn from the atmosphere to fuel the oxidation process and methane, carbon dioxide and hydrogen sulfide are produced as oxygen is consumed.

Excessive oxygen in concentrations above 23.5% by volume can also create a hazardous atmosphere. When oxygen increases above the normal level of 20.9%, it increases the flammability range of combustible gases or vapors and causes accelerated combustion.

Excess oxygen also causes other combustible materials to burn violently. For example, there have been cases of workers being burned when their oxygen-enriched clothing ignited. Never purge confined spaces with pure oxygen in place of air. Improper blanking off of oxygen lines is another possible way for oxygen to enrich a confined space atmosphere.

II. Flammable/Combustible Gases

There have been many cases of fatalities in confined spaces because of fires and explosions. Most of these accidents occurred because the atmosphere was not monitored, explosion proof equipment was not used, or some other source of ignition was present. When fuel, oxygen and a source of ignition are present in the right mixture, a fire or explosion will occur. The combination of the above elements is known as the fire triangle. If you remove any of the legs of the triangle, you can prevent combustion.

The percentage of combustible gas vapor in the air is the determining factor. All combustible gases/vapors have different flammable ranges. OSHA defines "flammable or explosive atmosphere" as one that poses a hazard when flammable materials are present at a concentration greater than 10% of their lower explosive limit.

The lowest concentration at which a vapor can ignite is its Lower Explosive Limit (LEL). Concentrations below this limit are too lean to burn. The highest concentration that can be ignited is its Upper Explosive Limit (UEL). Above this concentration, the mixture has too much gas/vapor and not enough air to ignite.

An explosion occurs when the atmosphere has just the right amount of a particular gas in air to explode. Care must be taken whenever there is a combustible gas present. A lean mixture can collect in low-lying areas and form a combustible concentration. Conversely, opening an access cover that allows air to enter an atmosphere that was originally too rich in gas to burn, could bring the gas into its flammable range, and possibly cause an explosion.

III. Toxic Hazards

Another potential atmospheric hazard in confined spaces are toxic contaminants that can be in the form of a liquid, solid or gas. These contaminants can produce an atmospheric condition that is immediately dangerous to life and health. A substance that is present in a

concentration above its permissible exposure limit is also hazardous. Before a confined space can be entered, the toxic chemicals in them must be identified and the space tested to determine the concentration of these chemicals.

Some of the more common toxic chemicals found in confined spaces on the DDC projects are:

Carbon Monoxide is a colorless, odorless, and tasteless gas. Internal combustion engines usually create it. In high concentrations of carbon monoxide, a worker may collapse with little or no warning and thus be unable to aid himself. Carbon monoxide is called the silent killer. Carbon monoxide poisoning can occur quite suddenly.

<u>PPM Level</u>	<u>Effects & Symptoms</u>
35	OSHA PEL (1989)
200-500	Headache and discomfort
600-1000	Dizziness, nausea, dull headache, heart pounding, ringing in ears
1500	Dangerous to life
4000	Unconsciousness and death will occur within a few minutes

Hydrogen Sulfide or H₂S can be extremely dangerous in the workplace. This colorless gas, smells like rotten eggs, but a few breaths of it deadens the sense of smell. Therefore, do not count on the "rotten egg" smell to warn you of its presence. In high concentrations, hydrogen sulfide is flammable and explosive and will produce sulfur dioxide as a byproduct, another toxic gas. Above all, H₂S is extremely toxic. It can cause unconsciousness and respiratory arrest.

<u>PPM Level</u>	<u>Effects & Symptoms</u>
10	OSHA PEL (1989)
15	OSHA STEL (15 minute exposure)
75-150	Slight eye, respiratory irritation
170-300	Marked irritation
400-600	Unconsciousness and death in one hour

1000 Death in minutes

40000 4% volume LEL

On the DDC projects, hydrogen sulfide may be found in sewer manholes, anywhere rotting materials or vegetation is found (storm drains), or in below grade crawl spaces where sewer line leaks have occurred.

b) Engulfment Hazards

Engulfment hazards, though normally not found on DDC projects, refer to situations where loose material such as sawdust or grains are stored in bulk and can trap or envelop the entrant. Often a dry bulk material is stored in confined spaces such as tanks or silos. Someone may enter an area that appears to have a solid walking surface, but it may have a hidden air pocket underneath, which could collapse under the weight of the entrant. The weight of the material can compress the torso or the material can fill the respiratory system of the entrant, resulting in asphyxiation.

c) Entrapment Hazards

If the walls converge inward or the floor slopes down and tapers to a small cross section, there is a risk of being trapped and/or asphyxiated.

d) Mechanical Hazards

Confined spaces, because of their often-tight configuration, can place entrants in dangerous proximity to physical hazards. Limited space can restrict the employee's ability to avoid these potentially fatal conditions.

