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Checklists for surveying and assessing industrial plant handling materials and substances, which are hazardous to water

№ 17

Checklists for oil processing / industrial plants

Part 2

Requirements to the structure and equipment of industrial plants

For our Environment

Umwelt Bundesamt

DOKUMENTATIONEN 26/2015

Advisory Assistance Programme (AAP) of the
Federal Ministry for the
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№ 17

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Part 2 Requirements to the structure and equipment of industrial plants

by

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Recommendations for oil processing / industrial plants

1. Recommendations for oil processing plants are divided into two parts.
2. The first Part covers mainly issues of safety management in general.

The second Part covers recommendations on safety procedures to prevent accidents during construction and equipment of industrial plants regarding protection of water bodies.

Part 2: Requirements to the Structure and Equipment of Industrial Plants

The following Checklist inspects the safety standard of industrial plants, especially of oil processing, on the basis of recommendations regarding the requirements to the structure and equipment of industrial plants.

The recommendations on the following directions are presented for this purpose:

1. Sustainability
2. Observation, distance
3. Firmness
4. Hatches, other pits, protective canals
5. Details of equipment, safety devices, measures of precaution
6. Collecting reservoirs, collecting basins, collecting bowls
   - Size and constitution
   - Tightness, durability
   - Rainwater
7. Installations for treatment of waste water organized as a collecting facility
8. Industrial equipment for the container with hard material
9. Fire-protection measures
10. Additional requirements to the equipment with internal exceeded or lowered pressure
11. Torchlight system
12. Nonflammable durable fittings
13. Refrigerating and heating installation
14. Uploading and offloading from the ship

The detailed text of Recommendations see at “Recommendations for Oil Processing Plants” – part of Danube Regional UNDP/GEF Project – Accidents prevention measures – Pilot Project – Oil Processing Plants" (RER/03/G31/A/1G/31).

Checklist to control implementation of recommendations

General data of the equipment being examined

Industrial title:

❒ Present collecting capacity Volume: m^3

Name of material:
(Further data in the Checklist № 1 "Materials")

WRI:

Productional material of the equipment:

Note:

1 Sustainability

1.1 Was the equipment installed by a specialized company and was any attention paid tot he impeccable status of equipment?

❒ Yes→ 1.2 ❒ No → 1.3 ❒ Not applicable
❒ Action ❒ No action

1.2 Was a bearing surface considered during this?

❒ Yes ❒ No ❒ Not applicable
❒ Action ❒ No action

1.3 Is it noticeable that the equipment was moved, tilted, lowered, or exploited during deformation with this endangering the reservoir or a device?

❒ Yes (not visible) ❒ No (visible) ❒ Not applicable
❒ Action ❒ No action

1.4 Is there any evidence of stability?

❒ Yes ❒ No ❒ Not applicable
❒ Action ❒ No action

1.5 Is the equipment in the area of flooding or a high water?

❒ Yes → 1.5.1 ❒ No → 2. ❒ Not applicable

1.6 If yes, is there any proof of safety regarding buoyancy?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:

Short-term:

- Training of personnel and guidance on recognition of deformation, displacement and tilt
- Regular control for timely identification of present problems

Medium-term:

- Drawing conclusions about relative properties of the soil regarding the bearing surface and expected load on the soil

Long-term:

- In the case of new equipment to plan additional measures

Determination of the real risk

Was the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

2 Observation, distance

2.1 Is there a distance between the walls, other building parts and tanks, pipelines and other equipment to be able to detect leaks and at any time to control the state of the receiving tank through the inspection / monitoring in place?

❒ Yes → 3. ❒ No → 2.2 ❒ Not applicable

❒ Action ❒ No action

2.2 Are there installed at adequate places leak detectors, which alert on a critical level of the liquid and create an optical alarm?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of actions:

Short-term:

- Training of personnel and instructions on regular control over equipment and correct reaction at the danger of overfilling.

Long-term:

- Installation of suitable sensors to detect leakage, and creating an acoustic and optical signal on leakage of dangerous liquid.

