Sealing systems against substances hazardous to water

Sealing system against substances hazardous to water

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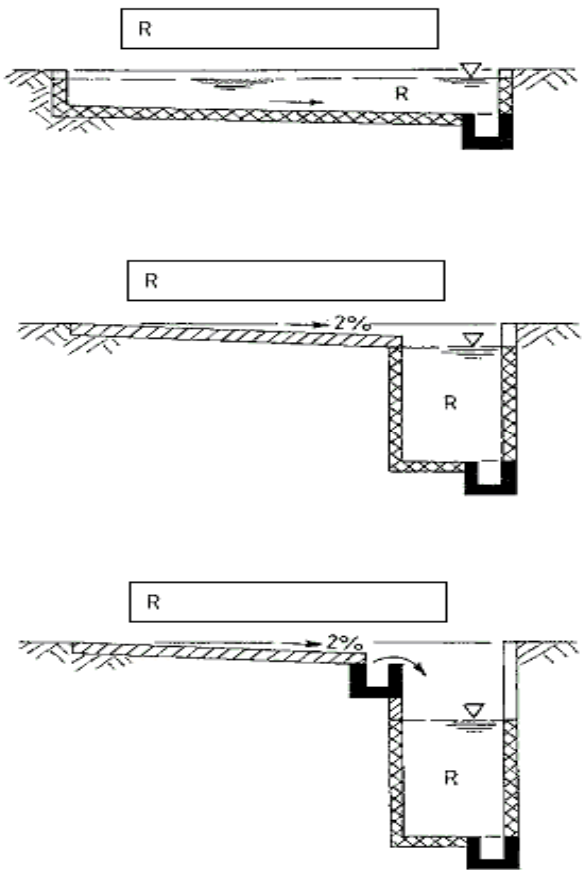
- **Excerpts from the ICPR/ICPE - recommendations:**
  - Sealing systems are liquid-proofed and durable design of collecting basin, - secondary containment or collecting surfaces, which can come in contact with substances hazardous to water in case of accidental leakages.
  - Sealing systems are meant to hinder substances hazardous to water from penetrating collecting basins, secondary containment and collecting surfaces.
- The sealing systems are supposed to have appropriate properties:
  - Resistance to the medium,
  - Liquid-proofed,
  - Durable to mechanical stress, among others

Sealing systems against substances hazardous to water

- **Sealant are used as sealing systems:**



Sealant are impermeable materials which can hold back liquids hazardous to water in case of failure of the tightness of over-ground storage facilities or plant components handling liquids hazardous to water in normal operating condition. They consist the following:

Surface: device for collecting liquids hazardous to water using a slopped surface

containment: device for holding liquids hazardous to water for a limited period of time,

Point of collection: The point where liquids hazardous to water are first collected

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- **Proofing the durability of the sealant (sealed surface) to the medium**
  - **Bibliographical references (regulations, checks by authorised external experts)**
  - **Reference objects**
  - **Laboratory experiments**
  - **Resistance lists**
- **Resistant to mechanical stress (using as a passage or road for vehicles) ⇨ e.g. using appropriate quality of concrete and the building material's thickness (B 35, d_{BT} Δ 200 mm)**

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Period of being exposed to stress

- low: short period of exposure < 8 hours
- medium: limited period 8...72 hours
- high: long period of exposure 72 hours ... 3 months

During the period of exposure, the liquid is allowed to seep through 2/3 of the building material‘s thickness in the maximum!

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- **Other excerpts of the ICPE recommendations**
  - If the material for the sealing systems in itself is not tight enough, other adequate sealant should be used or other similar safety measures should be taken:
    - Coating,
    - Laminating or
    - using foils.

Generally, the installation of <u>all</u> sealing systems should be executed by experts !

