Confined Spaces in Construction

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Abstract

In 2015, OSHA implemented a confined space standard for the construction industry. 29 CFR 1926.1200 Subpart AA now requires that the construction industry adhere to standards for confined spaces, which exceed the requirements for confined spaces in General Industry that have been in place since 1993. Prior to the enactment of Subpart AA, employers in the construction industry were only required to provide training to employees relating to the dangers of confined spaces and the proper personal protective equipment necessary to operate in that environment. This paper will explore the evolution of the confined space standard from the early years of OSHA, to the enactment of 29 CFR 1910.146 in 1993 for general industry, to Subpart AA in 2015, the hazards of confined spaces, the injury rates of confined spaces, the requirements of the recently implemented Subpart AA, and risk assessment of confined spaces.

History of the Confined Space Standard

The history of OSHA's confined space standard for the construction industry, 29 CFR 1926.1200 Subpart AA, can be traced back to the earliest days of the Occupational Safety and Health Organization. Shortly after the creation of OSHA in 1970, OSHA recognized the dangers of confined spaces, specifically within the shipbuilding industry. In May of 1971, OSHA adopted already existing Federal standards for work in confined spaces, which were found at that time in the Longshore and Harbor Workers' Compensation Act. OSHA's newly adopted confined space regulations for ship repairing, shipbuilding, and shipbreaking were published in 29 CFR 1915, 1916, and 1917, respectively. In 1982, parts 1915, 1916, and 1917 were combined into one standard for confined spaces for the shipbuilding industry in section 1915 (OSHA, 1994).

Recognizing that the shipbuilding industry was not the only industry where workers were exposed to the hazards of confined spaces, OSHA slowly evolved the vertical standards for confined spaces for shipbuilding in 29 CFR 1915 into the horizontal standard for confined spaces found in 29 CFR 1910.146. On June 5, 1989, OSHA published a proposed rule in the Federal Register regarding permit-required confined spaces for General Industry; 54 FR 24080. The Notice of Proposed Rulemaking allowed public comment on the general industry proposed rule until September 22, 1992. The final rule for confined spaces for General Industry took effect on January 14, 1993. Three industries were exempted from the confined space final rule found in 29 CFR 1910.146; shipbuilding, agriculture, and construction had their own vertical standards for confined spaces. At that time, however, the only confined space standard for the construction industry was the requirement to train employees on hazard identification of confined spaces and

the use of personal protective equipment. That rule was enacted in 1979, and was found in 29 CFR 1926.21(b)(6) (OSHA 2015).

After the General Industry confined space standard was enacted in 1993, OSHA recognized the need for a similar standard for the construction industry. Due to a legal challenge from the United Steelworkers of America, OSHA began working towards the goal of a confined space standard for the construction industry. In 2003, OSHA published a draft standard and encouraged a review by the Small Business Advocacy Review Panel. It was not until November 28, 2007 that OSHA published its proposed rule for confined spaces in the construction industry into the Federal Register, 72 FR 67351, and allowed commentary from the public regarding the proposed rule (OSHA 2015).

Comments from the public during this review process revealed that some construction employers had been following the General Industry standard on confined spaces, and there was a desire to keep the proposed construction standard as similar to the General Industry standard as possible. Recognizing that the challenges faced by the construction industry are different than those in General Industry, OSHA added to the General Industry standard several provisions that are unique to the construction industry when creating the final standard. OSHA addressed the unique issue of multiple employers working at one job site, and information exchange requirements between those employers as it relates to the identification of confined space hazards on a job site. Also addressed in the final rule are technological advancements that allow for continuous monitoring of hazards at a construction site. The final rule became effective on August 3, 2015 (OSHA 2015).

The need for a specific confined space standard for the construction industry is shown in the numbers of injuries and fatalities that occur specifically in confined spaces at construction sites. "An estimated 6 fatalities and 812 injuries occur annually among employees involved in construction work in confined spaces addressed by the provisions of this rulemaking" (OSHA, 2015). OSHA expects a 96% reduction in injuries and fatalities in confined spaces for the construction industry, assuming full compliance with all provisions of this standard, which equates to a reduction of 5.2 fatalities and 780 injuries per year (OSHA 2015).

The Hazards of Confined Spaces

Confined spaces present unique hazards to workers, including the construction industry. A review of OSHA's definition of hazards that create a permit-required confined space shows the major hazards to employees working in them: a hazardous atmosphere, a material that could engulf an employee, inwardly converging walls or a downward-sloped floor that could trap an employee, or any other serious safety or health hazard (OSHA, 2011).