Determination of the real risk

Was the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

3 Firmness

3.1 Is it possible during inspection to identify (as much as possible) equipment for tightness?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

3.2 Are the storage areas constructed in such way to exclude a danger of mechanical damages and other mechanic impact?

Examples of mechanic impact:

- Run down of a vehicle
- Damage made by cranes, excavators, conveyers

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

3.3 Are the system components used according to their intended use to the water-polluting materials and are they of adequate capacity/strength?

a) Regarding the mechanic requirements?

❒ Yes ❒ No ❒ Not applicable

Is there any evidence?

❒ Yes ❒ No ❒ Not applicable

b) Regarding the thermal requirements?

❒ Yes ❒ No ❒ Not applicable

Is there any evidence?

❒ Yes ❒ No ❒ Not applicable

c) Regarding the chemical requirements?

❒ Yes ❒ No ❒ Not applicable

Is there any evidence?

❒ Yes ❒ No ❒ Not applicable

d) Regarding the biological requirements?

❒ Yes ❒ No ❒ Not applicable

Is there any evidence?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

3.4 Have the intervals between inspections and the wall thickness been selected in such way, that ensures stability along with decreasing thickness of the walls by removing the mass?

❒ Yes ❒ No ❒ n.a.

❒ Activity ❒ No action

3.5 Is the plastic, which is used - sufficiently resistant to serve the purpose of using?

a) Regarding the mechanical requirements?

❒ Yes ❒ No ❒ Not applicable

b) Regarding the thermal requirements?

❒ Yes ❒ No ❒ Not applicable

c) Regarding the chemical requirements?

❒ Yes ❒ No ❒ Not applicable

d) Regarding the biological requirements?

❒ Yes ❒ No ❒ Not applicable

e) Regarding the process of obsolescence?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

3.6 Is there any equipment / machinery parts made of a material with poor corrosion resistance?

❒ Yes → 3.6.1 ❒ No → 4. ❒ Not applicable

❒ Activity ❒ No action

3.6.1. If yes, do they have suitable internal coating or facing?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

Note:

Examples of activities:

Short-term:

- Check walls for the required estimated pressure
- Measure thickness of walls in selected locations using ultrasound to establish a sufficient wall thickness (a mathematical test)
- Inspection of walls inside in selected locations
- Check the available documentation
- Reduction of intervals between inspections.

Medium-term:

- Check thickness and pressure
  - Testing means: **water**
    Testing pressure: 1.3 x maximally allowed increased pressure
  - Testing means: **Nitrogen or air** (take precaution measures).
    Testing pressure: 1.1 x maximally allowed increased pressure

- If the testing pressure is impossible to use for safety reasons: should be applied such non-destructive inspection methods as measurement of wall thickness by ultrasound.
- Covering of facing the details of equipment.

Long-term:

- A written record of stability and suitability of equipment in the hardware documentation on the basis of the test results and the positive experience of the company.
- New equipment: The evidence of the suitability and stability to the assembly provided by a manufacturer.

Determination of the real risk

Was the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

4 Hatches, pits and protective canals

❒ Relevant ❒ Irrelevant → 5.

4.1 Were the following protective devices prepared regarding liquid density and stability?

Note: The requirements of the paragraph 6.2.4 , sub-paragraph 1 are suitable to other pits, protective channels or protective pipes made of concrete, if water hazardous substances flowing there could penetrate no more than two-thirds into the zone of dense foundations and walls that do not contain cracks, to recognize and eliminate substances soluble in water. Crack-free zone is calculated from the thickness of the material minus the area of shrinkage cracks and fissures in the area. When failure happens, it is necessary to immediately restore the compacted area.

a) Hatches of underground reservoirs?

❒ Yes ❒ No ❒ Not applicable

b) Other underground pits?

❒ Yes ❒ No ❒ Not applicable

c) Protective canals?