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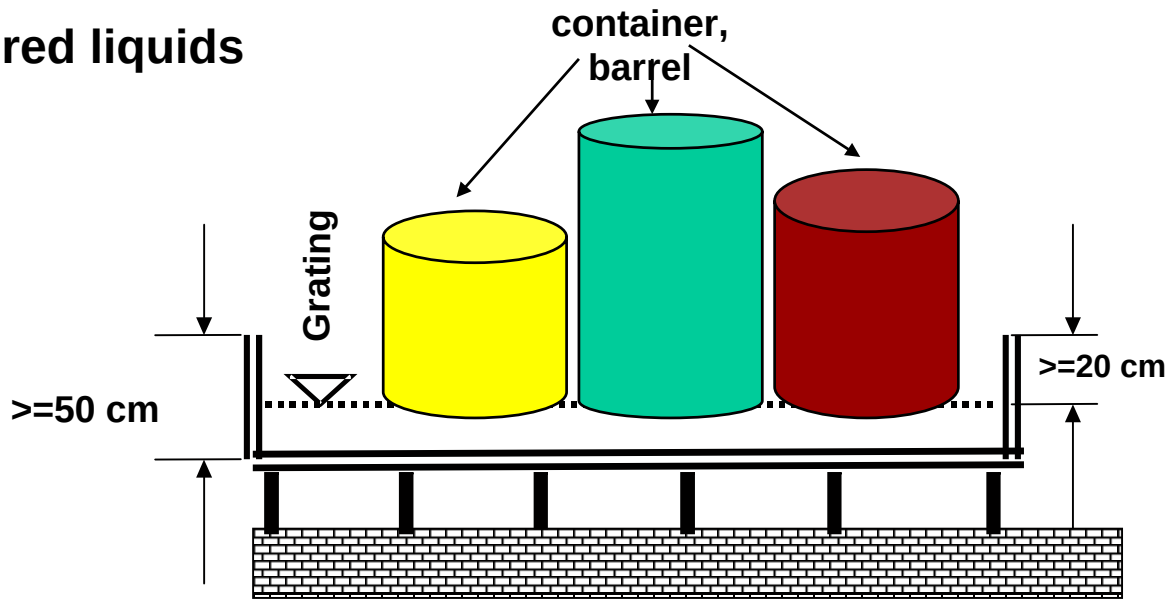
Secondary containment (as an example)

+ Wall thickness e.g. ≥ 3 mm (Steel) or ≥ 2 mm (CrNi-Steel)
+ Ground floor can be checked (can be rolled out on a slide, can be pulled out)
+ Guidelines for the stored liquids
+ Manufacturer‘s label



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Example of a barrel without a secondary containment

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Examples of secondary containments

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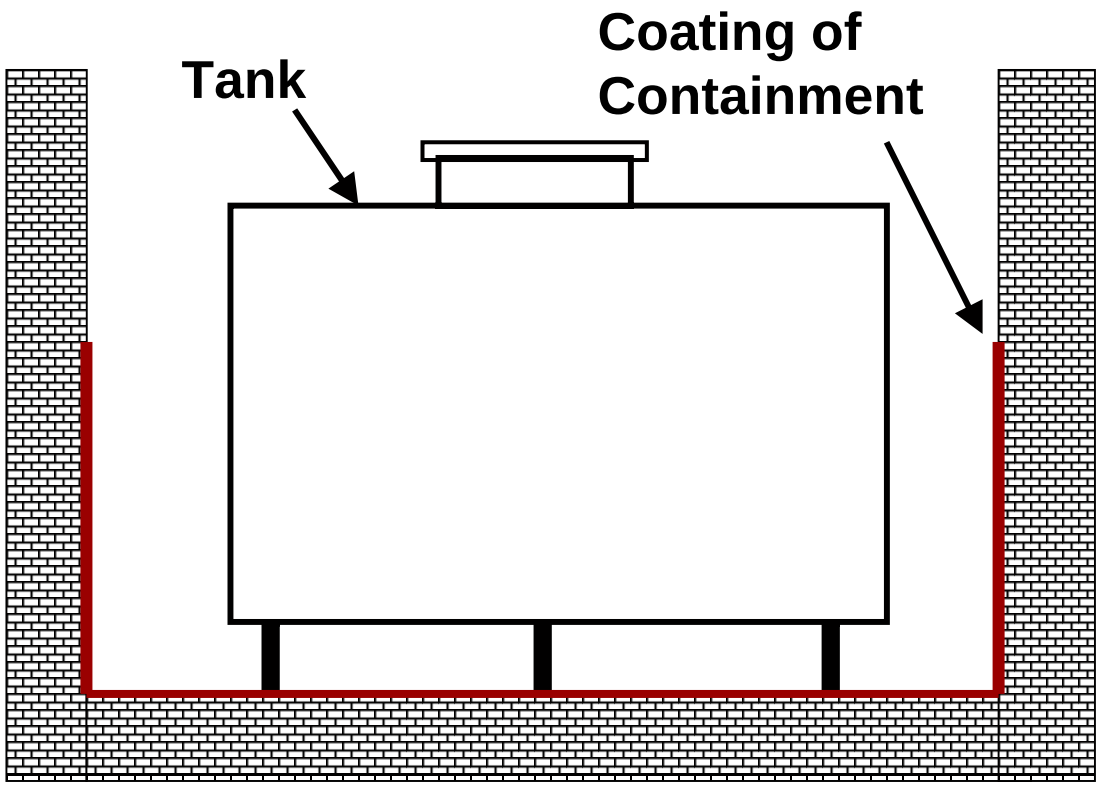
Secondary containment

