How do you Protect Workers in Sewer and Wastewater Confined Spaces?

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What is a confined space?

1. Enclosed
2. Worker can get inside
3. Not intended for continuous occupancy
4. Difficult to evacuate or rescue
A confined space is ...

- Not the type of place in which people normally work
- Where minor mistakes have major consequences
- Where the risk of an accident is much higher than normal
- Where there are multiple fatalities (atmospheric accidents)
- Where the victims include would-be rescuers.
Excluded confined spaces

- Swimming pools
- Crawl spaces under school portables or other non-industrial buildings
- Excavations
- Attic spaces
- Open, unconnected manholes for storm or sewer hookups at new construction sites
- Elevator shafts
- HVAC plenums
- Agricultural feed mixer wagons and trucks
# Hazards in Confined Spaces

<table>
<thead>
<tr>
<th>Atmospheric</th>
<th>Physical</th>
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<tbody>
<tr>
<td>• Toxic gases (CO, CO₂, H₂S, NH₃)</td>
<td>• Entrapment (trapped in a small space)</td>
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<td>• Low oxygen</td>
<td>• Engulfment (buried in material)</td>
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<td>• Explosive (CH₄, gasoline, propane)</td>
<td>• Drowning (water, sewage)</td>
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<td>• Machinery (aerators, mixers, pumps)</td>
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<td></td>
<td>• Electric shock</td>
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<td></td>
<td>• Temperature (steam, radiant heat, cold)</td>
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<td></td>
<td>• Noise</td>
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<td>Biological Agents</td>
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<td>• Bacteria and moulds</td>
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<td>• Vermin (spiders, snakes)</td>
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Tragedy in a wine fermentation tank – 2002

- 500 gallon wine fermentation tank.
- Worker collecting wine samples through the top hatch.
- Two workers died – one fell in and the other (a “rescuer”) suffocated.
A worker entered a flotation compartment of the barge hull and didn’t return.

Four other workers then entered the compartment to attempt rescue and were overcome.

The first worker died, as well as three of the other workers.
Sullivan mine – 2006

- Small water sampling shed
- Four people died:
  - 2 workers
  - 2 paramedics.
Workers die on a mushroom farm 2008
• Hazard assessments and work procedures
• Identification and entry permits
• Lockout and isolation
• Verification and testing
• Cleaning, purging, venting, inerting
• Ventilation
• Standby persons
• Rescue
• Personal protective equipment
• Written confined space program
Typical confined spaces in Municipal sewer systems

Manhole

Air valve chamber

Lift station (small)

Lift station (medium)

Lift station (hatches)

Wet wells
Typical confined spaces in treatment plants

Settling tanks
Grit chambers
Clarifiers
Tanks and vessels
How do you isolate a confined space?

Before a worker enters a confined space, any material conveyance equipment that transports material to or from the space must be free of material if the material could present a hazard.
How do you isolate adjacent piping?

Adjacent piping means a device such as a pipe, line, duct or conduit which is connected to a confined space or is so located as to allow a substance from within the device to enter the confined space.

- Disconnecting, blanking or blinding
- Double block and bleed system – harmful substance that is not a gas, vapour, nor a volatile liquid
- Except when used in a double block and bleed system, the closing of one or more valves in a line is NOT acceptable
- Lock out the pressure source and depressurize the line – hazardous only because of pressure, temperature or quantity
- Isolation from gases found in a gravity-flow municipal sanitary or storm sewer system may be accomplished by a p-trap
Blanks and blinds
Double Block & Bleed

Valve is locked in closed position

Valve is locked in closed position

Valve is locked in open position
Section 9.18(4) – The closing of one or more valves in a line is not an acceptable means of isolation …

a) Does not apply to water piping that is part of a public water supply system if the piping and associated equipment is designed, constructed, maintained and certified by a professional engineer to American Water Works Association standards.

b) Does not apply to a dam water passageway if the structures of the passageway, including a gate valve or other flow control device, are certified by a professional engineer as being safe for workers to enter to perform the intended work.
Section 9.22(1) – If isolation using the measures specified in section 9.18 is not practicable, the employer may implement alternate measures acceptable to the Board. The submission should include:

1. A description of the space, or the group of spaces
2. Why isolation is not practicable
3. Contact information
4. A description of the hazards to be addressed
5. Risk assessment
6. The alternate measures that will be used to address the hazards
7. How workers will be informed, instructed in and use the measures
8. How use of the alternate measures will be supervised
9. The time period for which the alternate measures will be needed.
Alternative Measures – Considerations

- Atmosphere hazard in the undisturbed space and with controls
- Historical air monitoring data
- Identify adjacent piping
- Conditions at the time of entry (weather, traffic, etc.)
- Duration of the entry
- Number of workers in the space
- Nature of the work
- Warning time provided to entrant
- Time for space to fill with liquid
- Time required for evacuation
Alternative measures of control

- Engineering
- Administrative
- PPE
Engineering controls

- Cutting piping to insert sealing device
- Installation of mechanical blocking devices (i.e. plugs and gates)
- Freezing to form a plug
- By-passing using other piping/channels
- Damming
- Closing of valves
Alternative Measures – Considerations

If an engineered alternative measure (e.g., gate or plug) must be installed:

• What is the installation procedure?
• How is it tested and monitored?
• What is the acceptable flow/leakage?
• What is the acceptable level of liquid in the space?
• How will excess flow be controlled (e.g., pumps)?
• Where will the discharge go?
• What happens if the alternative measure fails?
• How will the equipment be removed when the work is completed?
Administrative controls

- Written procedures for installation and monitoring of alternate measures (e.g., plugs, flow rate, height)
- Supervision and Instruction
- Communication
- Work Scheduling
  - Low flow/use periods
  - Favorable weather
- Personal Hygiene and decontamination
- Inoculations
- Rescue
Written procedures: What is the Employer doing differently?

How will workers be protected using the alternate measures?

- De-energization/locking out
- Installation of isolating device(s)
- Testing and monitoring the isolation device(s)
- Removing the isolation device(s)
- Ventilation
- Personal protective equipment
- Standby/rescue
Personal protective equipment

• Safety headgear
• Hearing protection
• Safety protective footwear
  ◦ Impervious steel toed rubber boots
• Limb and body protection:
  ◦ Impervious hip waders, disposable coveralls
  ◦ Impervious gloves
• Respirator
  ◦ Full Face Respirator
  ◦ Half Face Respirator and Goggles
• Gas Monitoring
Example – Manhole entry
• Manholes less than 8 metres in depth
• Flushed before entry if not clean
• Flows must be at the lowest practicable levels through work scheduling or mechanical means
• All work within the manholes will be conducted during off peak times
• An effective retrieval system for emergency rescue must be in place and connected to the worker at all times

• If rescue cannot be effected from the entrance to the manhole, rescue workers entering the manhole must be adequately protected from the physical and atmospheric hazards of the confined space
• Neoprene hip waters or waterproof coveralls
• CSA approved heavy boots (waterproof) with no-slip grips
• Tyvek coveralls with a hood
• Hardhat with strap and head lamp
• Neoprene rubber or nitrile gloves
• Protective chemical eye goggles
• Half-face respirator equipped with OV/Acid Gas P100 filter cartridges
• Vertical movement only, no horizontal movement
• Less than 1 meter depth of flow. Measure and record flow every 20 minutes
• Gas monitoring (H₂S, LEL, O₂, CO) every 20 minutes
• Voice or radio communication
• Continuous ventilation with 1200 to 1500 cfm fan (to pressurize the manhole)
• Each worker is routinely inoculated against hepatitis and tetanus
A **Prevention officer** responsible for the Firm may make a decision on behalf of WorkSafeBC. As needed, the officer may contact a Sr. Occupational Hygienist, Engineering or Prevention Practices for advice.

Where an application for acceptance involves a situation that is not a Municipal sewer or wastewater system, **Prevention Practices** will issue the decision to the applicant using the standard format for Acceptance Request decisions.
Thank You