



Protection against flood

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About 16,5 billion Euro damages of which 5,5 to 7 billion Euro was damages on public infrastructure

Economic damages was estimated at 4 billion Euro



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- ***Chemical factory belonging to PVC producer Spolana from the Czech republic***
 - ❑ Location is exactly near the Elbe
 - ❑ Mercury content of the ground is in the region of about 100.000 times higher than the content in a normal ground
 - ❑ About 250 tons of Dioxin und Furan are stored



UNECE

- ***UNECE-convention on the international effects of industrial wastes***
 - Take measures to avoid accidents
 - Reduce accidents risk

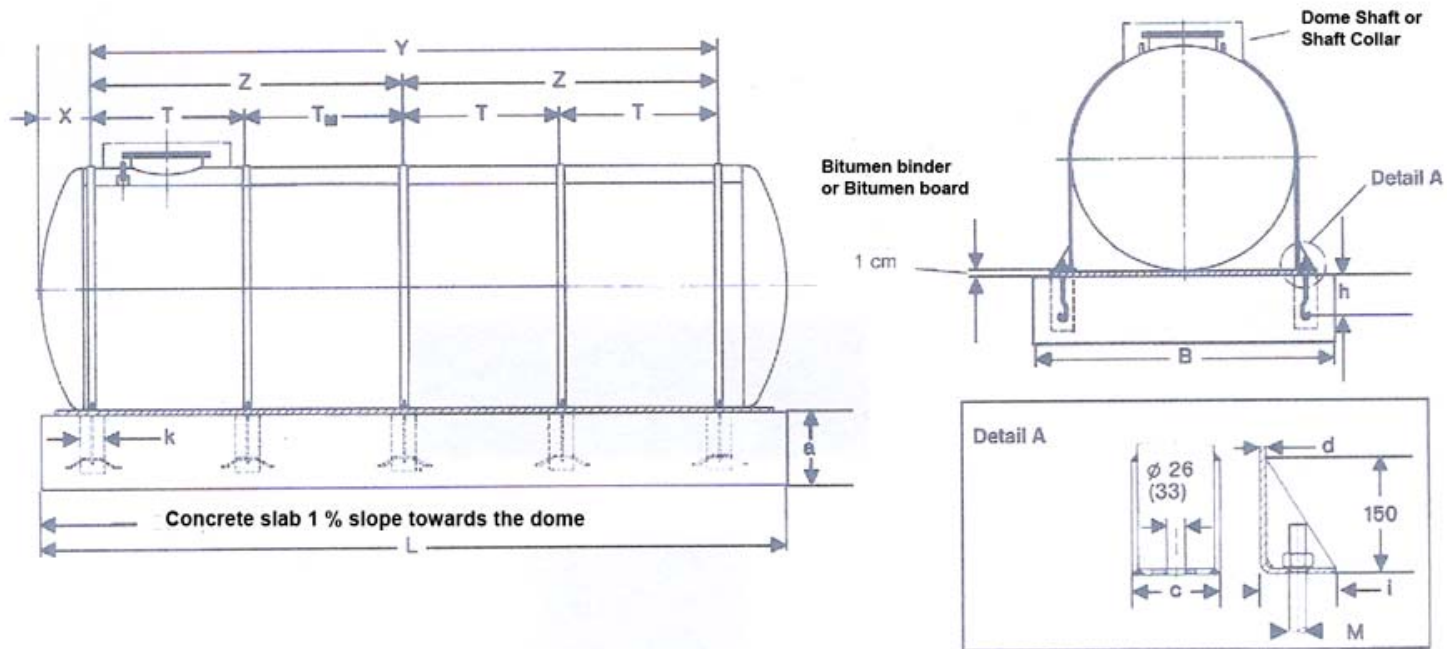
ICPE recommendations on requirements for industrial plants handling water-polluting substances in areas with a risk of flooding

- Flooding caused by high tide,
- Backwater (static) from the seas and rivers or from the sewage system,
- Rise in the level of ground water due to persistent case of flooding or
- Fire fighting water retained by containing facility for such water