Physical hazards such as grinding and mixing equipment, rotating gears and shafts can cause injury to entrants. This type of equipment is frequently not guarded in confined spaces because it is normally located where employees would not come in contact with it. Lockout and tagout procedures of all energy sources that are potentially hazardous to entrants must be employed to prevent the accidental start up of equipment before personnel are permitted to enter into a confined spaces.

e) Electrical Hazards

Confined spaces, because of their often-tight configuration, can place entrants in dangerous proximity to electrical hazards. Limited space can restrict the employee's ability to avoid these potentially fatal conditions.

Electrical hazards such as exposed energized wires or uncovered electrical equipment, may upon contact, shock or electrocute the entrant.

Lockout and tagout procedures of all energy sources that are potentially hazardous to entrants must be employed to prevent the accidental energizing of equipment before personnel are permitted to enter into confined spaces. Either low voltage tools (less than fifty (50) volts) or Ground Fault Circuit Breakers (GFCI) must be used on all electrical equipment used by employees in confined spaces.

f) Biological Hazards

Biological hazards such as molds, mildew and pathogens frequently can be found in confined spaces such as sewer lines or in below grade crawl spaces where sewer line leaks have occurred.

These hazards can irritate the respiratory system or threaten the body with a variety of diseases. Adequate personal protective equipment (PPE) and protective clothing must be used by the entrant(s).

g) Thermal Effects

Heat stress and hypothermia are potential confined space hazards. In confined spaces radiant heat, cold temperature, moisture content and air velocity may be difficult to control. In the colder months, sealing off confined spaces and the use of space heaters can produce an oxygen deficiency or a lethal atmosphere to arise due to the accumulation of toxic gases such as carbon monoxide.

h) Noise

Noise levels are often elevated because sounds tend to reverberate in confined spaces. High noise levels can often cause permanent hearing loss or may hinder communication between the entrant and the attendant causing them to miss important directions or warnings.

i) Other Hazards

Some other potential hazards that may be encountered in a confined space are:

- Structural design, such as baffled, bends in tunnels, and multi-level spaces can present unique physical hazards that at the very least may complicate a rescue
- Poor visibility or inadequate lighting;
- Poor footing or an unprotected drop off can add additional hazards to confined space entries;
- The spaces may harbor rodents, insects, snakes, and spiders, all of

which may be dangerous;

- Sudden changes in wind or weather can cause sudden changes in the confined space environment;
- Rain storms and water run off, can suddenly increase water levels in catch basins, combined sewer lines, storm drains, etc.

I. Testing and Monitoring of Atmospheric Conditions

It must be assumed that every permit required confined space has the potential to have a hazardous atmosphere. **No one should ever be allowed to make an entry without first checking the atmosphere, even if the entry is "just for a minute".**

In many confined spaces, there may be a high concentration of gases present at the entry point. It is important to sample around the confined space opening prior to removal of the cover. If there is a sampling port (opening), as in some manhole covers, place the probe in first to make sure that it is safe to open the cover.

Prior to every entry, atmospheric conditions shall be tested by an authorized space entry supervisor. As a minimum for entry, levels of oxygen concentration, LEL (lower explosive limit), and carbon monoxide and hydrogen sulfide shall be tested. All atmospheric testing shall be conducted with a properly calibrated equipment at the low, middle, and high levels within the space. DDC Infrastructure Division prohibits the practice of entering the confined space to conduct the atmospheric testing.

Acceptable levels for entry are:

- Oxygen concentration between 19.5 and 23.5 percent.
- 0% of the LEL
- 0 PPM hydrogen sulfide and carbon monoxide.

Any atmospheric conditions in a permit required confined space not acceptable for entry shall require:

- Elimination of the source of the atmospheric hazard and continuous ventilation to reduce the contaminants to an acceptable level.

Battery powered, direct reading instruments are considered to be the most practical devices for monitoring confined spaces on a periodic or continuous basis. These monitoring devices are classified into two groups: single gas monitors like the classic MSA explosion meters, or a

variety of multiple (three or four) gas meters, which are on the market today. As mentioned above, the OSHA permit required confined space standard requires confined spaces to be checked for multiple atmospheric hazards. Regardless of the type of instrument used to monitor the atmosphere, regular readings must be taken during all confined space operations as the level of oxygen, combustibility, or toxicity of a confined space can increase during an entry.