Research conducted by Burlet-Vienney, Chinniah, and Bahloul, tracked historical data for confined space fatalities from 1980-2010. From 1980-1989, each year averaged 67 deaths in confined spaces due to poisoning from airborne contaminants, and 12% of those involved multiple fatalities. From the years 1992-2005, the average annual deaths from airborne contaminate poisoning in confined spaces fell to 38 per year, whereas the number of multiple fatalities increased to 20% of that number. Between 1993-2004, 65% of all confined space deaths were the cause of a toxic or oxygen-deficient atmosphere, and 10% were caused by engulfment; 25% of fatalities were from all other causes. An average of 2.5 deaths per year from a flammable atmosphere in confined spaces occurred between the years 1993-2010. In the

construction industry between the years 1990-1999, 62% of all fatalities from atmospheric poisoning from carbon monoxide, hydrogen sulfide, and nitrogen, occurred in confined spaces (Burlet-Vienney, 2014). According to the Bureau of Labor Statistics, 136 American workers died in confined spaces in 2015 (BLS, 2015).

Research conducted by NIOSH and published in 1994 studied the causes of confined space deaths from the years 1980-1989. That research shows that out of 670 fatalities, 373 were caused by atmosphere, 227 from engulfment, and 70 from all other causes (NIOSH, 1994). More recent research by Burlet-Vinney and colleagues in 2015 showed the same pattern. "Many potential hazards exist in confined spaces. The main ones are atmospheric (i.e. poisoning, asphyxiation, explosion), biological, and physical (e.g. mechanical, electrical, engulfment, falls, lighting, outside traffic)" (Burlet-Vinney, 2015, p. 145).

Confined Spaces in General Industry

To understand the need for a specific confined space standard for the construction industry, rather than one that exactly mirrors the standard for General Industry, it is important to review the requirements of the General Industry standard found in 29 CFR 1910.146.

According to the National Institute for Occupational Safety and Health (NIOSH), 98 workers are killed on average each year in confined spaces (CDC, 2016). Confined spaces are defined as any space large enough for an employee to enter, has limited means to enter and exit, and is not designed for continuous occupancy by the employee. OSHA goes on to define a permit-required confined space as a confined space that involves any of the following: a hazardous atmosphere, a material that could engulf an employee, inwardly converging walls or a

downward-sloped floor that could trap an employee, or any other serious safety or health hazard (OSHA, 2011).

As the above definitions illustrate, there are hazards that exist in both confined spaces and permit-required confined spaces. Typical hazards of confined spaces include ergonomics issues from abnormal postures while working in the confined space, as well as the lack of sufficient emergency exit routes. Permit-required confined spaces have more serious, and life-threatening, hazards. As such, there are many rules put into place by the OSH Act to protect employees from permit-required confined spaces.

29 CFR 1910.146 requires that the employer evaluate the work environment to determine if any permit-required confined spaces exist. If so, the employer has two options: the employer can allow employee access to the spaces, or disallow access to the spaces (OSHA, 2011).

If an employer decides to disallow employee access to permit-required confined spaces, they are required to take actions to prevent the accidental entrance of employees into the confined spaces. First, the employer shall place signage on the entrance to the confined space to warn employees with language such as “DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” (OSHA, 2011). The employer is also required to monitor changes in existing confined spaces to see if changes result in the confined space becoming a permit-required confined space, and if so to take appropriate action as the rules of permit-required confined spaces require. Additionally, any contractor performing work at the employer’s site in a permit-required confined space shall be informed of the presence of permit-required confined spaces, the hazards that exist, the protocol that the employer has initiated for entry into the space, and a debriefing after their entry into the space (OSHA, 2011).

When an employer decides to allow its own employees to enter the permit-required confined space, there are several protocols that must be initiated and followed. The employer is required to develop a permit entry program that addresses who can enter the space, under what conditions, and what measures are to be taken to safeguard the safety of the employees entering the space.

A permit entry program should address the following items:

- Training for employees entering the space.
- Written rescue procedures to remove an incapacitated employee from the space.
- Mechanical ventilation of the space prior to, and during, the employee entering.
- Monitoring of the air quality before and during entry into the space.
- Availability of proper air monitoring and life-saving equipment as required by this standard.
- The presence of a secondary employee to monitor the activities of the primary employee entering the space.
- A life-line or other rescue equipment available to remove an incapacitated employee from the space.
- A permit to enter the space shall be required for any person entering the space, and all requirements shall be met before the permit is issued (OSHA, 2011).