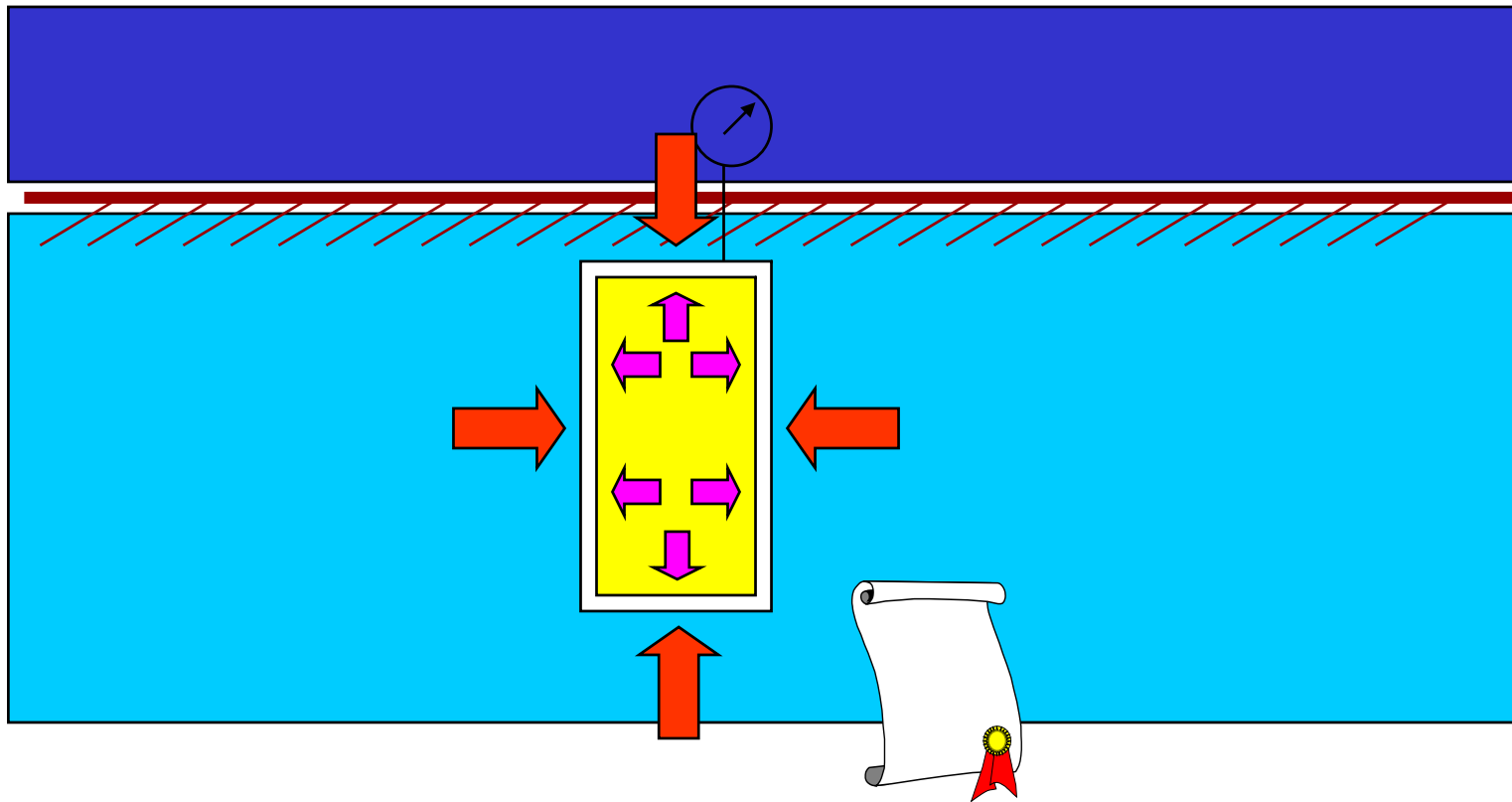
Underground storage systems

- ❑ **Underground containers and pipelines should be secured against the force of buoyancy and the security should be about 1,3 times that of the an empty container (in regard to a totally flooded container)**
 - ❑ *Increasing the height of the earth heaps*
 - ❑ *Covering the container with concrete slabs*
 - ❑ *Anchoring with steel bands fixed in a concrete slab.*

Underground storage systems



Underground storage systems



Outdoor over-ground storage systems

- **Container and plant units must be protected against the force of buoyancy and from mechanical damages that could be caused by floating substances and similar objects**
 - ***Provide the containers and plant units with protective devices, for example:***
 - ***Steel lattice,***
 - ***Support made of steel,***
 - ***Protective walls,***
 - ***Earth dams or similar constructions.***



Outdoor over-ground storage systems

- ❑ Containers and plant units must not hinder the free flow of the floodwater.
 - ❑ *Containers and plant units should be erected outside the danger area.*
 - ❑ *If possible floodwater can also be kept away from the plant with the aid of earth dams.*
- ❑ The lower bottom edge of the container be must be above the water level that is equal to a recurrent interval of 100 years.