❒ Yes ❒ No ❒ Not applicable

d) Protective pipes?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

4.2 Can the rainwater flow into hatches, other pits and protective canals?

❒ Yes → 4.2.1 ❒ No → 4.3 ❒ Not applicable

❒ Action ❒ No action

4.2.1. Is it possible to safely dispose the water after inspection?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

4.3 Can the condensation moisture be formed?

❒ Yes → 4.3.1 ❒ No→ 4.4 ❒ Not applicable

❒ Action ❒ No action

Is it possible to safely dispose the water after inspection?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

4.4 Do the hatches, other pits and protective canals have points or places joining to the water discharge facility?

❒ Yes (no joining places) ❒ No (there are places of joining) ❒ Not applicable

❒ Action ❒ No action

4.5 Is there a regular monitoring of hatches, pits and other protective canals?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

Notes:

Examples of activities:

Short-term:

- Exclude penetration of rainwater (e.g. coverage of pits).
- Sealing joints of drainage facilities.
- Undertake control operations.

Medium-term:

- Sealing joints of available pits.
- Installing insulation in places where condensation fluid is formed.

Long-term:

- Additional installation of pits with liquid.

Determination of the real risk

Was the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

5 Details of equipment, safety devices, precaution measures

5.1 Do the following safety devices to prevent dangerous high and low pressure in details of the equipment exist, especially in tanks and pipelines?

a) Ventilation devices?

❒ Yes ❒ No ❒ Not applicable

b) Safety valves?

❒ Yes ❒ No ❒ Not applicable

c) Protective membranes?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

5.2 Are these devices suitable to prevent dangerous high or low pressure in the details of equipment (evidence)?

a) Ventilation devices?

❒ Yes ❒ No ❒ Not applicable

b) Safety valves?

❒ Yes ❒ No ❒ Not applicable

c) Protective membranes?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

5.3 Are these safety devices equipped with additional devices, and are they located in such way, when the water hazardous substances can drain safely?

a) Safety valves?

❒ Yes ❒ No ❒ Not applicable

b) Protective membranes?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

5.4 Are the blocking devices accessible?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

5.5 Is it easy to detect blocking devices?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

5.6 Are there any automatic safety devices for cases of failure, fires, such as gates, valves or pumps?

❒ Yes ❒ No→ 5.4 ❒ Not applicable

❒ Activity ❒ No action

5.7 Are these automatic safety devices connected to:

- Energy supply, which does not depend on **equipment or do they have**

❒ Yes ❒ No ❒ Not applicable

- Other precaution measures, ensuring functioning at insufficient energy supply?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

5.3.2. Do these safety devices have any protective alarm concerning their performance?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

5.8 Is there any equipment with double-walls?

❒ Yes → 5.4.1 ❒ No→ 5.5 ❒ not applicable

❒ Action ❒ No action

5.4.1. Is there any observation done over the leakage in underground equipment using one of the following ways?

a) Using a liquid revealing a leakage and such liquid is not hazardous to water?

❒ Yes → 5.4.2 ❒ No ❒ Not applicable

b) Using vacuum system?

❒ Yes ❒ No ❒ Not applicable

c) Producing the excessive pressure with non-dangerous gas?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

5.4.2. Are only water hazardous substances or substances with low level of danger used in order to detect any leakage from the double-wall equipment located above the ground?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

5.9 Are there level indicators installed in, for example, in the mixing reactor or in columns?

❒ Yes → 5.5.1 ❒ No→ 5.6 ❒ Not applicable

❒ Action ❒ No action

5.10 Is an independent alarm signalization installed (minimum, maximum) to show levels corresponding the paragraph 5.5?

❒ Yes → 5.6 ❒ No → 5.5.2 ❒ Not applicable

❒ Action ❒ No action

5.5.2. If no, can the overfill be noticed just visibly, or it is not important on the basis of the technological process (for instance, overfill principle)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

5.11 Can the overfill be prevented?

See also the Checklist 2 «Overfill Prevention»

❒ Yes → 6. ❒ No→ 5.6.1 ❒ Not applicable

❒ Action ❒ No action

5.12 If no, is there any danger of overfill on the basis of technological process (for instance, overfill principle)?

❒ Yes ❒ No ❒ Not applicable

❒ Activity ❒ No action

Note:

Examples of activities:

