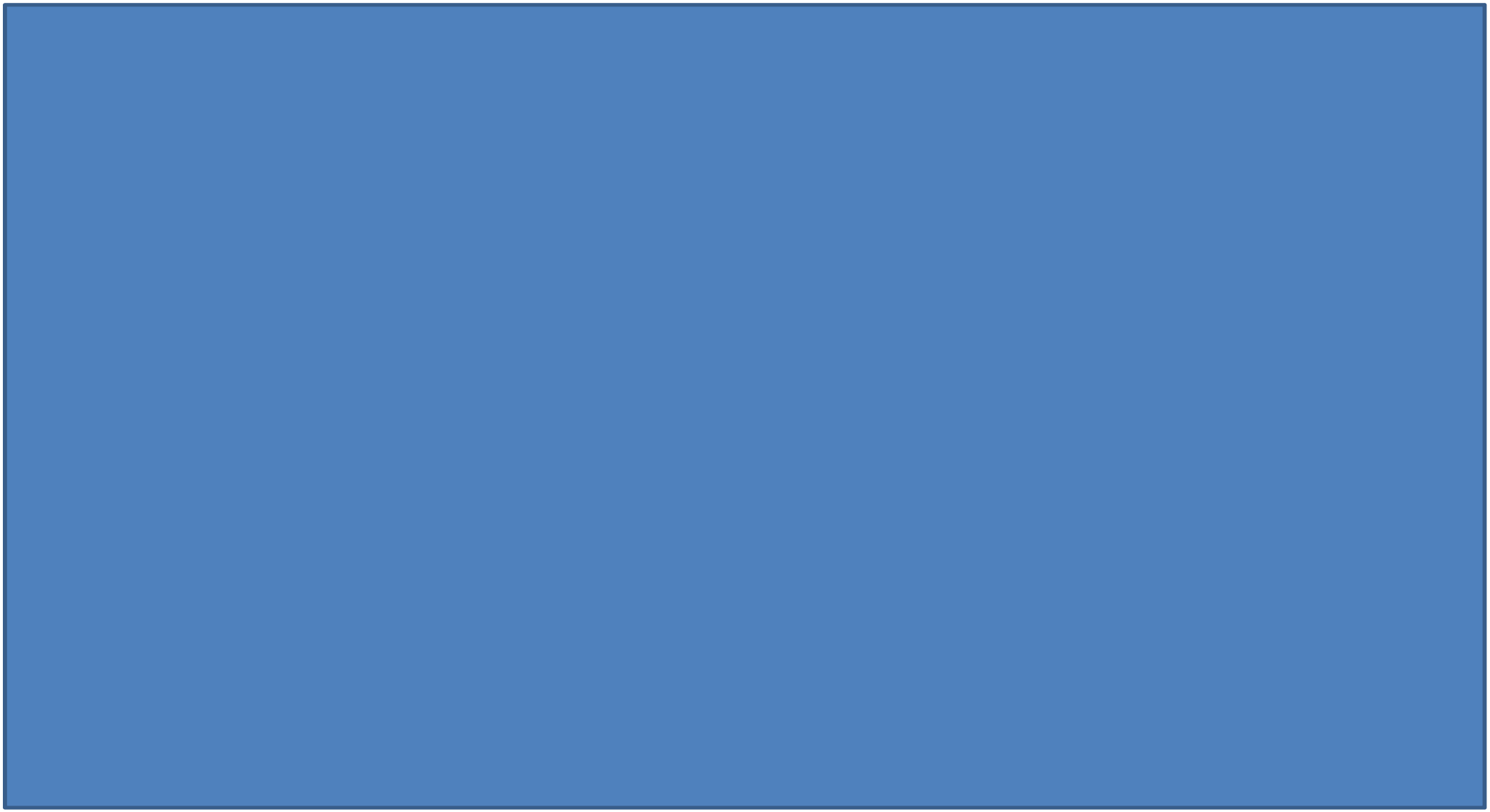
# PRESSURE VESSELS

## Safety and Health Officer Certificate Programme

# Session/LessonPlans



# OBJECTIVES

- State 2 classifications of pressure vessels
- State the definitions of steam boiler and unfired pressure vessel
- State 4 applications of pressure vessels
- State 5 hazardous conditions in the use of pressure vessels
- Explain the preventive and control measures as per statutory requirements

# SCOPE

- Definition
- Classifications and uses
- Hazardous conditions
- Factors that cause hazards and accidents
- Preventive and control measures
- Statutory requirements
- Conclusion

# DEFINITION

## Fired pressure vessel

- Vessel that receives heat from external fuel sources and generates energy for specific uses.