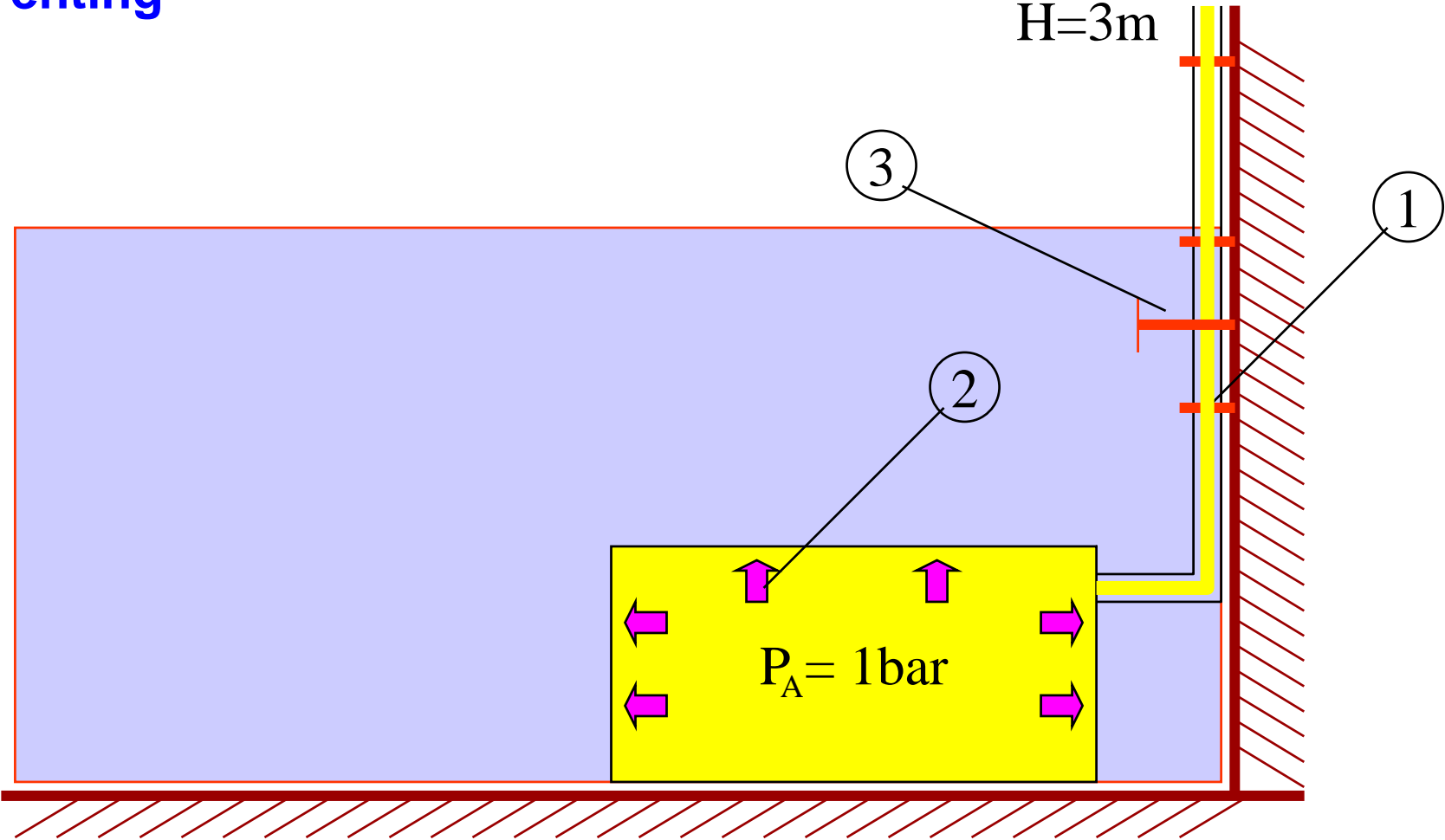


Indoor over-ground storage systems

- Containers should be installed in such a way that they are secured against the force of buoyancy by:
 - Anchoring them with steel bands fixed on the ground,
 - Anchoring them with steel bands fixed on the side walls,
 - Supporting them with steel braces fixed on the roof of the storage room