Short-term:

- If there are no any ventilating devices installed, then it is necessary to open a reservoir or install it;
- Training of personnel and instructions for regular control of level measuring devices and for correct reaction on the overfill danger;
- The filling process should be maintained by not less then two persons;
- To ensure direct observation over the level in a reservoir during filling process;
- The personnel undertakes control and observation over exceeded or lowered pressure;
- Training of personnel and instructions to act, if the allowed pressure will be exceeded or lowered;
- Regular check functioning of preventive valves;

Medium-term:

- Installation of allowed device on prevention of overfill;
- Install a device to control the internal lowered or exceeded pressure;
- Install safety valves or safety membranes;
- Ensure that the hazardous substances safely discharged from valves (for example, towards a separate emergency reservoir);
- Replacement of hazardous substances, used as a liquid to indicate a leakage.

Long-term:

- To develop a plan for servicing blocking devices and implement it so that the locking devices are well accessible and easy to maintain, and are near to the reservoir to provide quick response;
- Use a method to detect leaks (for example, to replace fluid in low pressure).

Determination of a real risk
Was the sub-point of recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

6 Foster reservoirs, collecting baths, receiving bowls

❒ Relevant ❒ Irrelevant → 7

Note: The sub-paragraph "not important" is only for the underground and double-wall equipment

6.1 Size and arrangementAre the separate reception tanks / receiving bowls placed among the equipment where the leakage of fluid cannot be excluded?

❒ Yes ❒ No ❒ Not applicable
❒ Action ❒ No action

6.2 Are the reception tanks / bowl receivers located directly next to the equipment?

❒ Yes → 6.1.3 ❒ No → 6.1.2.1 ❒ Not applicable
❒ Action ❒ No action

6.1.2.1. If no, can water hazardous substances be discharged towards them?

❒ Yes ❒ No ❒ Not applicable
❒ Action ❒ No action

6.3 Are the industrial wastewater treatment plants used as a replacement device, if contaminated substances with water-soluble substances in the event of failure leak out from the production equipment?

❒ Yes (does not drip into the Treatment device) → 6.1.4 ❒ No (does drip into the Treatment device)→ 6.13.1 ❒ Not applicable
❒ Action ❒ No action

6.1.3.1. Can the contaminated substances be kept with the water hazardous substances in the receiving reservoir at the industrial sewage?

❒ Yes → 6.1.3.2 ❒ No→ 6.1.4 ❒ Not applicable
❒ Action ❒ No action

6.1.3.2. Can the harmlessly contaminated substances and water hazardous substances be used or disposed in a proper way?

❒ Yes ❒ No ❒ Not applicable
❒ Action ❒ No action

6.4 Are the tanks with substances soluble in water, which at release can react with each other in such a way that will lead to rejection of reservoirs or receivers, - located at separate receiving containers or in separate zones of the same of the allocation among themselves so that when it denied receiving tanks or containers, in separate containers in some areas of a receptacle?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.5 Is the equipment in a container or anyhow differently protected against loss and leakage of a fluid?

❒ Yes → 6.1.6 ❒ No→ 6.1.5.1 ❒ Not applicable

❒ Action ❒ No action

6.1.2.1. If no, then does the receiving tank have a sufficient size to protect the whole service area against loss and leakage of fluid?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.6 Definition of the size of the receiving reservoir

6.1.2.2. Size of the installations located in the catchment area

Total weight of equipment located in the receiving tank .....m³

10% from the total weight of equipment located in the receiving tank .....m³

The volume of the largest production unit in a locked equipment .....m³

6.1.2.3. The size of the necessary receiving tank

Risk index for water equipment (Water Risk Index or WIR) (see the Checklist 1 „Materials“) .....

WRI	Requirements	Estimated volume
≤ 2	no ability to hold on the basis of production requirements	----
2 ≤ 3	The ability to hold water soluble substances for the volume which may leak before exploitation of a suitable preventive device (e.g., blocking or sealing the leaking equipment places where there is a leak)	.....m³
> 3	The ability to hold water-soluble substances for the volume, which can be released at violation of the production process, is taken into account without countermeasures. **Note**: The retention action, independent of human activity, which depends only on the construction and technical safeguards. To determine the volume there can be used as the largest volume of blocking the production unit in equipment: Anything that	.....m³

can leak out in the worst case, must be flowing or dripping into the receiving container.

