Confined Spaces

- Grain Bin Entry
  - 1910.272 g & h
  - Promulgated 1987
  - Revised 1996
  - Applies to grain storage structures
  - Industry specific

- Confined Space Entry
  - 1910.146
  - Promulgated 1993
  - Applies to all industries who have permit required confined spaces
  - Does not apply to grain storage structures
What is a Confined Space?

A space that:
- Is large enough and so configured that an employee can enter bodily and perform work;
- Has limited or restricted means of entry or exit;
- Is not designed for continuous human occupancy.
Hazards

- Atmospheric
- Mechanical
- Electrical
- Other hazards
  - engulfment
  - Falls
  - Harmful substances

- Conditions that exist or may develop

- Examples:
  - Oxygen enrichment or deficiency
  - Engulfment & entrapment
  - Lockout & isolation
  - Weather, electrical, etc.
Examples of Confined Spaces potentially found at grain locations*

- Liquid storage tanks
- Scales / Garners
- Hoppers
- Receiving Pits
- Rail cars, barges
- Distributors
- Dust systems
- Manholes
- Vaults
- Sewers
- Equipment or space you can enter to work. (e.g. legs, conveyors,)
- Extractor
- Process vessels

* Grain storage Spaces are regulated under 1910.272 g & h. OSHA’s grain handling standard and includes bins, silos, tanks, and flat storage locations where grain is stored.
Non-Permit Confined Space

- A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death of serious physical harm.
- Examples:
  - Boot pits, tunnels, motor control center, office basements, Dryer control room, Etc.
Permit-Required Confined Space

- A Permit-Required Confined Space is confined space that has one or more of the following characteristics:
  - Contains or has the 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 become trapped or asphyxiated; or
  - Contains any other serious safety or physical or health hazard. (examples, augers, unguarded drives, corrosives, etc.)
Atmospheric Hazards

In general industry, most deaths are related to atmospheric hazards due to poor ventilation

- Acceptable oxygen levels
  - 19.5% or 23.5% oxygen concentration
    - 23.6% - enriched
    - 19.5% - min. for safe entry
    - Below 19.5 - impaired judgment, difficult breathing, fatigue
    - 6% - death in minutes

- Flammable Gas and Toxic Vapor
  - Carbon Monoxide (<25 ppm)
  - Phospine Gas (.3 ppm or greater)
  - Can spontaneously ignite at 18,000 ppm
  - Hydrogen Sulfide (heavier than air – sinks)
  - Methane (lighter than air – rises)
  - Acetylene
  - Propane
  - Gasoline/Diesel fumes
  - Welding fumes
  - Chemical vapors
Atmospheric Hazards

cont.

- **Combustible Airborne Dust**
  - If visibility becomes less than 5 to 10 feet, ventilation measures must be taken to reduce dust concentration and improve visibility
  - Appropriate respiratory protection must be used in these situations
  - Must use manufacturer’s specifications to calibrate and maintain air monitoring device, and certify employees to perform testing.
  - At a minimum, employees must know how to use for testing atmospheric hazards, tester operation and proper procedures for checking the calibration, which includes documented observations.
    - Air monitoring device must be fresh air calibrated before each use to confirm operation.
  - Recertification required annually. This should be done in conjunction with annual confined space training.
Atmospheric Hazards
cont.

- Air monitoring equipment must be equipped with an alarm to inform of sensor or equipment failure
- Air monitoring must detect the following gases:
  - Oxygen (O₂) (19.5%-23.5%)
  - Flammable gases-Methane (CH₄)
  - Carbon Monoxide (CO) (<25ppm)
  - Phosphine (PH₃) (<.3ppm)
Mechanical Hazards

- Mechanical equipment presents the potential for injury when there is contact with the worker
  - Mechanical equipment:
    - Bin sweeps
    - Reclaim conveyors
    - Tractors
    - Augers
    - Shovel machine cables
    - Fill and discharge equipment
Other hazards

