

Recommendations of the International Joint River Bodies on requirements for industrial plants handling water-polluting substances in areas with a risk of flooding

Area of application: The requirements apply to plant, plant components (including pipelines) and safety systems which could be affected by flooding. It does not matter whether the flooding is caused by high tide, static water or from the sewage system, rise in the level of groundwater due to persistent case of flooding or fire-fighting water of retaining systems for fire fighting water. The requirements apply equally to new as well as existing plants.

1 Underground plant units

- 1.1 Underground containers and pipelines should be secured against the force of buoyancy, e.g. through:
 - Increasing the height of covering earth,
 - Covering the container with concrete slabs or
 - Anchoring with steel band fixed in a concrete slab.
- 1.2 The security of underground containers and pipelines against the force of buoyancy must be established to be about 1,3 times that of the security of an empty container against the force of buoyancy in regard to a totally flooded container.
- 1.3 Underground container and pipeline must be able to withstand the pressure exerted by the water due to flooding, which means they must be designed to withstand such stress statically. This must be proved with a producer's certificate.

2 Outdoor overground plant unit

- 2.1 Container and plant unit must be protected against the force of buoyancy and from mechanical damages due to floating substances and similar objects.
- 2.2 The containers and plant units must not hinder the free flow of the floodwater.
- 2.3 The lower bottom edge of the containers must be above the water level that is equal to a recurrence interval of about $HQ_{100}^{1)}$.
- 2.4 Pipelines should be laid in such a way that they are above the water level corresponding to a recurrence interval of about HQ_{100} .

¹⁾ Flooding with a recurrence interval of hundred years

3 Overground plant units in buildings

- 3.1 containers should be installed in such a way that they are secured against the force of buoyancy. The security against the force of buoyancy can be achieved through e.g.:
- Anchoring with steel bands fixed on the ground,
 - Anchoring with steel bands fixed on side walls,
 - Supporting with steel braces fixed on the roof of the storage rooms.
- 3.2 The ground, side walls and the roof of the storage rooms must be able to withstand the force of buoyancy. This should be assessed by a stress analyst.
- 3.3 If the containers are installed in a coated secondary containment, anchoring on the coatings should be avoided. If this can not be avoided, ensure that the sealing within the coated surfaces are perfectly executed.
- 3.4 If the containers are secured against the force of buoyancy with an anchor fixed to the side walls or roof of the storage room, ensure that a rotating motion of the container is not possible.
- 3.5 The security of underground plant units inside buildings against the force of buoyancy must be established to be at least 1,3 times that of the security of an empty container against the force of buoyancy in regard to a totally flooded container.
- 3.6 Container must be able to withstand the pressure exerted by the water due to flooding that means they must be designed to withstand such stress statically. This must be proved with a producer's certificate.

4 Plant units

- 4.1 Venting pipes must be installed in such a way that their open end can not be flooded. They should be secured with anchors along the whole length and installed in such a way that they can not be damaged by the pressure of the water or floating objects. In the case of extension of the venting pipe, the specialised company executing the job should establish whether the containers are designed to statically withstand internal pressure that could occur due to any overfilling of the container. If the venting pipes have to be installed higher than permissible (e.g. for containers having a test overpressure of about 0,3 bar, the venting pipe must be installed more than 3 m above the bottom of the container), then a solution for such cases is necessary (e.g. using containers having a higher permissible test overpressure). Shut-off devices are not allowed for venting pipes.
- 4.2 Filling ports should be closed with a seal if they can be flooded. The sealing is only allowed to be removed during filling procedures.

- 4.3 Pipelines (Filling, connecting and discharging pipelines) should be anchored along the whole length and installed in such a way that they can not be damaged.
- 4.4 All openings of the containers and pipelines should be installed in such a way that they are water-proofed, if the risk of their being flooded can not be ruled out.
- The dome cover should be sealed by a professional firm and must be safe from flooding. The tightening of the screws will not remedy for carelessly placed seals (for example if they are placed overlapping each other). The tightness must be proven with a producer's certificate.
 - Dome cover without screws must be fixed in such a way that they can not be shifted by stream of water during flooding. Additional screws are required in case of a doubt.
 - In the case of a level gauge made of plastic casing and mounted directly on top of the container (the so called floating equipment), it can be assumed that sufficient tightness can not be guaranteed. Such appliances should be dismantled if a total flooding of the container is possible and the port closed with a plug. Alternative to this is to install a pneumatic level gauge.