Protective paint or coating



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Example of containment with protective coating

It has to be proofed that coating material was used and must be executed by experts

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Coating and lining with plastic materials

- They meet the standards if:
  - Lining: at least 0,8 mm thick,
  - Coating: at least 0,8 mm thick or executed to meet authorised design/ method,
  - Proof of being resistant to the medium,
  - the joints are liquid-tight.

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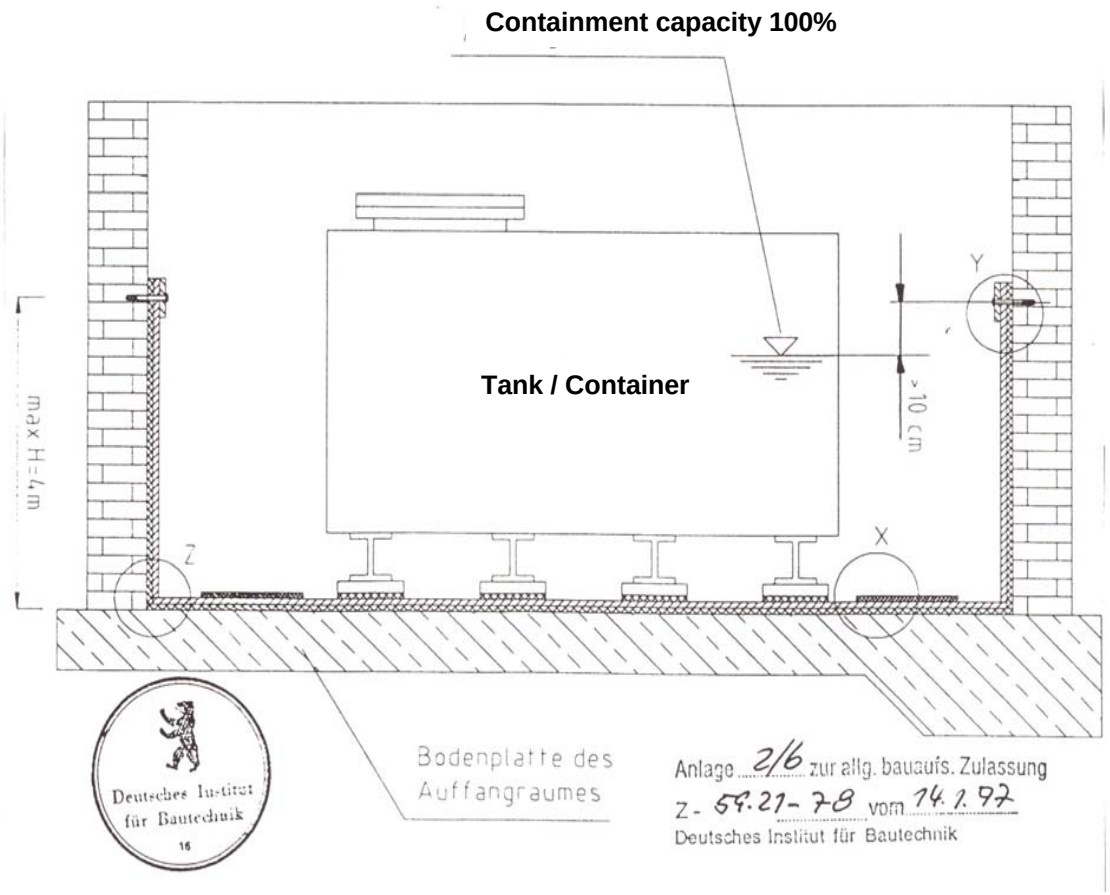
EXAMPLE: Lining a containment with foils



Sealing strips made of PVC-P, 1,5 mm thick, Installation using hot or cold welding

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Example lining with foil

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Lining with steel material

- They meet the standards if:
  - Minimum thickness:-

    stainless steel: ➢ 2 mm

    constructional steel: ➢ 5 mm
  - Proof of being resistant to the medium and
  - Random checking of the welded joints without the joints being destroyed.

