

The likely causes of loss of containment

Corrosion

May be internal or external, and may be enhanced by synergistic effects such as stress-corrosion cracking or erosion-corrosion. The safety report should identify particular areas where corrosion may occur and the measures taken to prevent and monitor such effects, for example design codes, construction standards, protective systems (inert linings, cathodic protection, etc) and periodic inspection.

Erosion

May be caused by excessive fluid velocity, a change in phase, cavitation or the presence of particulates. Your safety report should identify particular areas where erosion may occur and the measures taken to prevent and monitor such effects, including periodic inspection.

External loading

May be caused by extreme weather or ground movement (seismicity), by the forces applied during construction or during operation, and by failures of pipe or vessel supports nearby. Your safety report should show that the foreseeable events will not affect the integrity of the containment or its supporting structure.

Impact

Damage may occur from road and rail vehicles, or from missiles from failed equipment and other sources. The blast wave from an incident on a nearby plant may also cause impact damage. Your safety report should identify the main sources of impact considered in the design and the critical items of plant exposed to impact damage. It should also show that adequate precautions have been put into effect.

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Pressure

Over or Under Pressure Over- or under-pressure may cause loss of containment. Your safety report should show how excess pressure will be prevented during foreseeable failures, such as the failure of:

- (i) process controls between the system and other higher pressure systems or sources
- (ii) over-pressure safety devices
- (iii) external fire
- (iv) internal explosion
- (v) excessive reaction rate; and
- (vi) liquid expansion or exothermic reaction causing an increase in temperature and pressure.

Temperature

Excessively high or low temperatures of the containment structure may reduce its strength or make it susceptible to brittle failure. Excessively high rates of change in temperature may also generate high thermal stresses. Your safety report should identify the precautions in place to prevent thermal problems due to process upsets, fire, or possibly adverse weather conditions in the case of plant exposed to the elements. Examples of precautions taken may include separation, water deluge, insulation, fire walls, heat tracing.

Vibration

May be generated within the containment, caused by changes in phase, water hammer, high pressure drop or cavitation. Externally generated vibration may be due to the incorrect positioning of pumps, poor piping design, etc. Excessive vibration may induce fatigue failure of the containment. Your safety report should show how vibration has been assessed, and any potential problems addressed.

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Wrong equipment

If the wrong equipment has been specified or installed, there is a potential for failure. The safety report should identify the management controls in place to ensure correct specification, supply and installation of equipment, including spare parts.

Defective equipment

May cause failure due to pre-existing flaws, high stress, etc. Your safety report should show that suitable management procedures are in place to identify faults and control or limit the effects of failure.

Human error

Human error may cause failure of the containment by overfilling or overloading, or by some other manually initiated mal-operation, for example, operator initiating valve opening, and includes failure to take the required action. The safety report should consider the possibility and effects of human error and describe the measures in place to minimise the risk.