Examples:
- Internal design that presents an entrapment hazard
- Water, snow, ice or other surfaces that create a slip, trip or fall hazard
- Falls to lower levels in confine area
- Electrical Energy or exposed equipment
- Temperature extremes
- Hazardous Chemical residue
Evaluating spaces

- Each facility is required to develop and implement a written confined space program.
- Evaluate each space to determine whether it is a permit or non-permit required space.
- Each permit required space must be identified by the sign:
  DANGER: PERMIT REQUIRED CONFINED SPACE-DO NOT ENTER
- A hazard analysis for affected space at your location must be done
Hazard Evaluation of Spaces

HAZARD EVALUATION OF CONFINED SPACES  Page 1 of 2

Name of Space: 

Location:

Place of Entry Into Space:

Entry into the above-listed permit space requires compliance with the checklists that follow during normal entry situations. This checklist should be reviewed prior to issue of a permit to ensure the space is properly prepared and the entrants are aware of the hazards within. This confined space has [have] the following potential hazards that will need to be checked and/or controlled during entry:

☐ Explosive
☐ Atmospheric
☐ Flammable
☐ Electrical
☐ Mechanical (moving equipment)
☐ Other (List converging walls, falls, hot surfaces, etc.)
☐ List hazardous substances (steam, acids, caustic, chemicals, etc.)

RECOMMENDED CHECKS FOR AIR CONTAMINANTS

Enter a check in the space provided if the contaminant may be present in the space:

Numbers in parentheses show PEL/TLV:

☐ Ammonia (35 ppm)
☐ Carbon Monoxide (35 ppm)
☐ Hydrogen Sulfide (10 ppm)
☐ Sulfuric Acid (1 mg/m³)
☐ Welding Fumes (5 mg/m³)
☐ Propane (1000 ppm)

☐ One of the following insecticides/fungicides (circle one) ACTELIC / RELDAN (1 mg/m³) / MALATHION (15 mg/m³)
☐ PHOSPHINE (3 ppm) / METHYL BROMIDE (35 ppm)
☐ OTHER
☐ MISOS ON FILE FOR THE CONTAMINANTS LISTED. IF NOT OBTAINED PRIOR TO ENTRY

ATMOSPHERIC CONTROLS

The following are controls for potential atmospheric hazards such as air contaminants, oxygen deficiencies or flammable gases, vapors or dust. These can be utilized for entry during routine shutdowns and other controlled entries.

Control Methods: Natural Ventilation Provided: Forced Ventilation Provided:

☐ Air purged ☐ Open doors ☐ Purge blower
☐ Steam purged ☐ Hatch/Portals ☐ Ventilation fans
☐ Water wash ☐ Gates ☐ Exhaust fans
☐ Other ☐ Other ☐ Dust collection system

ISOLATION

The following methods are to be used to isolate entrants from potential hazards posed by mechanical, electrical, explosive or harmful substances.

List barriers, other electrical equipment and locations that shall be locked and tagged out:

1. __________ 2. __________ 3. __________ 4. __________ 5. __________ 6. __________

List the valves and locations that shall be locked and tagged out:

1. __________ 2. __________ 3. __________ 4. __________ 5. __________ 6. __________

List the lines and their locations to be isolated and the isolation method (disconnected, blanked or blinded):

1. __________ 2. __________ 3. __________ 4. __________ 5. __________ 6. __________

List gates to be locked and tagged closed to prevent harmful substances from contacting or engulfing entrants:

1. __________ 2. __________ 3. __________ 4. __________ 5. __________ 6. __________

List the locations that shall have barriers, rope or safety tape installed to control vehicles and pedestrian:

1. __________ 2. __________ 3. __________ 4. __________ 5. __________ 6. __________

List other energy sources and their locations to be isolated:

1. __________ 2. __________ 3. __________ 4. __________ 5. __________ 6. __________
HAZARD EVALUATION OF CONFINE SPACES

REQUIRED EQUIPMENT

Determine which of the following special safety equipment is typically required for entry into this space. If special conditions exist, such as the presence of hazardous chemicals, engulfment potential, or other mechanical hazard, the entry supervisor shall determine what additional personal protective equipment is required to ensure safe entry into the space.