- The following should be taken into consideration:
 - Make sure no rotating movement is possible
 - If possible avoid fixing the anchor on a coated surfaces
 - Secure against the force of buoyancy and floating with a 1,3 safety factor

Venting



Openings in the containers

- All openings in the containers and pipelines should be constructed as a water-tight device if they can not be arranged in way to avoid being flooded
- Sealing on dome covering should be constructed in a way to avoid being flooded
- Dome covering without screws must be fixed in such a way that it can not be shifted by any stream caused by flooding. In case of doubt, the dome covering should be screwed to strengthen it



Liquid level gauging

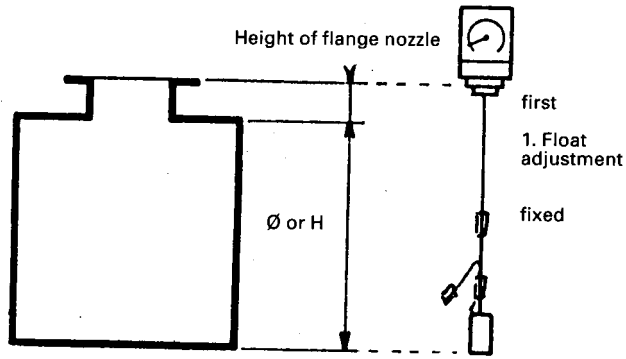
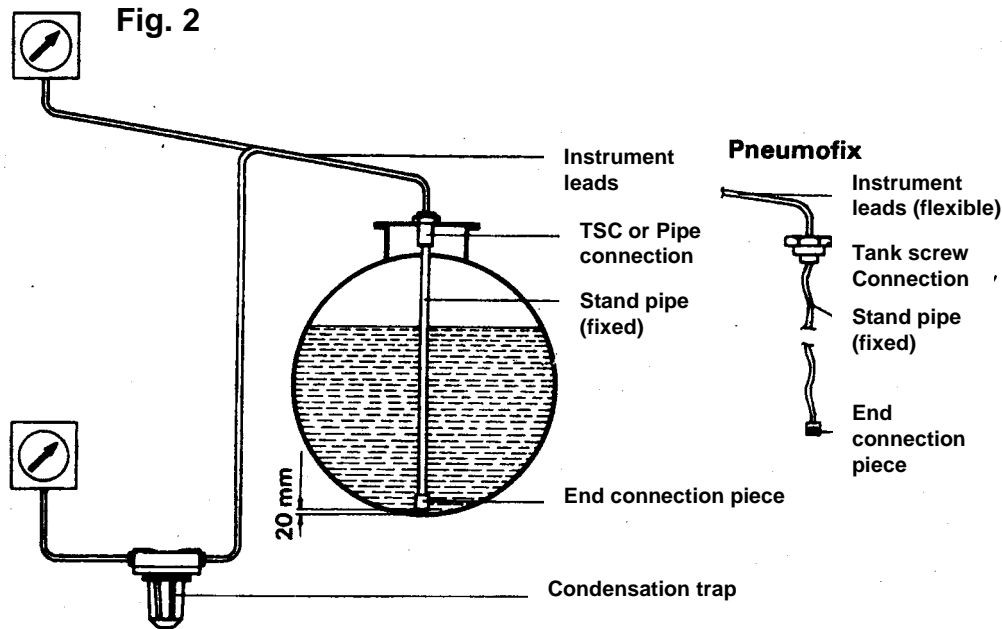


Fig. 1: Instrument Adjustment

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Liquid level gauge with plastic casing



Pneumatic Liquid level gauge

Liquid level gauging

- ❑ It can be assumed for liquid level gauge with plastic casing fitted directly on top of the container (the so called swimming equipment) that no sufficient tightness is guaranteed. Such equipments should be removed if a complete flooding of the container can not be avoided. The openings of the connection of the container should be tightly closed with a plug. A pneumatic liquid level gauge can also be fitted as an alternative.