Additional Requirements for Subpart AA

Several factors unique to the construction industry dictate that a confined space standard specific to the construction industry be adopted. The construction industry has a temporary and transient workforce. Construction sites typically have multiple employers working at the same site, either at the same time or at different times. The dynamic nature of a construction site results in new confined spaces existing one day that did not exist the previous day (Bonino, 2015).

Because of the nature of the construction industry, the construction confined space standard that was adopted in 2015 has several key differences as compared to the General Industry standard. There are five main additional requirements, and three extensions or clarifications, of Subpart AA as compared to 1910.146 (OSHA, 2016).

The first additional requirement of Subpart AA relates to the information exchange between the various entities at a construction site as it pertains to confined spaces. As noted earlier, the General Industry standard requires that the employer identify confined spaces and relay that information to their employees and any contractors working on the employer's premises. Since a construction site has multiple employers working simultaneously, Subpart AA clarifies the responsibilities of information flow among the parties. Parties are identified as the host employer, the controlling contractor, and sub-contractors. The host employer is defined as the person or entity that owns the property where the construction work is taking place. The controlling contractor is the person or entity that has overall control of the work taking place at the site, sometimes referred to as a general contractor in the popular vernacular. Sub-contractors are those individuals or companies that work for the controlling contractor. Subpart AA makes the controlling contractor the main point of contact regarding confined spaces at the job site. The host employer has the responsibility to communicate to the controlling contractor any

information about known confined spaces, but that is where the responsibility of the host employer ends as it relates to confined spaces. The controlling contractor is responsible for relaying any information about confined spaces to all the sub-contractors working at the site, and they in turn relay to the controlling contractor information about their confined space entry program. The controlling contractor is also responsible for making sure that sub-contractors are well informed of the existence of workers in confined spaces so that their employees do not create additional hazards for those workers that are working in the confined space (OSHA, 2016).

The main second addition to Subpart AA as it compares to the General Industry standard is that a competent person is responsible for evaluating the job site and identifying any existing confined spaces and permit-required confined spaces. A competent person is one who is "…capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them" (OSHA, 2015).

The third main addition to Subpart AA is that it requires continuous atmospheric monitoring of confined spaces. An exception to this rule is if the employer can show that equipment for continuous atmospheric monitoring is unavailable commercially, or that periodic monitoring will suffice. When continuous monitoring is necessary, the employer must either provide monitoring equipment with an audible alarm to warn entrants into the confined space that the atmosphere is no longer safe, or provide for an employee to check the equipment for changes in the atmosphere with enough regularity to ensure that the entrants will have sufficient time to escape the confined space if necessary. Any entrant to the confined space must be allowed to observe the atmospheric testing. Additionally, before any entrance is allowed, the

atmosphere must be tested, in the following order, for: oxygen content, flammable gasses, and toxic substances (Bonino, 2015).

The fourth addition to Subpart AA is the continuous monitoring of engulfment hazards. An employer must provide for an early warning system for engulfment hazards, which will provide enough time for employees in the confined space to escape. The early warning system can be electronic, or another employee if applicable (OSHA, 2016).

The fifth addition to Subpart AA allows for some flexibility at construction sites by providing a system to allow an entry permit to be suspended, rather than cancelled, when conditions dictate. The General Industry standard does not have this flexibility; the entry permit is either active, or cancelled. Due to the dynamic nature of the construction industry and how often conditions change, the ability to suspend a permit temporarily rather than cancel it altogether, is a benefit to the controlling contractor and sub-contractors. When conditions temporarily change and those conditions do not meet the requirements of the entry permit, the employer is now allowed to suspend the permit until the adverse condition is no longer applicable, if the temporary condition does not change the confined space or create any new hazards in the space (OSHA, 2016).

There are three additional changes to Subpart AA that are a part of the General Industry standard, but have been clarified in the new standard. Subpart AA requires employee training in a language that the employee can understand, which is the responsibility of the employer. If an employer's emergency plan requires the use of local emergency services to rescue an employee from a confined space, employers are now required to communicate with the local emergency services so that no employee is in a confined space at any point when emergency services will be

unable to respond immediately. And lastly, when employees are exposed to physical hazards in a confined space, employers are required to either remove the hazard or provide for appropriate lockout/tagout procedures (OSHA, 2016).