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Sealed floor of a filling site

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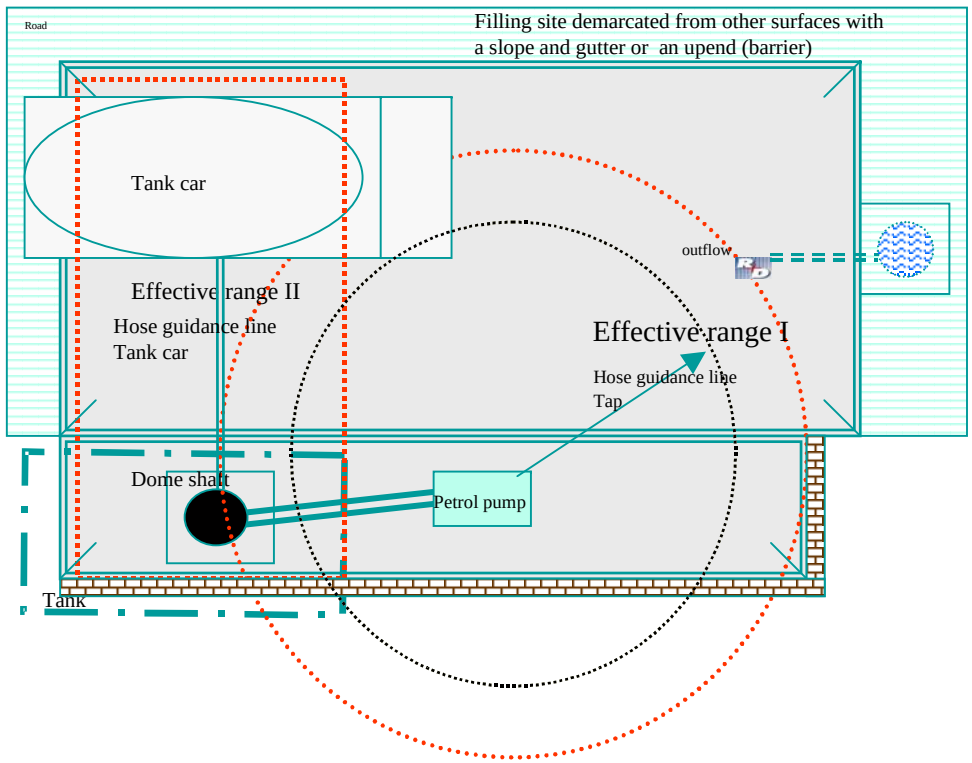
Sealed floor of a filling site

The filling systems consist of the filling site including the delivery systems (e.g. petrol pump, tapping devices, automatic tapping devices etc.) and the filling devices for the containers (remote filling shaft or box, dome shaft).



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Examples of sealed surfaces

	WRC 1	WRC 2	WRC 3
Filling and Emtying of containers	Water-tight concrete ½ a checking by operator	Liquid-tight concrete with A proof of tightness	Coating of the concrete
unloading of liquids into another storage materials	Cast asphalt 4cm thick	Cast asphalt 4cm thick with additional bitumen layer underneath	Water-tight concrete checking by operator every 6 months

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Sealed surfaces made of concrete

- A sealed surface meets the standards if:
  - the stress is low and of medium range,
  - Penetration depth is max. 2/3 of the concrete thickness,
  - Liquids WHC 1 + 2.
  - Quality of concrete Δ B 25 (Proof documented in the construction documents or Schmidt - Hammer),
  - Material thickness Δ 15 cm,
  - the joints are liquid-tight.

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Example of a sealed surface made of concrete

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Example of a sealed surface made of concrete (Storage for iron shavings containing emulsion)

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- **Sealed surface made of asphalt:**
  - **They meet the standards if:**
    - **low + medium stress,**
    - **WRC 1 + 2,**
    - **Proof of liquid tightness,**
    - **Minimum thickness of material: 4 cm, proof of the hollow volume Ω 3 % at a minimum thickness of material of 4 cm and**
    - **the joints are liquid-tight.**

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Example of a sealed surface made of asphalt