Employees shall monitor the atmosphere in the confined space continuously during entry, not just prior to entry. While working in a space, the atmosphere may change due to a leak or work activities. A monitor will be able to detect a change before the entrant does allowing enough time to safely leave the space.

Monitoring instruments must be working properly. The device must be calibrated according to the manufacturer's recommendations and calibration procedures. Employees designated to use atmospheric monitors must be taught all aspects of the instrument's use and limitations.

J. Roles and Responsibilities in the DDC Infrastructure Confined Space Program

Responsibilities of the Authorized Entrants

Authorized Entrants must:

- Know the hazards they may face in the confined space,
- Be able to recognize signs or symptoms of exposure,
- Understand the consequences of exposure to hazards,
- Know how to use any needed equipment,
- Communicate with attendants as necessary,
- Alert attendants when a warning symptom or other hazardous condition exists, and
- Exit as quickly as possible whenever ordered to by the attendant, alerted by an alarm, warning sign, or other prohibitive condition.

Responsibilities of the Attendant

Attendants must:

- Know the potential hazards of the confined space,

- Be aware of the behavioral effects of potential exposures,
- Maintain continuous count of authorized entrants,
- Communicate with entrants as necessary to monitor entrant status,
- Monitor activities inside and outside the permit space,
- Order exit of the space if required,
- Summon rescuers if necessary,
- Prevent unauthorized entry into confined spaces, and
- Remain outside the permit space during entry operations or until relieved by another attendant

Attendants may not perform any other duties during the duration of permitted activities.

Responsibilities of the Entry Supervisor

Entry supervisors must:

- Know the potential hazards of confined spaces,
- Verify that all tests have been conducted ,
- Verify all procedures and equipment are in place before endorsing permit,
- Issue a written permit for permit space,
- Terminate entry,
- Cancel permits,
- Verify that rescue services are available and the means for summoning them is operable,
- Order the removal of unauthorized individuals who enter either the area around the confined space or the confined space.

When shift and/or entry supervisors change, the next entry supervisor shall issue a new permit. Until the permit process is completed, entrants must evacuate the permit required confined space.

Rescue Services

Within the five boroughs of the City of New York, the FDNY is recognized as the rescue service for permit entry confined spaces. Prior to the issuance of any permit, the FDNY must be contacted and informed of the entry. Other requirements include the following:

- The FDNY must be made aware of hazards that they might encounter within the confined space; and must receive access to comparable permit spaces to develop rescue plans, and practice rescues;
- An MSDS for any chemical introduced into the permit required space by DDC must be immediately available on the project site and must be provided to healthcare providers if a medical emergency occurs during the permit required confined space entry.

K. Alternative Protection Procedures

For permit spaces where the only hazard is atmospheric and when ventilation alone can control the hazard, the DDC may use alternative procedures for entry. To qualify for alternative procedures, employees must:

- Ensure that it is safe to remove the entrance cover;
- Determine if ventilation alone is sufficient to maintain the permit space safe for entry;
- Ensure that the work to be performed within the permit required space introduces no additional hazards;
- Gather monitoring inspection data to support the above criteria;
- If entry is necessary to conduct initial data gathering, perform such entries under the full permit program; and
- Document the determination of the supporting evidence and make it available to employees.

Entry can take place only after it has been determined that:

- It is safe to remove the entrance cover;
- Openings are guarded to protect against falling and falling objects (Note: If the entrance of the permit required confined space is in a street or sidewalk, the proper MPT must be designed, approved, and installed prior to the entry);

- Internal atmospheric testing is conducted;
- Air remains non-hazardous whenever any employee is inside the space;
- Continuous forced air ventilation has eliminated any hazardous atmosphere; and
- The space is tested continuously during the entry.

Employees must exit immediately if a hazardous atmosphere is detected during entry and the space must be evaluated to determine how the hazardous atmosphere developed.

L. Communication Equipment and Lighting

There is a wide range of equipment that is used to protect workers in confined spaces. It is essential that all entries be preplanned so that suitable equipment is selected. NIOSH studies of confined space entry fatalities indicate that they are frequently caused by a lack of proper equipment, little or no training and failure to follow safety rules and procedures. An employee should never enter a confined space without the proper equipment and training.

Communication Equipment

The OSHA standard requires:

- Attendants and entrants to be able to communicate with each other, and
- Communication equipment to be available to quickly summon rescue services in the event of an emergency.