Personal Protective Equipment

- Harness and safety line
- Mechanical winch
- Respiratory equipment
  - Dust/mist mask
  - Half mask for ______
  - Full-face mask for ______
  - Air line respirator for ______
- Gloves for ______
  - Safety glasses
  - Safety Goggles
  - Full face shield

Atmospheric Monitoring Equipment

- Oxygen meter
- Combustible gas meter
- Indicator tube and pump for ______

Illumination

- Rated drop light
- Rated flash light
- Other ______

Rescue Equipment (need not be at the space, but should be readily obtainable)

- Emergency oxygen
- Stretcher
- Harness, Ropes, etc
- Mechanical winch
- First aid kit
- Stretcher
- SCBA(s)
- Grain Rescue Tube ______
- Other ______

Miscellaneous Equipment

- Radios
- Phones
- Intercom
- Other ______

Type of Space based on this evaluation (circle one and record on Appendix A)

- Permit required Confine Space
- Reclassified Confine Space
- Confine space using Alternate Method
- Grain storage space with grain

EVALUATED BY: ______
DATE: ______
Reclassified Permit Required Space

- If there is no atmospheric hazard in a space, determine if the hazard in any spaces can be eliminated by using lockout without entering the space. (Dust systems)
- If so, the space can be entered as a normal space once the hazard is eliminated
- You can also use an alternate procedure for working in a space with forced air ventilation to eliminate an atmospheric hazard
Written Confined Space Program

- Make an evaluation of all confine spaces
- Use OSHA’s Decision flow chart or do a hazard evaluation of each space. Compile a list of all spaces
- Place signs on all Permit Required confined spaces, Danger –Permit Required Confined Space. Do not enter.
- Determine if any spaces can be reclassified as a non permit space by eliminating atmospheric hazard by using forced air ventilation or mechanical hazard using lockout without entering the space
- Establish procedures for safely entering and working in the space
- Obtain needed equipment including meter to measure for air quality, harnesses, lifelines, hoists, etc.
• Train all affected workers regarding hazards and their duties to avoid hazards. Train entry supervisors, attendants and entrants. Certify the training with each worker signing that they were trained.

• Determine if you will have your own rescue team or rely on a local service. Must practice rescues yearly. Ensure that the local service is qualified & able to respond. See Appendix F for advice on how to evaluate the rescue service.

• You will need to purchase a hoist system that can lower and retrieve people for top entries. Get a grain rescue tube to aid in rescue.
Roles and Duties

- Train the workers in their duties to ensure safe entries
- Entry Supervisor
- Attendant
- Entrant
- Approver
Entry Supervisor

- The employee responsible for coordinating the entry into the confined space. This must be a person(s) trained and having received prior approval.
Entry Supervisor Responsibilities

- Know the potential hazards of confined space entry
- Personally inspect the confined space to be entered
- Verify that all permit requirements have been met, including atmospheric testing, protective equipment, and proper authorization
- Ensure that the safe work plan and rescue plan has been discussed with all involved employees
- Ensure that entry and operations are within the terms of the entry permit and entry conditions are maintained
- Ensure that the entrant and attendant fully understand their respective responsibilities
Entry Supervisor Responsibilities cont.