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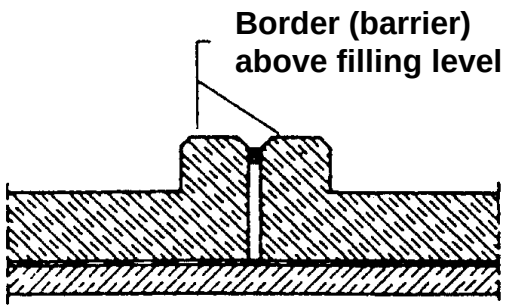
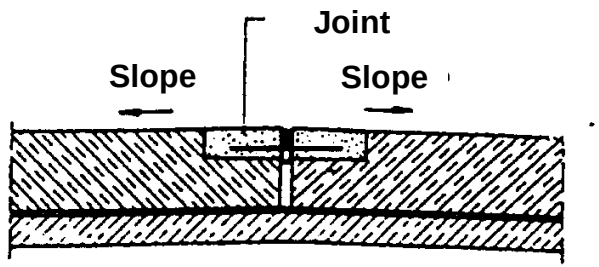
Sealed surfaces

- Have to be liquid-tight, including the joints !



Joints should be constructed on dry surfaces



joints should be constructed at the top

Joints must be resistant and durable to the medium being contained in respect to the mechanical, thermal stress and negative effects of the weather!

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Requirements on sealing systems for joints

row	Effects of liquid hazardous to water	Requirements according to		
		M	V	U
	1	2	3	4
1	drips rarely	o	-	-
2	sprinkles often	o	o	-
3	covers whole surface *)	o	o	o

*) Duration of application

Explanation of symbols

o there are requirements

o there are no requirements

M resistant to material

V bounding properties

U encirclement

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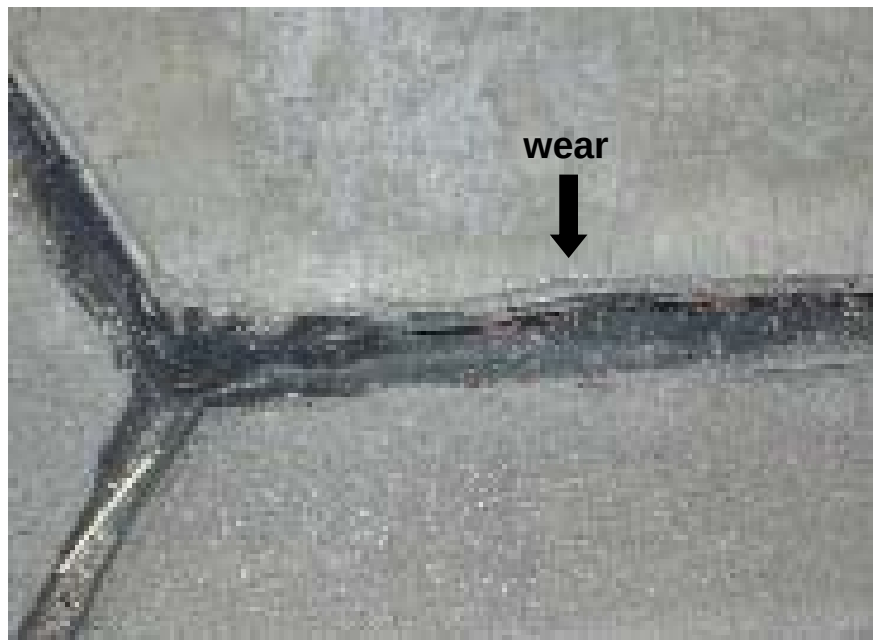
Example of how joints should be constructed



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- **Pipeline leading to sealing systems:**
  - **The pipelines, including connections to parts of the sealed surfaces must be able to undergo tightness tests.**
  - **The pipelines as well as sealing components must fulfil the requirements for tightness and durability.**
  - **Single shell underground pipelines must be connected together and with other parts of the sealed surfaces by means of a welded, adhesives or flange connectors which can be seen as a permanent connection.**
  - **Other kind of connection can only be allowed if equivalent conditions can met !**

