

Industrial Hygiene

November/December 2022

in the **Workplace**

COVER TOPIC:

Erasing Crystalline
Silica Dangers

page 8

Silicosis

ALSO IN THIS ISSUE:

Respirator Fit-Testing 14

Safety Training 18

Technology & Safety 22

Lone Workers 28

....and more!

Birmingham, MI
Permit 93
PAID
US Postage
Presorted Std

rdgmedia
PUBLICATION

www.IndustrialHygienePub.com

Safe Confined Space Entry for Cement Silos and Hoppers

Whether it's 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 labor 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 or 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.

This article highlights some of the current general rules and best practices of confined space entry of a silo or hopper.



The back wall of this chute is bolted onto the side flanges, allowing the chute to be opened without confined space entry. (photo © Copyright Martin Engineering 2022)



An estimated 7% of the U.S. fatalities recorded by MSHA between 1995 and 2011 occurred in a confined space. (photo © Copyright Martin Engineering 2022)

What is Confined Space Entry?

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, vapor or mist, in excess of 10% percent of its lower flammable limit (LFL). Atmospheric oxygen concentration below 19.5% or above 23.5%.
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. Contains any other recognized, 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 labor standpoint. When maintenance and repair work can be done without requiring permits or specially trained personnel, the risk and labor expense associated with such tasks is reduced. Consequently, designing systems to minimize permit-required confined spaces can provide a significant return on investment.

1 Dougherty, Dorothy, “Permit-Required Confined Spaces,” Occupational Safety and Health Administration, Department of Labor, Dec. 12, 2011. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9797&p_table=STANDARDS

Proper air cannon placement in chutes and silos is unique to each system. (photo © Copyright Martin Engineering 2022)

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 equipment to eliminate confined space entry.

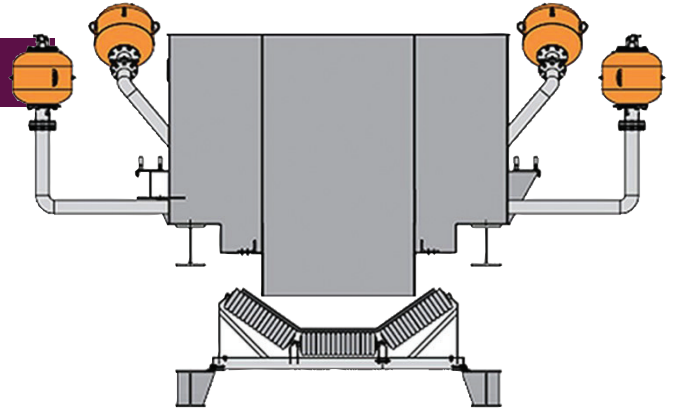
Many manufacturers offer systems and products that can reduce the need for confined space entry. Examples would include:

- 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
- Installation of flow aids, such as air cannons and vibrators, to reduce buildup
- Modular air cleaners for specific locations rather than centralized dust collection

Regulations and Standards

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

2 Staff, "Confined Spaces: Planning Entry and Working Safely in a Confined Space," Worksafe New Zealand, Government of New Zealand. Jan. 29, 2016. <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>



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

Australia/New Zealand

Australian Standard (AS) and New Zealand Standard (NZS) 2865: Confined Spaces² Persons conducting a business or undertaking (PCBU) or other responsible party issues a confined space entry permit or letter of authorization. The permit acts as a safety checklist.

CASELLA

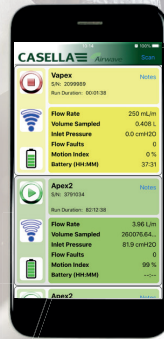
Air Sampling Pumps

Vortex3
High Flow

VAPex
Low Flow

Apex2
Medium Flow

Working today for a healthier tomorrow



Casella's air sampling pump family brings the latest technology to the market:

- High back pressure capabilities
- Long battery life
- Ingress protection (IP65)
- Rugged, easy to clean designs
- Remotely monitor the pumps and download data

13 Pratts Junction Road, Sterling, MA 01564-2305

T: (800) 366 2966
E: info-us@casellasolutions.com

www.casellasolutions.com



Confined Space Safety

*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 (size, design, areas for pocketing, double wall, etc.); and knowledge and data on the generation and accumulation of contaminants.

*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.

United States

Having summarized the requirements for an OSHA confined space entry permit in the “What is Confined Space Entry?” section of this article, the provisions below define the environment where a permit is not needed.

