Thorpe Specialty Services, Inc.
Best Practices Statement - Confined Space Statement
Moving Materials In A Confined Space Using A Conveyor System

Moving tools and materials into and out of a confined space can be a challenge. The equipment designed to move tools and materials such as forklifts and wheelbarrows are generally spec'd to move over flat, unobstructed surfaces. This is rarely the case going into and inside a confined space.

Thorpe is a plant maintenance company that works in multiple areas of plant construction, maintenance, and repair. One of the main areas we work in is Refractory. Refractory lining materials are very dense and therefore very heavy. Manual handling and transporting of heavy materials present certain Ergonomic hazards. Therefore, we implemented the use of specialty conveyor systems to help with the transfer of tools and materials into and out of the confined space. However, this presents its own set of challenges and hazards including whether the use of a conveyor system requires the confined space to be classified as Permit Required.

When deciding to designate a Confined Space as Permit Required or Non-Permit Required, OSHA lays out 4 characteristics to consider:

1. Contains or has a potential to contain a hazardous atmosphere;
2. Contains a material that has the potential for engulfing an 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 smaller cross-section; Or
4. Contains any other recognized serious safety or health hazard.

While the first 3 are clear and specific, the 4th characteristic could be considered a "catch-all" for other types of hazards that should be considered. The verbiage contains two modifiers that help narrow definition which are "recognized" and "serious".
OSHA defines a Recognized Hazard as follows:

> "The hazard must be a recognized hazard, meaning that the employer knew or should have known about the hazard in the situation, the hazard is obvious, or it is a recognized one within the industry."

OSHA defines Serious Hazard as:

> "There is a substantial probability serious physical harm could result if the employer does not eliminate the hazard."

One of the main categories of hazards in construction or maintenance work that gets generally overlooked is Ergonomics. Many people, including industry professionals, who work in plants view Ergonomics as a secondary hazard that is relegated to office workers who sit at desks all day and type on keyboards, think carpal tunnel. However, our understanding of Ergonomics has grown over the years to encompass all types of strains, sprains, repetitive motion injuries or MSDs or Musculoskeletal Disorders. These types of injuries, either acute or chronic, should always be considered in the context of entering a Confined Space.

The Ergonomic hazards associated with entering a Confined Space include:

- Working in awkward positions;
- Bending and stretching to move through the space;
- Vibration injuries running pneumatic equipment;
- Lifting object causing sprains and strains;
- Using physical force when the body is not properly positioned to support the force;
- Manual Handling of heavy tools and materials into and out of the Confined Space.

It is the last one that we will address in this article, Moving or carrying heavy tools and materials into and out of Confined Spaces. As stated earlier, Thorpe is a plant maintenance company, in other words, we fix things in plants when they break or require regularly scheduled maintenance. As part of this work we deal with confined spaces on a regular basis. One of the main trades we perform is the demo and reinstallation (bricklaying) of refractory materials inside of Kilns which are used to heat materials to very high temperatures during regular operations.

These materials are necessarily dense to withstand the extreme temperatures required to burn or melt the materials in the kiln when in operation. To complete the re-lining of a kiln, the old material must be removed, and new material applied one brick at a time to protect the integrity of the outside shell during operation. This is a very manual and labor-intensive process.

The interiors of Confined Spaces are rarely flat and open. There are usually tripping hazards and beams that prevent the easy movement of tools and materials into and out of the space. At Thorpe we have developed and implemented a program to use conveyors to assist with this part of the maintenance process, thereby eliminating the need for workers to carry heavy materials into and out of the space. This addresses several recognized potential hazards such as:

- Slips, trips and falls;
- Fatigue, and
- Strains, sprains and other MSDs.

However, conveyors present their own set of hazards including rotating parts and falling objects that can result in crush or entanglement injuries and pinch points. While 29CFR 1910 General Industry does not address Conveyors System as a Standard, The Construction Regulation covers Conveyor Systems in 29CFR 1926.555 – Helicopters, Hoists, Elevators and Conveyors. OSHA Guidance when this happen has consistently stated if a standard does not exist to cover activities in the one part of the CFR (1910) then 29CFR 1926 can be used for guidance and enforcement.

One hazard that we have recognized at Thorpe and addressed is the restriction that the conveyor adds to the entryway, i.e. < 24 inches in the least dimension as defined in 1910.146 Appendix F:

> 1910.146 Appendix F – 10(3)(b) *Unrestricted – A portal of greater than 24 inches in the least dimension. These portals allow relatively free movement into and out of the permit space.*

This is an important consideration because as part of the confined space evaluation process for Permit Required or Non-Permit Required the size of the entryway must be reviewed to

understand how a rescue team would be able to access the confined space in the case of an emergency.

According to Andy Lancaster[1] - Confined Space SME and 29 CFR 1910.146 Contributor

"The conveyor itself could impede rescue team if rescue becomes necessary."

More on that in a minute.

At Thorpe we have identified 3 types of conveyors for use in confined spaces depending on the layout of the confined space and the scope of the work to be performed. These are hydraulic, electric and gravity feed.

Hydraulic Conveyor – These are generally considered the most robust and versatile type of conveyor. Most are powered by 480 VAC motors that are placed outside the confined space and the hydraulic motor(s) are fed by pressure lines. The hydraulic motor offers a greater power to weight ratio than electric conveyors that would need to be much larger in size to equal the power of a hydraulic conveyor. The hydraulic motor runs significantly quieter than it's electric counterpart due to the reduced cooling requirement for the hydraulic motor. The electric motor requires high speed fans to remain with operating temperatures. Hydraulic conveyors are sealed so they can operate in wet or dusty environments without issue. However, assembly / disassembly of the hydraulic conveyor system is time consuming and once built it is not portable.

Electric Conveyor – This type of conveyor is self-contained and is used in 10-foot sections. This makes setup quick and simple compared to the hydraulic conveyor which must be assembled and then belted. This conveyor is useful in situations where there are short distances to cover and 2 or 3 sections can be lined up to carry materials. However, the units themselves are generally heavy since the electric motor is part of the unit.

Gravity Fed Conveyor – This is the simplest and most light weight of the 3 conveyor types. It can be assembled and deployed / removed quickly. In situations where the conveyor itself could pose an entryway restriction hazard, i.e. < 24 inches in the least dimension, this conveyor system is a good option because it can be removed quickly and easily by one person to allow full access through the entryway thereby eliminating the restriction hazard if required in a rescue situation. The biggest disadvantage to the Gravity Fed Conveyor is that the operator(s) cannot remotely control the motion of the materials on the conveyor once the items are released. This can lead to pinch points and material falling from the end of the conveyor if left unattended.

Each conveyor system has Pros and Cons that should be considered based on the job scope and the type of confined space that is being accessed. A thorough evaluation of the space prior to commencement of work will help determine which conveyor system is appropriate. At Thorpe our goal is ZERO injuries to personnel. To achieve this goal we use all the tools available to us to ensure our people are working in an environment that is safe and free from recognized hazards.

Footnotes:

[1]**Andy Lancaster –** Confined Space SME and 29 CFR 1910.146 Contributor

"The conveyor itself could impede rescue if rescue becomes necessary. If a permit is required, the conveyor use should be listed on the permit."

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