# CLASSIFICATION OF FIRED PRESSURE VESSEL

- Any closed vessel
- Above atmospheric pressure
- Generates heat from certain external sources
- Produces steam (under pressure)
- Energy heats the medium [liquid fuel] in the installation system

  For (boilers) steam, this includes economiser, super heater and other equipments that may be attached.
- Example: thermal oil heater, autoclave

# DEFINITION

## Unfired pressure vessel

- Vessel that requires no heat from external heat sources to operate.

# CLASSIFICATION OF UNFIRED PRESSURE VESSEL

- Any closed vessel
- Contains gas (oxygen), gas mixture (propane and ethane), steam (from boiler), liquid (water or chemical) or solid (cement, sugar, fertilizer or flour)
- May be below or above atmospheric pressure
- Example: air compacter, water softener

# APPLICATIONS AND USES OF PRESSURE VESSELS

| Item | Uses/Application |
|---|---|
| ■ Steam boilers<br>□Generate steam | ■ Food processing<br>■ Medical processes<br>■ Manufacturing processes<br>■ Utilities (Generate electricity) |
| ■Air compactor<br>■Storage of compact air, gas, liquid | ■ Manufacturing processes<br>■ Water treatment plant<br>■ Food processing |

# HAZARDOUS SITUATIONS RELATED TO PRESSURE VESSELS

1. Mechanical blasts
2. Leakage in wall or tube
3. Toxic releases into the air
4. Cracks in wall or tube
5. Structural changes

# CAUSES OF HAZARDOUS SITUATIONS

- Excess pressure in vessel
- Faulty design
- Thinning of wall due to erosion
- Failure of automatic system

# PREVENTIVE AND CONTROL MEASURES

## SAFETY DEVICES FOR PRESSURE VESSELS

| Safety equipment/device | STEAM BOILER | UNFIRED PRESSURE VESSEL |
|---|---|---|
| ■ Water indicator | / | / |
| ■ Safety Release Valve | / | / |
| ■ Pressure indicator | / | |
| ■ Detector and alarm for high or low water levels | / | — |
| ■ Blow down valves | / | / |
| ■ Feed check valve | / | / |

# PREVENTIVE AND CONTROL MEASURES

- Design should follow specifications in code of practice
- Vessel should be equipped with safety devices such as safety valve
- Regular maintenance for vessel and its accessories
- Scheduled inspection of pressure vessel

# PREVENTIVE AND CONTROL MEASURES

- Controls on maintenance and repair works
- 
- Provide training for operators
- Select suitable pressure vessel according to process requirements
- Appoint competent operator responsible for handling steam boiler

# FACTORIES AND MACHINERY (STEAM BOILERS AND UNFIRED PRESSURE VESSELS) REGULATIONS 1970

1) Approval of design
2) Approval for construction
3) Hydrostatic / Steam tests
4) Important requirements
5) Person in charge (boiler)

# FACTORIES AND MACHINERY (STEAM BOILERS AND UNFIRED PRESSURE VESSELS) REGULATIONS 1970

6) Certificate of Fitness

7) Scheduled inspection

8) Installation method

9) Pressure allocation for operations system

# FACTORIES AND MACHINERY (STEAM BOILERS AND UNFIRED PRESSURE VESSELS) REGULATIONS 1970

10) Maintenance requirements

11) Notification of hazardous incident

12) Approval for restoration and modification

13) Control of welder, contractor

# GUIDELINES FOR INSTALLATION AND USE

- Ensure that approval of design has been received from DOSH Malaysia

- Schedule for Hydrostatic and Steam tests for steam boiler with DOSH

  (Attach JKJ 105/106 and JKJ 127)

# GUIDELINES FOR INSTALLATION AND USE

- Apply for permission to install and register with DOSH
- (attach JKJ 105/106 and JKJ 127)
- Obtain the Certificate of Fitness (CF) for the registration
- The vessel may only be used after CF has been obtained

# CONCLUSION

- Pressure vessels may be classified into two: fired pressure vessels and unfired pressure vessels
- Pressure vessel operations have the potential to cause hazardous situations and incidences

# CONCLUSION

- There are statutory provisions in the FMA 1967 and OSHA 1994 regulating the use of pressure vessels
- The user/owner of the pressure vessel is responsible to ensure the safety of the vessel using various methods discussed in the lesson

# Quiz

## Time : 20 minutes

In an incident that occurred on 2nd December 2001 at approximately 10.30pm, an air compactor registration number PMT 1245 broke and caused leakage at the bottom part of the wall. The unfired pressure vessel is the vertical type and has been placed outside the building since its installation 6 years ago. The employer intends to repair the leak by welding another piece of metal above it. Your observation of the vessel has revealed that the pressure indicator needle is not functioning and the release valve has signs of corrosion.

# Questions ??

1) List 3 (three) factors that caused the failure.
2) Recommend 4 (four) prevention and control methods that may be taken by the employer to avoid a recurrence of the incident.
3) State whether the repair works intended by the employer can be done successfully. What is your advice as the Safety and Health Officer to the employer?