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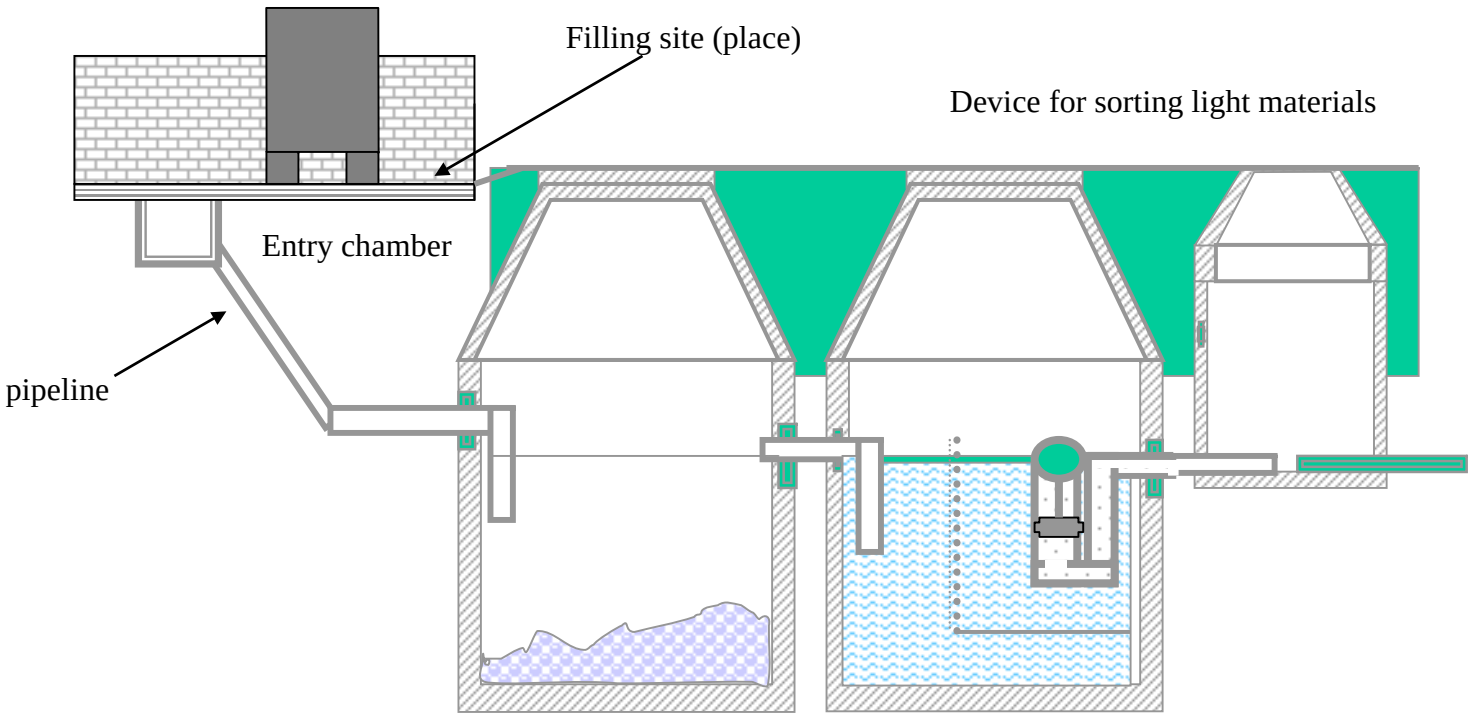
Example of pipe connection, drainage of a sealed surface



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Example of a pipeline penetrating the floor of a collecting basin

Evaluating sealed surfaces

- **Observable sealed surfaces:**
  - **Check the surfaces for contamination and damages caused by cracks, mechanical stress or effects of chemicals. This checks should be conducted on joints, welded joints and other interfaces between different components.**
  - **Their function as a tight surface should be evaluated (e.g. non-destructive method of checking, random drilling of the nucleus, comparison with available architect's plans).**
  - **The surfaces should be repaired in case of damages!**

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- **Non-observable sealed surfaces:**
  - **These surface are normally equipped (e.g. with a leakage detecting device). The tightness is to be ascertained with special methods (e.g. non-destructive method of checking, random drilling of the nucleus, comparison with available architect's plans).**

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Sealed surface made of steel (shaving bunker)

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Examining sealed surfaces with Schmidt‘s Hammer

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Example of defective sealed surfaces

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Example of damaged protective paint of a secondary containment

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Example of inadmissible penetration of a containment by pipelines

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Suggestions for the realization

- Short-term
  - Written documentation of execution and state of the sealed surface,
  - Mending of damages,
  - Regular view check of the sealed surface
- Medium-term
  - Checking the tightness of the sealed surface with an approved testing method
- Long-term
  - Construct new sealed surfaces made of (concrete, steel metal, tiles, foils, laminate