TRAINING AND COMPETENCY REQUIREMENT FOR SAFE WORKING IN CONFINED SPACE

Vyas Pranav Kumar Devendra Bhai
Fire Officer
Ship Recycling Yard Alang
Notified Area Gujarat Maritime Board Ship Recycling Yard, Gujarat, India

Abstract: Confined space work is a high-risk activity, posing a significant hazard for both workers and rescuers involved in the emergency response. Risks due to working in confined spaces can be extremely dangerous. The leading cause of accidents and fatalities in confined spaces is atmospheric condition. Further common causes are fire, explosion, ignition of flammable contaminants, spontaneous combustion and contact with temperature extremes. Recent pilot projects have been developed focusing on the application of Internet of Things (IOT) technologies for confined space work. The aim of the paper is to propose a reference framework for analyzing risks and work procedures in confined spaces further specified with a training module. After a first legislative overview and a literature review on the topic, the authors conceptualize a procedure for analyzing the dangerous scenario in confined spaces and for defining the impact of IOT technologies for preventing and managing confined spaces risks. The framework supports both safety managers and risk analysts in reducing hazards in confined spaces.

***IndexTerms* – Confined Space, Training Module.**

I. INTRODUCTION

A confined space is defined in the United States Occupational Safety and Health Administration (OSHA) regulation as "a space that:

- is large enough and so configured that an employee can bodily enter and perform work,
- Has limited means of entry or egress, and
- Is not designed for continuous employee occupancy." Confined spaces are primarily entered for purposes such as maintenance, repair, inspection, cleaning, and unclogging. Confined space work is widely regulated and standardized in North America. It should has limited or restricted means for entry or exit for example, tanks, storage bins, hoppers, vaults, and pits, and is not designed for continuous employee occupancy. Confined space emergencies are rare, high-risk incidents. When they do happen, they can lead to firefighter injuries or deaths. First responders must be aware of the hazards and limitations of confined spaces so they can be prepared when they approach an incident in or around a confined space, and when they attempt to enter confined spaces during non-emergencies. Many confined spaces accidents occur because the worker does not realize the danger or potential dangers within or nearby the space. Workers may not take into account the new hazards and other conditions created during work in confined spaces. Thus, it is crucial to carefully identify all confined space hazards before entry.

1.1 Classification of confined space

There are two types of confined spaces depending on existence of atmospheric hazards, permit required confined space and non-permit required confined space. For a confined space has been identified as having any potential hazards there needs to a written program developed, that outlines and instructs on the proper procedures for working around these spaces. This permit must be posted near the space entry for entrants to verify that pre-entry procedures have been done.
Draft guideline for Training & working in Confined Space emphasis to life safety of Firefighting personal 2018

Many organizations related to workers safety at work had put regulations and standards that cover work in confined spaces. Two of these were: The safety, health and welfare at work confined spaces regulations 2001, regulation No.5, and the Occupational Safety and Health Standards, standard No 1910.146.

1.1.1 Non-Permit Confined Space

By OSHA's definition in CFR 1910.146, a 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."

- It is critical to ensure that when a confined space is classified as a non-permit space, that all potential for health or safety hazards have been eliminated. The following conditions must be met:
- The confined space contains no potential or existing hazardous atmosphere
- The confined space does not contain hazards capable of causing physical harm or fatality. This includes, but is not limited to, electrical shock, hazards of moving components, or engulfment in liquid or solid material.
- It is important to note that if a confined space must be entered to remove the existing hazards, the space is treated as a permit-required confined space until all hazards are eliminated.
- Documentation must be provided on how the confined space was determined to be a non-permit confined space.

1.1.2 Permit-Required Confined Space

By OSHA's definition in CFR 1910.146, a permit-required confined 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."

A confined space deemed as permit-required may pose health or safety hazards and require a permit for entry.

- Once a confined space has been identified as permit-required, the employer should provide signage or some other form of effective communication to let others know of the existing confined space.
- Before an authorizer employee can enter a permit-required confined space, a written or printed permit must be provided by the employer to allow entry into the confined space.

1.1.3 Do Not Enter Confined Space

Regardless of the classification level of confined space, an employer may decide that its employees will never enter permit spaces. To properly implement this, the employee has to ensure that effective measures are taken to prevent workers from entering permit spaces, such as adequate signage or any other equivalent means.