In a small confined space, when the entrant is near the entrance, communication can be accomplished by voice or hand signals. The type of communication depends on the situation. When possible, the best method is for the attendant to see and hear the entrant. The attendant can see if the entrant is experiencing early signs or symptoms of exposure. Because background noise or respirators may interfere with communication equipment, hand signals may be a good method. Entrants and attendants may signal each other by tugging on a lifeline that is attached to the entrant.

Two-way radios are frequently used in confined space entries. Battery operated, voice activated radios are frequently used because they permit workers to communicate with each other without having to use their

hands to hold radios. While two-way radios may seem like the best means of monitoring communications, the batteries can go dead, are subject to interference, or may be out of range within a confined space. Care must also be used so that they are intrinsically safe when used in combustible atmospheres. The employees must decide prior to making an entry into a confined space what means of communication will be utilized.

Lighting

Confined spaces frequently do not have a built in source of light. The OSHA Standard requires sufficient illumination be available to:

- Enable workers to work safely, and
- To allow safe exit of the space in the event of an emergency.

When portable light sources are used, it is important, as with any electrically powered tool, that they are not used in a flammable environment, unless they are explosion proof. Whenever portable light sources and/or electrically powered equipment, operating at fifty (50) volts or more, is used in a damp or wet confined space, the use of a ground fault circuit breaker (GFCI) is required to be utilized.

M. Personal Protective Equipment

Selection of personal protective equipment (PPE) cannot be made until a hazard assessment is made of the confined space. Once the hazards have been identified and quantified (air monitoring) the proper PPE can be selected. The types of PPE available should be listed on the entry permit and contained in the written permit program.

PPE can protect the entrant from a wide variety of hazards. PPE for confined spaces can be broken into two categories: respiratory protection and protective clothing.

Respirators

DDC Infrastructures will not enter a permit required confined space that requires the use of a respirator.

Protective Clothing

There is a wide variety of clothing designed to protect entrants from a range of hazards such as corrosive chemicals, cuts, abrasions, and biological hazards. The proper selection of protective clothing will depend on the types of hazards and work performed in the confined space.

The clothing may be cotton work clothes, or jumpsuits that contain built in harnesses for fall protection.

Thermal Conditions

It is quite possible to have either cold or hot environments depending on factors such as the climate and the nature of the space. Protection may be as simple as layering clothing to protect entrants from the cold.

Heat stress can present a major problem due to the constricted nature of a confined space, or a lack of ventilation. Specially designed vests and suits that cool the body through ice packs or fluids, pumped through tubes sewn into clothing, are a possible solution to this problem.

Chemical Protective Clothing

DDC Infrastructures employees will not enter a permit required confined space that requires the use of chemical protective clothing.

Eye and Face Protection

Eye and face protection, depending on the type selected, can protect from a number of hazards:

- Safety glasses with side shields and/or goggles provide impact protection from potential hazards generated by flying particles during cleaning, chipping, cutting, drilling, etc.
- Goggles can offer 360-degree coverage of the eyes and provide protection from flying particles and liquid or chemical splash.
- Full-face shields protect more of the face from flying debris and chemical splashes.
- Welding goggles and face shields are required for cutting and welding and provide protection from radiant light.

Eye and face protection must meet the criteria specified in the ANSI Z87.1-1989 Standards.

Head Protection

Head protection in the form of protective hard hats is required to be worn whenever there is a potential danger of injury from:

- Falling objects from above,

- Side impact to the head from swinging objects, or
- Contact, to the head, with exposed, energized electrical equipment.

Head protection must be able to resist penetration, absorb the shock of a blow and protect against electric shock. Hard hats should conform to the ANSI Z 89.1-1986 Standard. Head protection is required to be worn whenever entering into a vertical confined space five (5) or more feet in depth.

Hearing Protection

Exposure to high noise levels can cause irreversible injury, hearing loss or impairment. It can also create physical and psychological stress. High noise levels in confined spaces may result from equipment operating in or near the confined space or from an operation performed within the space such as grinding, welding, hammering, etc. Due to the restrictive configurations of confined spaces, sound may reverberate and be amplified resulting in high [greater than 85 dB(A)] noise levels. In some cases, hearing protection may be required.

Foot Protection

Standard work shoes must be worn by all field employees whenever they are working.