6.1.2.4. The receiving container is more then 10% from the total mass and more then certain volumes, determined at the paragraph 6.1.6.2?

The size of the available receiving reservoir .....m

Note: It is necessary to take into consideration only the free reception capacity, which means the amount of technical liquid in the receptacle is to be emptied.

❒ Yes → 6.1.6.5 ❒ No → 6.1.6.4 ❒ Not applicable

❒ Action ❒ No action

6.1.2.5. Can the ability to retain with the help of double-walled reservoirs be substituted with a device showing the leakage?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.1.2.6. Is the equipment in water or on the water surface where it is impossible to install a retaining device nearby?

❒ Yes → 6.1.6.5.1 ❒ No→ 6.2 ❒ Not applicable

❒ Action ❒ No action

6.1.2.6.1. If yes, is it guaranteed in the manual that leak, which cannot be excluded by inspection, repair and maintain in good condition, we can immediately recognize and eliminate harmlessly?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:

Short-term:

- Temporary increase receiving capacity of the receptacle by means from own production assets
- Development of operation instructions, describing the technical capacity and the right way to quickly resolve a problem (money, people, etc.)
- Preparation of binding material.

Medium-term:

- To build-up a protective partition
- To prepare separate collecting bowls, if the leakage can not be stopped.

Long-term:

- On the basis of the already established parameters to build-up reception tanks and basins, if hazardous liquid substances may leak out, for example, due to incomplete tightness, overflow, and other events.

6.7 Tightness, wear resistance

6.2.1 Are the diverting systems or the receiving capacity made of non-metallic porous materials?

❒ Yes → 6.2.1.1 ❒ No → 6.2.2 ❒ Not applicable

❒ Activity ❒ No action

6.2.1.1. Is it allowed, that through the airtight bases and the walls the liquid can penetrate up the two thirds of the sealing thickness before finding any damages and before elimination of the dangerous liquid substances?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.8 Are the receiving containers strong enough against dripping substances?

❒ Yes ❒ No → 6.2.3 ❒ Not applicable

❒ Action ❒ No action

6.2.1.2. Is there any evidence of leaks and deterioration due to the leaking substances?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.2.3 Do the pipes and cables go through the base or walls of the receiving paddle?

❒ Yes (do not go through) → 6.3 ❒ No (do go) → 6.2.3.1 ❒ Not applicable

❒ Action ❒ No action

6.2.3.1. Are these pipes and cables waterproof?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:

Short-term:

- Temporary increase capacity of receptacle by means of own production facilities.
- Development of operation instructions, describing the technical capacity and the right way to quickly resolve a problem (money, people, etc.)
- Prepare a binding material.

Medium-term:

- To bring evidence of tightness and durability against water hazardous substances (literature, laboratory, inspection, documentally proven experience).

Long-term:

- Ensure tightness and durability of collecting containers
- (requirements to the tightness see the Checklist Nr. 5 „System of creating tightness“, recommendation 1/sub-para 1).

6.9 Rainwater

6.3.1 Can the rainwater drip into the collecting vessel?

❒ Yes → 7 ❒ No→ 6.3.1.1 ❒ Not applicable

❒ Action ❒ no action

6.2.3.2. Is the rainwater removed after the test mentioned above?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.2.3.3. Does the collecting vessel have additional reserve of 5 sm for the rainwater?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

6.2.3.4. If the receptacle has outlets for draining rainwater, it is possible that water hazardous substances may overfill out of them?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:

Short-term:

- The development of the instruction will depend on the way of removing the rainwater
- To develop instructions for workers on how to deal with the contaminated rainwater
- Valves of drain holes of collecting devices must be always closed

Medium-term:

- To increase the collecting capacity of the receptacle by creating an additional 5 sm sideboard.

