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Safe confined space entry

The accumulation of bulk material on the inside of hoppers and silos often requires maintenance staff to enter confined spaces to clear pathways and restore normal flow, thus avoiding expensive plant downtime. However, such tasks are not without risk and a review of current general rules and best practices is appropriate.

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Whether it be humidity, moisture content, size/texture of the raw material, or increased volume, many factors can cause bulk materials to adhere to the sides of silos and hoppers, resulting in lost capacity or clogging. Accumulation contributes to ratholing or bridging that eventually stops production, causing expensive downtime and requiring extra labour to clear the obstruction, often involving confined space entry.

The consequences of untrained or inexperienced staff entering a silo or hopper can be disastrous, including physical injury, burial and asphyxiation. Disrupted material adhered to the sides of the vessel can suddenly break loose and fall on a worker. If the discharge door is in the open position, cargo can suddenly evacuate, causing unsecured workers to get caught in the flow. Vessels containing combustible dust, without proper testing, ventilation and safety measures, could result in a deadly explosion.

Confined space entry by untrained personnel is a formula for serious injury

An estimated seven per cent of fatalities recorded by MSHA in the USA between 1995-2011 occurred in a confined space

Confined space entry: a definition

The US Occupational Safety and Health Administration (OSHA) defines "confined space" as an area not designed for continuous employee occupancy and large enough for an employee to enter and perform assigned work, but with limited or restricted means for entry or exit.[1] "Permit-required confined space" means a confined space that has one or more of the following characteristics:

1. The vessel contains or has the potential of containing a hazardous atmosphere such as exposure to explosive dust, flammable gas, vapour, or mist in excess of 10 per cent of its lower flammable limit (LFL). Atmospheric oxygen concentration below 19.5 per cent or above 23.5 per cent.
2. There is the potential for material to engulf, entrap or asphyxiate an entrant by inwardly converging walls or by a door which slopes downward and tapers to a smaller cross-section.
3. The space contains any other recognised serious safety or health hazards.

Entering a confined space

Working in confined spaces requires securing a permit for the job and takes longer than the same work in unconfined spaces. With requirements that include special personnel training, safety harness and rigging, extensive preparation and added personnel for a 'buddy system', permit-required confined space entry entails cumbersome and costly, but necessary, safety procedures.

Unique to every operation, improved systems that incorporate easier access for entering and exiting the enclosure and natural ventilation of the internal work areas are cost-effective over time from a safety and labour standpoint.

When maintenance and repair work can be carried out without requiring permits or specially trained personnel, the risk and

labour expense associated with such tasks is reduced.

Therefore, designing systems to minimise permit-required confined spaces can provide a significant investment return.

The best time to reduce the amount of confined-space entry for component maintenance and replacement is during the specification and design stages of a project. Once the system is constructed and in operation, it is far more difficult to redesign to eliminate confined space entry.

The back wall of this chute is bolted onto the side flanges, allowing the chute to be opened without confined space entry

Many manufacturers offer systems and products that can reduce the need for confined space entry. Examples include:

- chutes with abrasion-resistant liners using modular designs for quick replacement
- chutes that hinge open and lay down for liner replacement
- skirtboards with external liners
- belt cleaners that can be withdrawn from the side of the conveyor for service without confined space entry
- flow aids such as air cannons and vibrators to reduce build-up
- modular air cleaners for specific locations rather than centralised dust collection.

Regulations and standards

Rules regarding confined space entry vary greatly depending on the country, even down to the state, province or prefecture level.

As always, regional and local codes should be identified and followed. However, general rules can be drawn from regulations established in major industrial markets such as Australia/New Zealand, Canada and the USA.

Australia and New Zealand

Australian Standard (AS) and New Zealand Standard (NZS) 2865: Confined Spaces[2] – Persons conducting a business or undertaking (PCBU) or other responsible party issues a confined space entry permit or letter of authorisation. The permit acts as a safety checklist.

According to AS Regulation 67 & 77: Confined Space Permits[3], the permit must be completed in writing and:

- specifies the confined space
- records the names of persons permitted to enter the confined space and the work period
- enacts risk control measures based on the risk assessment
- contains space for an acknowledgement that work in the confined space has been completed and all persons have left the space.

Canada

Ministry of Labour: Confined Spaces[4] – The evaluation of the space to determine if the regulatory requirements apply may include consideration of previous data (including air sampling), knowledge of the process and space, data on space configuration (including size, design, areas for pocketing and double wall) and knowledge and data on the generation and accumulation of contaminants.

According to the Canadian Centre for Occupational Health and Safety (OHS)[5], the entry permit system is an example of an administrative control used in confined spaces. The results of the tests for these hazards are to be recorded on the entry permit, along with the equipment or method(s) that were used in performing the tests.