II CLASSIFICATION OF HAZARDS IN CONFINED SPACE:

Hazards of the confined spaces can be classified into Atmospheric and Non-Atmospheric hazards. Atmospheric hazards are hazards that involve problems with the air of the space. The hazardous atmosphere is any atmosphere that may incapacitate, injure, or impair an employee's self-rescue or lead to acute illness or death to workers and rescuers who enter confined spaces, for example, Oxygen deficiency, Oxygen enrichment, Toxic atmospheres, and Irritant atmospheres.

- There are many actual and potential non- atmospheric hazards within confined space, they must be eliminated before entry. Examples of these are Mechanical hazards, Electrical hazards, Environmental hazards, Engulfment, Biological Hazard. The related parts were the employer, the competent and the workers.
- The Proprietors (employer) shall appoint a competent person to carry out risk assessment when work is to be undertaken in a confined space, and whenever there is any significant change in the conditions of the confined space or of the work therein. Also adopt all necessary safety measures and issue certificates in relation to work safety according to recommendations made in the risk assessment report, allowing only certified workers to work in the confined space.
- The competent (expert) person shall assess all possible hazards of working in confined spaces, make recommendations on the safety and health measures for workers working in confined spaces and submit reports to proprietors or contractors. The Certified (authenticated) workers shall observe instructions and attend training, comply with all safety working procedures formulated and make proper use of any safety equipment or emergency facilities and report any fault or defect in the equipment or facilities immediately.
- Currently, it is required that the employer has to carry out a risk assessment for work in the confined space in addition to the entry permit, before the worker enters that space for the first time. For a confined space employer shall conduct a risk assessment for each hazard identified, including the chance of encountering such hazards by any person, the extent of impact, and the effectiveness of the existing measures for controlling risks.

III CONTROL OF HAZARDS IN CONFINED SPACES

The traditional hazard control methods found in regular worksites can be effective in a confined space. These include engineering controls, administrative controls and Personal Protective Equipment (PPE). Engineering controls are designed to remove the hazard while administrative controls and Personal Protective Equipment try to minimize the contact with the hazard. However, often because of the nature of the confined space and depending on the hazard, special precautions, not normally required in a regular worksite, may also need to be taken. The engineering control commonly used in confined spaces is mechanical ventilation. The Entry Permit system is an example of an administrative control used in confined spaces. Personal protective equipment (respirators, gloves, ear plugs) is commonly used in confined spaces as well.

3.1 Air Quality Maintenance

Natural ventilation (natural air currents) is usually not reliable and sufficient to maintain the air quality. Mechanical ventilation (blowers, fans) is usually necessary to maintain air quality.

- If mechanical ventilation is provided, there should be a warning system in place to immediately notify the worker in the event of a hazard or a failure in the ventilation equipment.
- Care should be taken to make sure the air being provided by the ventilation system to the confined space is 'clean'.
- Ease of air movement throughout the confined space should be considered, because of the danger of pockets of toxic gases remains even with the use of mechanical ventilation.
- Do not substitute oxygen for fresh air. Increasing the oxygen content will significantly increase the risk of fire and explosion.

 The use of mechanical ventilation should be noted on the entry permit.

The following paragraphs provide information on ventilation, isolation and respirators. All these are important for air quality maintenance and safety of workers. All these are monitored and regulated as per regulations of industrial health and hygiene.

3.2 Ventilation

Ventilation by a blower or fan may be necessary to remove harmful gases and vapours from a confined space. There are several methods for ventilating a confined space. The method and equipment chosen are dependent upon the size of the confined space openings, the gases to be exhausted (e.g. are they inflammable?), and the source of makeup air. Under certain conditions where inflammable gases or vapours have displaced the oxygen level, but are too rich to burn, the forced air ventilation may dilute them until they are out of the explosive range. Also, if inert gases (e.g. carbon dioxide, nitrogen, argon) are used in the confined space, the space should be well ventilated and re-tested before a worker enters. A common method of ventilation requires a large hose, one end attached to a fan and the other lowered into a manhole or opening. For example, a manhole would have the ventilating hose run to the bottom to blow out all harmful gases and vapours. The air intake should be placed in an area that will draw in fresh air only. Ventilation should be continuous where possible, because in many confined spaces the hazardous atmosphere will be formed again when the flow of air is stopped.