- Complete the permit and receive proper authorization
- Monitor the entry operation for potential hazards due to changing conditions and terminate the permit if unsafe conditions arise
- Must be familiar with facility design and operation
- Must be on-site during the entire entry
- The entry supervisor may also serve as the attendant or entrant if he/she is properly trained and equipped for the task.
- Must be willing to terminate the permit
Attendant

- The employee who remains outside the confined space and monitors the entrant(s); guards the space against unauthorized entry; warns the entrants of any unusual conditions; and summons the rescue personnel, if needed
Attendant Responsibilities

- To monitor entrants during the job and during entry & exit to help insure their safety
  - The attendant may not abandon his/her post for any reason while personnel are in the space unless relieved by another qualified attendant.
- Recognize and distinguish the hazards that may exist during the entry
- Be able to recognize the signs and symptoms of exposure
- Communicate with entrants to monitor their status and any possible affects of hazards
Attendant Responsibilities

- Alert entrants of any hazards or conditions that would make an evacuation necessary
- These conditions may be:
  - A prohibited condition is detected
  - A change in atmospheric condition
  - A change in material condition
  - An entrant show signs of hazard exposure
  - The attendant cannot effectively and safely perform duties, or communication with or between entrants is lost
  - An endangering situation is detected outside of the space
Attendant Responsibilities, cont.

- Monitor conditions inside and outside the space to determine if it is safe for entrants to remain in the space
- Order entrants to evacuate the space immediately when necessary
- Ensure that no unauthorized workers enter the permit space
- Ensure there is a means of communications to summon help is available and working properly
- Initiate the procedures to summon rescue and emergency services
Entrant

- The employee(s) who will physically enter the confined space to perform the work
Entrant Responsibilities

- Know and identify potential hazards of the confined space and terminate the permit and exit the space if conditions are detected
- Be aware of and avoid mechanical and engulfment hazards
- Recognize and distinguish signs and symptoms of exposure
  - Difficulty concentrating and loss of coordination
  - Feeling faint, dizzy, confused or passes out.
- Identify the consequences of exposure hazards
- Know how to use the equipment necessary to complete the task
Entrant Responsibilities, cont.

- Continuously communicate with attendant and, if necessary, alert attendant
- Know how to exit the space
- Continuously monitor the space for potential hazards due to changing conditions
Training Requirements

All trainers must sign off that employees have been trained

- New employees must be fully trained before being a part of an entry procedure
- Re-training experienced employees
  - All affected employees must receive training annually
  - Review any incidents that happen and apply new knowledge
  - You may want to have workers take a written test for each role they may perform to demonstrate proficiency
Confined Space Safe Work Plans

• Safe Work Plan
  1. All employees involved must discuss alternatives to eliminate entry and must be fully trained before any entry in confined spaces
  2. Workers must be trained in the specific task procedure
     Examples include:
     • Bin shoveling procedures
     • Bin sweep operation and procedures
     • Bin cleaning
     • Probing and monitoring grain conditions
     • End-loader operation
     • Boatswain chair procedures
  3. Identify potential hazards and conditions that may develop during the entry
Confined Space Safe Work Plans

- Work requiring a body harness and life line
  - If a potential engulfment hazard exists, **NEVER** stand or walk on any loose product where the depth is potentially greater than waist deep (recommend one (1) foot deep), unless appropriate harness and lifeline is worn to preventing entrant from sinking further than waist deep
  - To evaluate avalanching hazard if you are at a distance that is at least at twice the height from the grain you will not become engulfed
  - When lowering or raising a person on a boatswain chair, the lifeline must be attached to a mechanical device designed for human retrieval
Rescue plan

What is a rescue?

- Immediate evacuation of the space due to an immediate space threatening condition (i.e., Engulfment/Atmosphere, etc.)
- Emphasis should be on properly evaluating spaces during inventory process and pre-entry and developing a rescue plan that addresses specific risks given the facilities proximity to off-site rescue and type of spaces entered
Rescue plan

• What are the means of rescue?
  • Off-site (local fire department)
  • On-site (trained staff)
  • Non-entry rescue (lifeline/tripod/etc.)

