Risk Assessment for Confined Space
What is confined space?

means any chamber, tank, manhole, vat, silo, pit, pipe, flue or other enclosed space, in which —

(a) dangerous gases, vapours or fumes are liable to be present to such an extent as to involve a risk of fire or explosion, or persons being overcome thereby;
(b) the supply of air is inadequate, or is likely to be reduced to be inadequate, for sustaining life; or
(c) there is a risk of engulfment by material

- WSH (Confined Spaces) Regulations
Risk Assessment

the process of evaluating the probability and consequences of injury or illness arising from exposure to an identified hazard, and determining the appropriate measures for risk control.
What is Hazard?

anything with the potential to cause harm or bodily injury;

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>mechanical, electrical, excessive noise, heat, radiation etc;</td>
</tr>
<tr>
<td>Chemical</td>
<td>acids, alkalis, solvents</td>
</tr>
<tr>
<td>Biological</td>
<td>bacteria, fungi and viruses</td>
</tr>
<tr>
<td>Ergonomic</td>
<td>repetitive work, awkward postures, prolonged standing</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>overwork, poor supervision</td>
</tr>
</tbody>
</table>
What is risk?

risk

the likelihood that a hazard will cause a specific bodily injury to any person;

- MOM’s WSH(RM)Reg

combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s)

- OHSAS18001 - 2007
Risk Management Process

1. Preparation
2. Hazard Identification
3. Risk Evaluation
4. Risk Control
5. Record Keeping
6. Implementation & Review

Communication

Risk Assessment

Based on MOM Guideline
Risk Assessment for Confined Space

1. **IDENTIFY HAZARDS**
   - Dangerous gas
   - Lack of oxygen
   - Flammable material
   - Toxic substances

2. **EVALUATE RISK**
   - Safe work Procedures
   - Ventilation
   - Administrative
   - Engineering
   - PPE
   - Respirator
   - Accident
   - Death
   - Fire / explosion
   - Toxic effect

3. **CONTROL RISK**
   - Control measures

Risk:
- Likelihood & Severity of accident
# Risk Register

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Activity</td>
<td>Hazard</td>
<td>Possible Accident / Ill Health &amp; Persons-at-Risk</td>
</tr>
</tbody>
</table>

## Risk Assessment Form

- **Dept / Section:**
- **Conducted by:**
- **Date of Assessment:**
- **Process / Location:**
- **Approved By:**
- **Date Approved:**
- **Last Review Date:**
- **Next Review:**
- **Ref No.:**
Confined Space Risk Assessment

1. Identify Hazards
Confined Space Hazards

Confined space is a work area:

- not primarily designed or intended for human occupancy
- has a restricted entrance or exit

Examples:
- Tanks and vessels
- Tunnels
- Manholes
Confined Space Hazards

- Main hazards associated with confined space
  - Oxygen deficiency
  - Flammable material
  - Toxic substances

- Others:
  - Noise
  - Entanglement
  - Slips and falls
  - Radiation
  - Temperature extremes including atmospheric and surface.
  - Flooding
  - Electrical shock
  - Biological hazards.
2. EVALUATE RISK
Risk Evaluation

\[ \text{RISK} = \text{LIKELIHOOD} \times \text{SEVERITY} \]
## Risk Evaluation – Likelihood

Table 1: Likelihood of occurrence of an accident or incident or ill health

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote</td>
<td>Not likely to occur</td>
</tr>
<tr>
<td>Occasional</td>
<td>Possible or known to occur</td>
</tr>
<tr>
<td>Frequent</td>
<td>Common or repeating occurrence</td>
</tr>
</tbody>
</table>

- MOM RA Guideline
## Risk Evaluation – Severity

Table 2: Severity is the degree or extent of injury or harm caused by the hazards, or as a result of an accident

<table>
<thead>
<tr>
<th>Severity</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>No injury, injury or ill-health requiring first aid treatment only</td>
<td><em>minor cuts and bruises, irritation, ill-health with temporary discomfort</em></td>
</tr>
<tr>
<td>Moderate</td>
<td>Injury requiring medical treatment or ill-health leading to disability</td>
<td><em>lacerations, burns, sprains, minor fractures, dermatitis, deafness, work-related upper limb disorders</em></td>
</tr>
<tr>
<td>Major</td>
<td>Fatal, serious injury or life-threatening occupational disease</td>
<td><em>amputations, major fractures, multiple injuries, occupational cancer, acute poisoning and fatal diseases</em></td>
</tr>
</tbody>
</table>

- MOM RA Guideline
### Risk Assessment Matrix (RAM)

#### Table 3: RAM to determine Risk Level

<table>
<thead>
<tr>
<th>Severity</th>
<th>Likelihood</th>
<th>Remote</th>
<th>Occasional</th>
<th>Frequent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>Medium Risk</td>
<td>High Risk</td>
<td>High Risk</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Low Risk</td>
<td>Medium Risk</td>
<td>High Risk</td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>Low Risk</td>
<td>Low Risk</td>
<td>Medium Risk</td>
<td></td>
</tr>
</tbody>
</table>
## Acceptability of risk