3.3 Isolation

Isolation of a confined space is a process where the space is removed from service by:

 Locking out by electrical sources, preferably at disconnected switches remote from the equipment
 Blanking and bleeding of pneumatic and hydraulic lines
 Disconnecting belt and chain drives, and mechanical linkages on shaft— driven equipment where possible, and
 Securing mechanical moving parts within confined spaces with latches, chains, chocke, blocks, or other devices.

3.4 Respirators

Respirators are devices that can allow workers to safely breathe without inhaling toxic gases or particles. Two basic types are air-purifiers, which filter dangerous substances from the air, and air-suppliers, which deliver a supply of safe breathing air from a tank or an uncontaminated area nearby. Selecting the proper respirator for the job, the hazard, and the person is very important, as is thorough training in the use and limitations of respirators. Questions regarding the proper selection and use of respirators should be addressed to a certified industrial hygienist.

IV TRAINING MODULE

A special-operations response team will spend far less time on actual calls than it will in training for them, but that time spent in preparation will make all the, difference when the alarm does sound. Put simply, training is the essence of success. Any failure to train your personnel adequately will serve nothing but a false sense of security, and no one should venture thirty feet under a rubble pile or deep into a fuel tank without an appreciable understanding of the issues involved.

Naturally, the training within any organization should be formatted to meet the potential response needs. It should also be realistic and scenario-driven, conducted within real time frames. Training that is realistic will present a certain amount of risk, and since the experience gained may save someone's life in a real situation, the challenges should be met rather than watered down and sanitized.

Training can be conducted by in-house personnel; outside contractors; through state or local instructional institutions, such as community or technical colleges; or by implementing a train – the –trainer program at different levels of capability. Whatever path you choose. Your instruction must be high-calibre personnel with adult-education skills, plus a significant background in technical-rescue operations, not just confined space. Someone that goes to a course or two and comes back an expert should be considered more of a liability than an asset.

4.1 training the team

If you hire a private company, make sure that you do your homework ahead of time and consider five key questions when choosing the company and its instructions.

 Are the instructors and owners active in technical rescue or emergence services, or are they just out to make money?
 Are the people you're hiring adult educators or merely instructions?
 Will a company's low bid mean substandard quality?
 Have the instructors ever responded in the real world, or has all their experience been gained in the classroom and simulated exercises?
 Is the company insured?

4.2 course introduction

Many workplaces contain spaces that are "confined" because their Configuration hinders the activities of employees who must enter, work in or exit from them. In many instances, employees who work in confined spaces also face increased risk of exposure to serious physical injury from hazard such as entrapment, engulfment and hazardous atmospheric conditions. Confinement itself may pose entrapment hazards and work in confined spaces may keep employees closer to hazards such as machinery components than they would be otherwise. For example, confinement, limited access and restricted airflow can result in hazardous conditions that would not normally arise in an open workplace. Keep in mind: Most permit-space accidents happen for the following reasons:

- Workers haven't been properly trained to recognize permit-space.
- Hazards aren't eliminated or controlled before workers enter the space.
- Rescuers are inexperienced or improperly trained.

V. RESULTS AND DISCUSSION

Even after all to the team members have crawled out of the hole at the conclusion of an incident, several responsibilities remain. Termination is a beginning of a new phase. If conducted properly, it will provide you with a wealth of information. It is during this phase that you can document the incident thoroughly, not only for the learning experience, but also to protect yourself and the organization against any enquiry, investigation or litigation that may follow. The operation officer is the entity who should collect all the tactical worksheets, notes, blueprints, maps, and any other documentation of the incident. All this information should be collected to produce a post incident report, as well as to create a central file on the operation.