USA

Following on from the earlier-mentioned requirement to obtain an OSHA confined space entry permit, the provisions below define the environment where a permit is not needed, according to US OSHA: 1910.146(c)(7), 1910.146(c)(7)(i), 1910.146(c)(7)(ii). A space classified by the employer as a permit-required confined space may be reclassified as a non-permit confined space under the following procedures:

- If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.
- If testing and inspection during entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

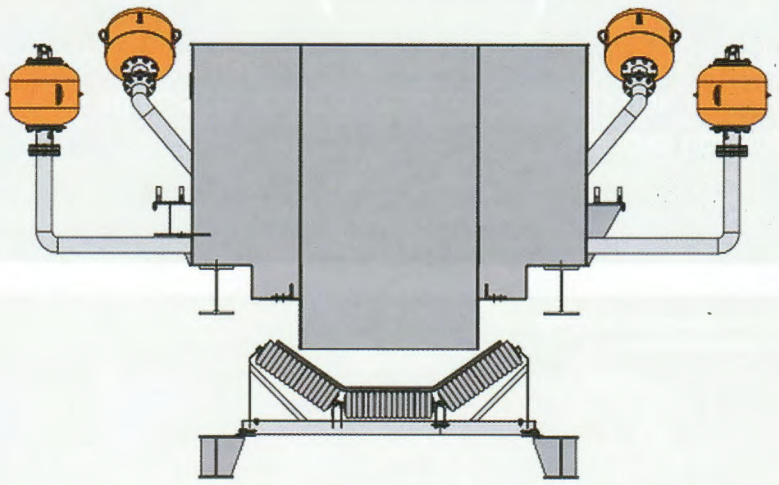
Best practices

Commonalities between governmental regulations provide employers with a measured approach to safety. These procedures include:

Prior to starting the job

- Review the permit and the job specific work procedures.

The placement of air cannons in chutes and silos eliminates the need for confined space entry to carry outmaintenance tasks



- Gather and inspect all necessary personal protective equipment.
- Test and/or calibrate any safety gear, test instrumentation or communication tools.
- Perform a short risk assessment.
- Conduct proper tests for toxins, vapour, dust levels, oxygen levels and material-specific hazards.
- Perform as much cleaning and maintenance as possible outside of the vessel.
- Post completed confined space entry permit outside of the vessel.
- Isolate contaminants and moving parts to prevent accidental introduction of materials.
- Workers should complete the proper log-out/tag-out procedure prior to entry.

During procedure

- Perform maintenance/cleaning using non-toxic substances such as water and avoid using heat/fire in the confined space. Never use oxygen to purge a confined space, as this can create a fire and explosion hazard.
- Provide ventilation if possible.
- Select personal protective/safety equipment such as safety helmet, gloves, hearing protectors, safety harness and lifeline and breathing apparatus.
- Assign a trained observer to monitor the procedure and internal conditions.
- Practice fast evacuation of the confined space.

Closing thoughts: covering your access

For a clean, safe and productive system, access to equipment for maintenance and repair is essential. No trade-off between safety, accessibility and cost is necessary when designing access to a silo, chute or other confined area. Safe access that is carefully located and adequately sized will increase dependability, reduce downtime — and the associated labour expense — required for maintenance, minimising hazards such as dust and confined space entry.

Over time, well-designed access improves safety and saves money. Consider equipment designs that eliminate the need for confined space entry, including improved access doors, vibrators, air cannons or silo cleaning services. Vessels that are properly retrofit with the right cleaning and material discharge equipment experience longer life and less downtime, while creating a safer workplace. ■

REFERENCES

[1] DOUGHERTY, D (2011) *Permit-Required Confined Spaces* US Department of Labor – Occupational Safety and Health Administration. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9797&p_table=STANDARDS

[2] STAFF (2016) *Confined Spaces: Planning Entry and Working Safely in a Confined Space.* Government of New Zealand – Worksafe New Zealand. http://www.worksafe.govt.nz/worksafe/information-guidance/all-guidance-items/confined-spaces-planning-entry-and-working-safely-in-a-confined-space/confined-spaces-planning-entry.pdf

[3] STAFF (2016) *Confined Spaces: Code of Practices.* Government of Australia – Safe Work Australia. http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/634/Confined_Spaces.pdf

[4] STAFF (2011) *Confined Spaces: Confined Space Guidelines*, Government of Canada– Ministry of Labour. https://www.labour.gov.on.ca/english/hs/pubs/confined/cs_4.php

[5] STAFF (2017) *Confined Space Introduction.* Government of Canada – Canadian Centre for Occupational Health and Safety. https://www.ccohs.ca/oshanswers/hsprograms/confinedspace_intro.html.