Risk Assessment for Confined Spaces

As mentioned previously, Subpart AA requires that a competent person evaluate a job site to determine what confined spaces, and permit-required confined spaces, exist. The first step in protecting workers from the hazards of confined spaces, therefore, is a thorough evaluation of any confined spaces at the site to determine what hazards exist, the probability and severity of the potential harms, and an evaluation of control methods to reduce or eliminate those harms.

A five-step risk assessment tool for confined spaces was developed by Burlet-Vienney, Chinniah, Bahloul, and Roberge and published in Safety Science. They define risk assessment as, "a comprehensive evaluation of the probability and degree of possible injury or damage to health in a hazardous situation, undertaken to select appropriate controls" (Burlet-Vienney, 2015, p.145). Their research prior to the development of the risk assessment tool revealed that, where injuries and fatalities had occurred in confined spaces among the organizations that were studied by the group, most of the incident reports indicated problems with identifying risks and/or underestimating the hazard potential. Over half of these organizations did not conduct any risk analysis before issuing permits for entry, and of those organizations that did a risk analysis, none quantified the risks that they discovered in their risk assessment (Burlet-Vienney, 2015).

The risk assessment tool for confined spaces that was developed by the Burlet-Vienney team is based on the five stages of the risk management process. Step one is to identify and characterize the confined space. Step two is to analyze the risk and identify the hazards. Step

three is to estimate the risk potential. Step four is to evaluate the risk by summarizing the data. Step five is to implement controls, and review the effectiveness of the controls (Burlet-Vienney, 2015).

To identify and characterize the confined space, the Burlet-Vienney team created an extensive questionnaire for this purpose. Five categories of hazards were used to develop the questionnaire: machine, material, environment, method, and manpower. This questionnaire is then used to create a list of potential hazards within a confined space, and those potential hazards are then transferred to a table where hazards are grouped into seven distinct classes: atmospheric, chemical, biological, falling, mechanical, physical, and ergonomic. This leads to step two in the risk assessment process (Burlet-Vienney, 2015).

Step two involves the identification of hazards. The questionnaire generates the identification of potential hazards, and the second step involves narrowing down those potential hazards into a list of hazards specific to the work being done and the space it is being done in. These hazards are then transferred to a table that lists the hazards based on the seven classes previously mentioned (Burlet-Vienney, 2015).

Step three, risk estimation, has the qualified person that is assessing the risks assign a numerical value to each risk listed in step two. The Burlet-Vienney team have designed a matrix for this purpose. Their matrix is a table that accounts for the probability of the hazard on one axis, and the severity of the hazard on the other axis. Based on the subjective decision of the probability and severity of a hazard, a number value from 1-4 is assigned to each identified hazard, with 4 being the most probable and severe hazards and 1 being the least (Burlet-Vienney, 2015).

Step four of the process involves a summary of the information derived from the process to this point. The assessor is directed to create a radar chart showing the seven hazard classes, and the 1-4 rating of each hazard class based on the matrix table from step three. This will allow the assessor to visualize where the hazards exist based on the seven hazard classes and their hazard potential. This will return a number from 0-7. Any result above a 0 without risk reduction measures will require the confined space to be labeled as a permit-required confined space, and treated as such (Burlet-Vienney, 2015).

Step five is the risk reduction and feedback phase. At this point, the assessor will need to implement risk controls to address any score above a zero from the previous step, with the goal of bringing the score to zero. If the score cannot be brought to zero, the space is labeled as a permit-required confined space (Burlet-Vienney, 2015).

Conclusion

Confined spaces can contain many deadly hazards for employees. Hazardous atmospheres, possible engulfment from materials, and falls from height, to name a few. Because of these hazards, employers are required by law to analyze the risks of confined spaces before requiring an employee to enter the space, and take appropriate action to protect the employee.

Such has been the case for those in the shipbuilding industry since 1971, and then for those working in General Industry since 1993. Confined spaces and employee protection in the construction industry was largely ignored until the General Industry standard was published and became law. Even then, it would be another 22 years before OSHA finally created a confined space rule for the construction industry.

Subpart AA addresses many unique complications to confined spaces in the construction industry. Due to the dynamic nature of the construction industry, constant changes in the physical layout of the job site, and the comings-and-goings of many workers, a specific standard for the construction industry was warranted. Subpart AA addresses communications between the involved parties at a job site as it relates to confined spaces, as well as other issues unique to construction sites.

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