5.1 TERMINATION ACTIVITIES

From the data and diagrams, you collect, you should now begin to document in full the course of your operations. This process may begin with an accurate diagram, detailing the location and positions of the victims within the space. Illustrate and describe in words also the surroundings in which they were found. Were they without breathing apparatus upon discovery? Was that apparatus full or empty? Was there evidence of a fall? Trauma? Burns? Were any mechanical systems connected with the space operational when responding units arrived? Documenting the details now will put you in a better standing should you have to answer to OSHA or some other investigative enquiry later. A prime aspect of this aspect is to compile a list of witnesses and co-workers at the site during the incident. The input of the entry team is critical, since it is, they who can provide the best information for creating accurate maps and drawings of the space. Include statements or any other documentation of any problems that were encountered in the space, including environmental hazards and operational difficulties. If you have a required OSHA document on hand, complete it currently, while the incident is still fresh in everyone's mind. If it hasn't be done already, contact the local OSHA office or the state OSHA representative. Naturally, if the site has been declared a crime scene, you should coordinate your documentation efforts with the appropriate law enforcement agency.

VI. CONCLUSION

In this study we have inducted many facts and findings related fatalities in confined space. The rate of accidental fatalities in our country is comparatively very high particularly in confined or enclosed area. It may be construction industry or mining general, agriculture, marine, shipping industry and municipal functions according to our opinion. The reason for fatalities is non-competency of workers, lack of knowledge, lack of awareness, shortest of equipment's or unavailability and irregular practice and improper training. Inspite of legal obligations of factories mining safety act, Oil industry safety directorate guidelines, OSHA standards, NFPA standards, IMO and ILO guidelines, we are lacking the knowledge of subject.

This is the reason why we first responders (Fire Service community) come across various difficulties in attending such kind of job. The study opines that our college (NFSC,nagpur) can play vital role in training and facilitates the trainees from all over India and other countries. To be trained here in the subject of "Safe confined space working and rescue". Capsule course should be inducted as a specialized course in this college and the participants who successfully complete the course can work and supervise the confined space work. NFSC can offer this program to the community, companies and organization those who want or desire to work in safety of confined areas. The fire service personnel opt training and achieve competency can give the training to others also for the purpose of minimizing fatalities, accidents, damage to the property to protect man-hours in process and safe economy of the country and development of the nation. JAI HIND

REFERENCES

1. The factories Act, 1948 (Act No.63 of 1948), as amended by the factories (Amended) Act 1987(Act of 1987), serves to assist in formulating national policies in India with respect to occupational safety and health in factories yard docks in India. It deals with various problems concerning safety, health, efficiency and well-being of the persons at work places.
2. OSHA: standard for confined spaces FR 1910.1461- contains the requirements for practices and procedures to protect employees in general industries from the hazards of entering permit hazards.
3. BIS-15001-2001- Bueareau of Indian standard, Standard occupational health and safety management.
4. 29 CFR 1915 confined and enclosed spaces and other dangerous atmosphere in shipyards employment, vessels at sea, fishing industries, vessel at dockside.
5. BIS-11972.1987-code of practice for safety precautions to be taken when entering & sewerage system (CED-24- public health engineering)
6. IS-3786-1983. Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents (CHD -8 occupational safety, health and chemical hazards)
7. IS-15793-2007 Emerging environment, occupational health and safety legal compliance requirements of good practices.
8. IS-18001-2007. Occupational health and safety management system-requirements with guidance for use (first revision)
9. IMO. Resolution A.1050(27) revise recommendations for entering enclosed spaces ABOARD SHIPS.
10. Guidance on enclosed space entry and rescue-Based on guidance in the international chamber of shipping tanker safety guide(chemicals)
11. SOLAS Chapter III, regulation 19, (1,1,2015)
12. The proposed NFPA 350:-Guide for safe confined space entry and work
13. NFPA 306-Standard for control of gas hazards on vessels(marine chemist origin)
14. NFPA 326- Standard for the safeguarding of tanks and containers for entry cleaning or repair.
15. NFPA 1670- operations and training for technical search and rescue incidents.
16. NFPA.1006- Rescue Technician professional qualifications.
17. OISD-105 sep 2004-work permit system (Oil industrial safety directorate)
18. OISD-155 (July- 1995) - personal protective equipment.
19. OISD-206 (Sep 2001) guidelines on safety management system in petroleum industry.
20. OISD-207 (Apr-2016) contractor's safety.
21. ILO-1997 No. 1713 health and safety.
22. ILO 134/ILO 152 – IMO The confined space regulations 1997. 23. OSHAcademy confined space program 713 study Guide.