# Confined Space Safety

## ExxonMobil Singapore Manufacturing Complex

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# What is Confined Space?

**Definition**

- Is not intended for continuous occupancy
- Has an opening large enough for one's torso and head to pass either intentionally or unintentionally
- Has the potential for a hazardous environment or a configuration where emergency response would be difficult

**Confined Spaces entry remains a high risk activity in Process Industry**

- Hazards are not obvious / visible / dynamic
  - Mechanical, electrical, pressure, chemicals, temperature
  - Contaminants generated during work

- Difficult emergency response
  - Entrant to exit
  - Rescue teams to enter

# Examples of Confined Spaces

- Process vessels (e.g., towers, drums, reactors)
- Storage tanks (including floating roof pontoons)
- Spheres
- Silos/hoppers
- Exchanger shells
- Vessel skirts and stacks
- Boilers, Heaters, and Furnaces
- Sewers, Tunnels, and Pipelines
- Air Blower Ducts
- Excavated trenches or pits greater than 1.25 m in depth where there is a risk of exposure to harmful/toxic vapors, or engulfment
- Enclosed basement at sub-station
- Equipment sheeted-in for weather protection, asbestos stripping, or spark containment without sufficient open area to maintain adequate natural ventilation

Tank

Pipe

Trenches

Ballast Tank

# Potential Confined Space Hazards

**Atmosphere inside a Confined Space may be contaminated by any of the following sources:**

1. Inadequate ventilation (Oxygen deficient atmosphere)
2. Vaporization of residual hydrocarbons (Combustible atmosphere)
3. Inadequate cleaning of residual materials
4. Work that generates contaminants
   - E.g. Welding, painting, application and removal of liners in vessels
5. Connection of a nitrogen or other utility/gas hose to the Confined Space
6. Improper/inadequate isolation of process piping
7. Leakage of gas cylinders/hoses inside the space
8. Contaminants drawn into the Confined Space from the outside
   - E.g. Diesel engine or vacuum truck exhaust

**Other Physical Hazards**

1. Excessive noise
2. Elevated temperature
3. Engulfment exposure hazards
4. Internal moving or powered equipment hazards
5. Ergonomic issues
6. Radiation sources
7. Slips, trips, falls and impact

# Safeguards for CSE – Planning & Preparation


**Hazard Assessment**

- Prior to entry, hazards of confined space must be assessed and analyzed
- Include mechanical integrity of internal structures / components
- Mitigations must be taken to reduce risks to an acceptable level


**Remove Residual Materials**

- Confined space must be drained, flushed, purged ,cleaned and ventilated to minimize the amount of residual hazardous material present


**Control the Atmosphere in Confined Space**

- Must be positively isolated from all potentially hazardous material either by blinding or disconnecting and blanking all process lines connected to the space
- All energy sources and electrically equipment must be de-energized and secured e.g. steam valves, mixers, soot blowers
- When blinding is not practical, lines running through the confined space should be isolated and depressurized and tracked

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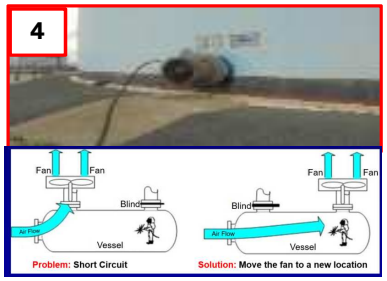
# Safeguards for CSE – Planning & Preparation




**Maintain a Safe Atmosphere**

- Adequate and effective ventilation must be maintained at all times during entry
- Consider nature of the residual hazards present, any fumes/vapors from mechanical work being performed
- Additional exhaust ventilation must be considered for removal of fumes from burning or welding, vapors from painting/coating activities
- Provide sufficient lighting


**Emergency Rescue Plan**

- Develop jointly by work group and emergency response personnel
- Drills for complex and elevated confined space entries (e.g. tower entry, top entry reactors, and vessels with baffles, etc.) – must be proven to be executable


**Atmosphere Testing**

- Atmosphere inside and outside the confined space must be tested by a trained and competent person
- Evaluate the hazards inside and outside of the confined space when developing the gas testing requirements
- Gas Testing Parameters
  - Must be gas tested at sufficient locations
  - Must be tested for O2 content, flammability, Presence of other toxic and harmful vapors
  - Confirm acceptable gas test results

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# Safeguards for CSE – Execution

**Pre-task Talk / Toolbox talk**

- Barricade and Signage
- Safe Work Procedures
- Safe Entry Conditions
- Job Stoppage Condition
- Emergency Response

**Continuous Monitoring**

- Control of Entry
- Atmospheric Testing
- Energy Isolation (LOTO)
- PPE / RPE


Signage

Safe Access & Egress

Control Entry



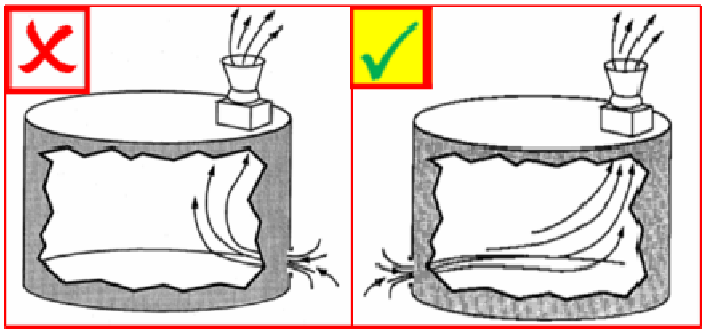

**JOB STOPPAGE CONDITION**

- When 4in 1 gas meter sounds an alarm
- Ventilation failure
- When rapid rise in temperature is seen
- Any emergency inside/outside the confined space
- Any sign of distress from the entrants
- Temperature/oxygen level exceeds allowable limit
- Loss of primary lightings

## Field Effectiveness Verification

Hazards Recognition  Defensive Safe Behaviour

# Effective vs Presence of Safeguards

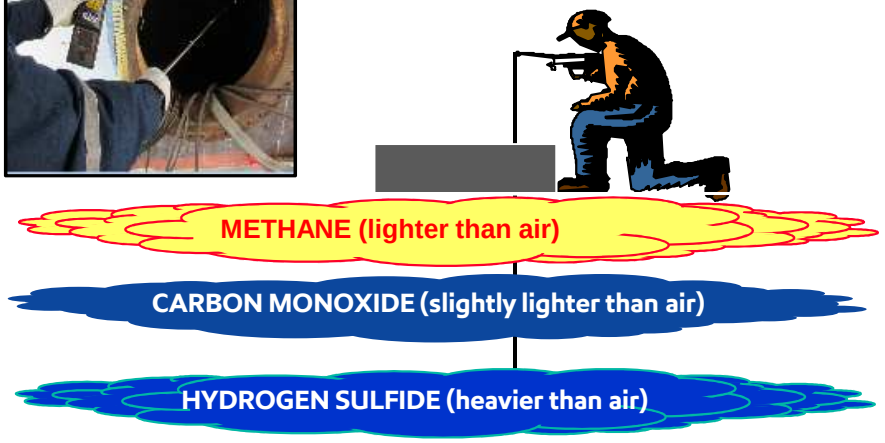


Prevent Unauthorised Entry

Ventilation Ducting Collapsed

Effective Ventilation

CS Gas Testing



# Summary

- **Confined Space Entry is a high risk activity**
- **Planning and Preparation**
- **Field Execution Effectiveness vs Presence of Safeguards**
- **Confined Space injuries and deaths can be prevented if everyone follows the precautions EVERY TIME**