**Table 4 - Acceptability of risk and recommended actions**

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Acceptability of Risk</th>
<th>Recommended Remedial Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>Acceptable</td>
<td>No additional risk control measures may be needed. Frequent review may be needed to ensure accuracy and currency.</td>
</tr>
<tr>
<td>Medium Risk</td>
<td>Moderately acceptable</td>
<td>Management attention is required. Careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to ALARP within a defined time period. Interim risk control measures, eg admin controls, may be implemented.</td>
</tr>
<tr>
<td>High Risk</td>
<td>Not acceptable</td>
<td>Immediate management intervention required and must be reduced to at least Medium Risk before work commences. There should not be any interim risk control measures and risk control measures should not be overly dependent on PPE. If needed, the hazard should be eliminated before work commences.</td>
</tr>
</tbody>
</table>
**Risk Evaluation Steps**

1. **Step 1** Determine Likelihood

   *Use Table 1:* Determination of Likelihood of Occurrence or Exposure” to determine the likelihood of occurrence or exposure for each work activities or trade job steps hazard identified.

2. **Step 2** Determine Severity

   *Use Table 2:* Determination of Severity of Illness or Injury” to determine the consequence of occurrence of each hazard identified.

3. **Step 3** Determine Risk Level

   *Use Table 3:* Determination of Risk Level of Occurrence or Exposure” to determine the risk level of occurrence or explosion each work activities or trade job steps hazard identified.

4. **Step 4** Determine Actions Needed

   *Use Table 4:* Acceptability of Risks and Recommended Actions to determine the remedial action required for each type of risk level. At this juncture, timeline of implementing these remedial actions can be added.
Confined Space Risk Assessment

3. CONTROL RISK
Risk Control Measures

Mitigating Risks

- Reduce the Likelihood
- Reduce the Consequence
Hierarchy of Risk Controls

Effectiveness to reduce risk

High

- **ELIMINATION**
  - Eliminate the need to for cleaning tank through design eg flashing system

- **SUBSTITUTION**
  - Use alternative means of cleaning, from outside

- **ENGINEERING CONTROL**
  - Provide ventilation; isolate tank through blanking, disconnect pipes

- **ADMINISTRATIVE CONTROL**
  - Implement safe work procedure for maintenance

Low

- **Personal Protective Equipment**
  - Make provision for use of respirator, harness etc.

**Examples**

- Eliminate the need to for cleaning tank through design eg flashing system
- Use alternative means of cleaning, from outside
- Provide ventilation; isolate tank through blanking, disconnect pipes
- Implement safe work procedure for maintenance
- Make provision for use of respirator, harness etc.
Confined Space Permit

- Means of communication among parties who are involved in those jobs
- To have proper authorization of work
- To identify all the hazards and take necessary precautions
Confined Space Entry - Testing

• The CS Safety Assessor tests the space for hazardous concentrations of known harmful substances:
  • Hydrogen sulfide
  • Carbon monoxide
  • Lower Explosive Limit (LEL)
  • Oxygen
Confined Space Entry - Ventilation

If concentrations of materials are found to be at harmful levels, the confined space must be ventilated to remove them before entry.

Fresh outside air - to dilute and remove contaminants - to supply oxygen.
Confined Space Risk Assessment – Work Examples

- Get into your groups.
- Each group will be given a case study to work on.
- Read the case information and conduct a risk assessment.
- You should apply the knowledge learnt throughout today’s seminar, include legal requirements, in the case study.
- Record your works on the RA form provided.
- Each group should take about 30 minutes to work on the case.
- You may make reasonable assumptions in case of incomplete information given.
- Elect a person in the group to share your answer in an 10 minutes presentation.
Case Study 1
Case Study 1

The fire water tank has a capacity of 180 m³ (12 x 5 x 3 m (L x B x H)). It is installed in a basement room beside the basement car park of the building. The ceiling height of the room was about 4 m. The room is not air conditioned.

Work to be carried out includes checking for a suspected leak at the base of the water tank and attempting to weld it from both inside and outside of the tank.
Case Study 2

Underground diesel storage tank
Case Study 2

An underground tank is used to store diesel for use by generator and forklift trucks on site. It is to be cleaned and inspected for any cracks.

To generator and point of use

From diesel inlet pump

0.8 m dia manhole

ladder

Underground diesel tank
Case Study 3

View from this side

Production Hooper
Case Study 3

Production hopper as show is to be clear of raw material compounds which are supposed to be fine power but are found to stuck to the hopper wall and dropped of as small balls, affecting the quality of products. Workers are to go in to the hopper use a burning torch to soften the stuck materials and scrapped it off from the wall. A vacuum cleaner is then used to suck away the particles dislodged.