• Drills must occur annually

• For off-site rescue:
  • the agency must be offered the opportunity to tour the location and be given the opportunity to drill or practice rescue operations
  • The agency and location must discuss what equipment is needed, how it is maintained, and where it is stored
Contractor Confined Space Entry

- Contractors need to show proof of certification of training
- Contractor must be informed that the workspace they will be entering is a permit-required confined space
- Contractors must follow a confined space entry procedure program and complete a permit form that follows the guidelines as established through OSHA’s permit required confined spaces guidelines (1910.146)
Confined Space Entry Permit
Entry Permit Procedures

- Atmospheric check must be made for Oxygen Content and, flammable atmosphere at a minimum other substances (toxics-such as Phosphine, Carbon monoxide, etc.) need to be checked if there if is a reason to believe they must exists.

- **NOTICE:** Any time a limit is exceeded, no matter what the reason, all personnel shall immediately exit the space, and no others shall enter until atmospheric conditions are returned to safe levels- NO EXCEPTIONS.
Entry Permit Procedures

- Other permits may be required see section entitled Other permits required. These must be obtained and valid before a confined space permit is issued.
- Check all equipment before use during entry to include: PPE, Testing devices, Communication systems, electrical or powered devices.
Grain Bin Entry-1910.272

- Covers entry into bins, silos, tanks and flat storage
- Entry into any structure that requires the worker to enter from the top or high up on the side of a tank is covered by 272(g)
- Entry into flat storage at the bottom of the structure “through a ground level unrestricted entrance” where you are able to step or walk through the opening is a 272(h) entry
Entry into grain storage

- Must issue an entry permit
- Must evaluate atmospheric hazards you may need to use a meter
- Ensure workers will not be exposed to Mechanical equipment
- Check that no grain hazards exist such as grain hung on the sides, too steep of grain mass that can avalanche or bridging grain conditions
Workers most often are engulfed when they go in to unplug the grain flow.

Typical Engulfment Hazards

Efforts are needed to improve the ability to clean out from outside the bin.
Entry into grain storage

- Ensure there are no engulfment hazards when workers are inside and on the grain. Turn off all reclaim conveyors and lock them out.
- Never walk down grain to make it flow as that is an unsafe practice and forbidden.
- Workers must wear a full body harness and lifeline when on the grain over waist deep and be secured so they can not sink into the grain further than waist deep.
Entry into grain storage

- A standby observer must serve as an attendant to ensure proper practices are followed and help the entrants with monitoring conditions and keep the worker secured.

- Employees shall be trained in the hazards of engulfment and in avoiding mechanical hazards. Training is to be given annually.
Entry into grain storage

- Rescue procedures and equipment are needed to have more effective means to rescue worker who become engulfed.
- Many in the industry are working with their local emergency services to provide for rescue. Grain rescued tubes or solid barricades or coffer dams are available from a number of resources. Some companies are going together and donating them to local rescue services. For top entries a winch is a necessity.
Entry into grain storage

• If you are entering a bin of any type above the grain follow 272(g). If you are entering the bottom of a bin through unrestricted ground level opening and there is no atmospheric concerns follow 272(h).
• You can turn aeration on or use forced air fans to get ensure there is no question about the atmosphere issue.
Entry into grain storage

Recently we see some new interpretations being applied by OSHA regarding **not entering grain bins if augers are operating**. The standard allowed entry provided workers are protected from being exposed to the hazard of moving equipment. (1996 memo). However in **Feb 2011** OSHA states that everyone **must shut off all equipment before entry, test the air before entering, and always wear a life line even if standing on the bin floor**.
Reclaim operations

Older style smaller auger with back & top guarded
Power Sweep
Auger reclaim

Grating over reclaim conveyor draw off
Entry into grain storage

Ground level & unrestricted

This type of 2 ring door (5’) is available for most new tanks

Tank was modified with this walk in door
Entry into grain storage

- We will have to wait and see if reason returns or if OSHA continues to make new rules without going through the rulemaking process.
- As to air monitoring most people have to have one to meet confine space rules. I recommend making an initial reading before entering the grain bin until we get this matter finalized.