Fall Protection/Retrieval Systems

Entering confined spaces often involves the risk of a vertical free fall hazard when climbing down or being lowered into a vertical confined space. Rescuing someone in a confined space exposes the rescuer to the danger of being overcome and trapped, particularly if they are entering through a small opening.

The type of entry/retrieval equipment required is dependent upon the type of entry:

- The depth, configuration, and size of the inside of the confined space,
- Means of access, configuration, and size of the outside opening,
- Obstacles within the space,
- The number of occupants, and
- Whether it is a vertical or horizontal entry.

N. Tools

Tools used in confined space entry should be assembled prior to entry into the space. Provisions should be made on how tools will be lowered and raised without endangering the entrant. Tools and equipment should not be placed adjacent to a vertical entry to prevent someone from kicking these tools down onto the entrant.

It is mandatory that only non-sparking, air powered, or explosion proof tools be used in an explosive or flammable atmosphere. All electrical equipment used in hazardous atmospheres should meet Article 500 of the National Electric Code (NFPA-70). Because sparks can be produced by striking and grinding operations or by static electricity, it is best not to enter a flammable/explosive environment unless the employee is equipped and experienced with this type of hazard.

O. Signs, Signals and Barricades

The OSHA standard requires effective measures to prevent non-authorized people from entering confined spaces. Barricades, traffic control devices, etc. should be placed around open manholes and other confined space entry points to protect passersby and the entrants.

Any openings that are in the traveled way of any traffic, vehicular, pedestrian or other, must be properly maintained and protected. Maintenance and protection of traffic (MPT) must be designed, approved, and installed according to the Manual of Uniform Traffic Control Devices and all NYC requirements, prior to the entry.

P. Ventilation

Alternative procedures (1910.146(C)(5)) for Permit Required Confined Space entries are permitted because OSHA recognizes that the major hazard of many confined space entries, hazardous atmospheres, can be controlled through the use of forced air ventilation. When atmospheric testing indicates that there is a dangerous atmospheric condition, engineering controls are the preferred means to correct the condition.

The size, shape, opening, and configuration of the space might create pockets with hazardous atmospheres at the corners and top of the space. When tests indicate the presence of a hazardous gas or vapor, pre-entry purging is used to remove or dissipate the contaminant. Purging can be done through the use of an inert gas such as nitrogen, air, steam, water, or a cleaning agent. Different methods may be used for purging and forced air ventilation based on such factors as the nature of the material in the vessel, the decomposition of materials in the space, and the amount of scale or residue build up on the walls of the space.

The volume of the space to be ventilated and the output capacity of the

ventilation equipment must be considered. The air movers should meet the ANSI/NFPA 91-1983 and ANSI Z9.2-1979 Standards. Bonding wires and intrinsically safe air movers should be used when moving flammable gases or vapors.

Local ventilation is usually forced supplied air that provides fresh air into the breathing zone of the worker and dissipates any vapors. If a ventilation system is used, it should have an alarm to warn of a breakdown or failure.

The location of the air supply duct in a small entry port may interfere with the entry, exit, work task, or communications. Specially designed air hoses are available which take up only a few inches of space at the manhole entry port. These systems can eliminate the need to remove the hose each time an entry or egress is required.

Natural ventilation may be acceptable if it can provide a safe atmosphere.

It is extremely important to remember that ventilation may not be enough to ensure a sufficient quantity of fresh air in a confined space. This is why it is important to continuously monitor the space. Specific types of PPE are required to ensure a safe entry when atmospheric hazards cannot be controlled.

Q. Training

The DDC will provide employee training:

- Prior to working in a confined space,
- When there is a change in employee task and/or responsibility, or
- If new hazards arise.

This written permit required confined space program requires employees to demonstrate proficiency in the duties assigned to them during a permit required confined space entry.

The DDC must also certify the training. Certification will contain the employee's name, the signature of the trainer, and the dates of training. The certification will be available for inspection by employees and their authorized representatives.

The entrant will be trained in hazard recognition, including the mode, signs, symptoms, and consequences of the overexposure. Entrants must also know the purpose, proper use and limitations of personal protective equipment, rescue equipment, and tools used in confined

space entries. The method of communication between the entrant and the attendant will be identified during the training.

The attendant will be trained in hazard recognition, including the signs of overexposure and the behavioral effects of overexposure in entrants. Attendants must also be familiar with rescue procedures to facilitate a rapid intervention by the FDNY. The method of communication between the entrant and the attendant will be identified during the training.

The training requirement for entry supervisors is equivalent to the attendant/entrant training. Additionally, training should include skills and knowledge to make competent decisions about confined space procedures.