U.S. 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:



Never do this: Confined space entry by untrained personnel is a formula for serious injury. (photo © Copyright Martin Engineering 2022)

Prior to starting the job

- Review the permit and the job specific work procedures.
- Gather and inspect all necessary PPE.
- Test and/or calibrate any safety gear, test instrumentation or communication tools.
- Perform a short risk-assessment.
- Conduct proper tests for toxins, vapor, 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.
- Proper lock-out/tag-out/block-out/test-out procedures must be completed and documented 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.

Continued on page 54

³ Staff, “Confined Spaces: Code of Practices,” Safe Work Australia, Government of Australia. Feb. 1, 2016. http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/634/Confined_Spaces.pdf

⁴ Staff, “Confined Spaces: Confined Space Guidelines,” Ministry of Labour, Government of Canada. July 2011. https://www.labour.gov.on.ca/english/hs/pubs/confined/cs_4.php

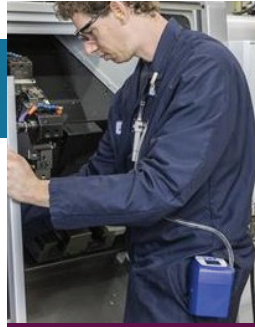
⁵ Staff, “Confined Space Introduction,” Canadian Centre for Occupational Health and Safety, Government of Canada. Feb. 17, 2017. https://www.ccohs.ca/oshanswers/hsprograms/confinedspace_intro.html

A More Effective Silica Exposure Monitoring Approach

Continued from page 10

Advantages of Using Both Gravimetric Sampling and Real-Time Monitoring

A safer and more effective program for monitoring employee exposure to respirable, crystalline silica involves the combination of two methods: gravimetric reference assessments and real-time monitoring using a light-scattering photometer. Gravimetric assessments are necessary to show compliance to the OSHA RCS Standard, but this method lacks certain characteristics that are important for further safety. By including a light-scattering photometer in this process, employers can see aerosol data in real-time; better identify problematic areas of exposure; and be more confident in the engineering controls they put in place to reduce exposure. **IHW**



Gathering data real-time in the workers breathing zone with TSI's SidePak™ Personal Aerosol Monitor. (Photo courtesy of TSI, Inc.)

About the Author

Logan Myers is an Associate Business Analyst at TSI, Inc. He spent much of 2020 and 2021 studying methods of reducing silica exposure in an effort to put forward solutions that help people combat overexposure of respirable crystalline silica.

Safe Confined Space Entry for Cement Silos and Hoppers

Continued from page 26

- 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 and reduce downtime—and the associated labor expense—required for maintenance, thus minimizing 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. **IHW**

[Daniel Marshall is a Product Engineer with Martin Engineering. © 2022 Martin Engineering Company. All rights reserved. Martin Engineering products are protected by U.S. Patents, corresponding foreign patents and patents pending. Additional information can be obtained at www.martin-eng.com/trademarks.]

Considerations for Dust and Fume Control in the Workplace

Continued from page 13

5. Do you have potentially flammable vapors that could potentially be captured by ventilation controls. Additional considerations need to be made when exhausting flammable vapors.

While dusts and fumes may not be the first thought when thinking of workplace hazards, they shouldn't be ignored. Dust exposures are not limited to heavy industrial settings. Employees working in food manufacturing, mixing spices and flour, and industrial food fryer smoke are just a few more examples of how dust exposure can be everywhere.

Lastly, engineering controls are the best choice for reducing employee exposures. When engineering controls are not being implemented, or are not an option, respiratory protection may be needed to keep employee exposures within OSHA limits. **IHW**



Ashley Griesenbrock, CIH, CSP, is an Industrial Hygiene Consultant at Safex, an EHS consulting firm in Columbus, Ohio. She specializes in inhalation exposure assessments for metals, particulates, silica and VOCs, and she trains teams on various industrial hygiene and safety topics.

What Is Respirator Fit Testing (and Why It's Important for Your Workers)

Continued from page 15

tests, due to better staff training and the early identification of respirators that fit poorly.

What's more, real-time measurements not only allow you to quickly find the correct size of mask, but also provide staff with a greater understanding of how and when their respirator best protects them to achieve the best respirator fit possible. Ultimately, these efficiencies help increase the volume of fit testing and the ability of companies to manage the data and their respirator programs efficiently.

Wider adoption and acceptance of fit testing, particularly the ambient aerosol quantitative method, is one more crucial step in helping companies achieve compliance and—most importantly—keeping employees safe and healthy while on the job. **IHW**

About the Author

Jason Rutz is a Global Product Manager at TSI, a leading global supplier of measurement instrumentation and software services designed to assist safety professionals with a range of solutions for evaluating exposure and safety. For more details, visit TSI.com.