Long-term:

- If there are other possibilities to organize either drain or retain of the rainwater, then the discharge outlets can be removed.

Determination of a real risk

Was the sub-point of recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=70	RC=140

7 Productional equipment for hard substances

❒ relevant ❒ Not relevant → 8.

7.1 Are the water hazardous solid substances used at all the production and weather conditions for a strong and impervious surface? (See also the Checklist 5 „Sealing Systems")

Note: The surface is durable and impervious to road construction if connecting patch and similar decks are excluded. Particularly necessary to check the strength and tightness in closed rooms/areas using the substances in the form of an ointment with no box or packaging.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

7.2 Are the materials handled in containers or packaging follow all the requirements?

❒ Is the applied packaging tight? ❒ Yes ❒ No

❒ Is the packaging protected from any damage? ❒ Yes ❒ No

❒ Is the packaging protected from any weather influence? ❒ Yes ❒ No

❒ Is the applied packaging - firm? ❒ Yes ❒ No

Are the requirements, mentioned above, followed?

❒ Yes → 8. ❒ No → 7.3 ❒ Not applicable

❒ Action ❒ No action

7.3 Are the substances, used inside the room or outside the room on a surface, protected from all the weather conditions?

Note: The areas that are protected from natural influences, are covered, and the square of the roof is 2/3 x height of the light.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:

Short-term:

- Repair of damage the sealing surfaces and shelters.
- Regular supervision for tightness.
- Avoid bending the edges of the compacted surface, otherwise it will collect rainwater.

Medium-term:

- To do a roofing (the roof must be above the compacted surface with the square of the 2/3 x height of the light).

Long-term:

- To create new surface for compacting.

Determination of a real risk

Was the sub-point of recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=30	RC=60

8 Fire prevention

❒ Relevant ❒ not relevant → 9.

8.1 Are plants handling combustible liquids equipped with sufficient fire preventive facilities (e.g. Fire extinguisher and sprinkling facilities)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.1.1 Are the fire protection devices used in the right places?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.2 Are the fire protection devices functioning always?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.3 Is the the required amount of water provided for fire fighting and cooling measures?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.4 Can the material for the following plant components withstand the effects of a fire outbreak for at least 30 minutes?

a) Tank / plant components

❒ Yes ❒ No ❒ Not applicable

b) Pipeline

❒ Yes ❒ No ❒ Not applicable

c) Containing facilities

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.5 Are the necessary measures taken to prevent a fire outbreak either from the plant itself, or from the neighborhood spreading into the plant?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.6 Are the fire preventive facilities taken according to the type and amount of combustible liquids being handled, and are the following points taken into consideration?

❒ Local and operational conditions ❒ yes ❒ no

❒ Amount of combustible liquids ❒ yes ❒ no

❒ The degree of danger ❒ yes ❒ no

❒ Not applicable

❒ Action ❒ no action

8.6.1 Are the suitable facilities for informing the local fire brigade e.g. fire alarm available?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.7 Which fire preventive facilities are employed in outdoor above-ground plants?

❒ Stationary fire preventive facilities

❒ Mobile fire preventive facilities

❒ Semi mobile fire preventive facilities

(identical semi-mobile fire preventive facilities are mobile fire extinguishing vehicles, which in regard to the rate of fire extinguishing agent and their storage as well as the alarm concept and response time – fully correspond to the norms of fire safety and informing in the case of fire)

8.8 Which fire-extinguishing agents are used?

❒ Carbonic acid → 8.8.1

❒ Extinguishing powder→ 8.8.1

❒ Air foam → 8.9

❒ Water→ 8.9

8.8.1. Are special preventive measures taken to avoid danger of ignition due to electrostatic charges when carbonic acid or extinguishing powder are used in explosive atmosphere (e.g. for making atmosphere of inert gas or for testing)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.9 Are mobile sprinkling systems used?

❒ Yes → 8.9.1 ❒ No→ 8.10 ❒ Not applicable

❒ Action ❒ No action

8.9.1 Are the following points taken into consideration when mobile sprinkling systems are used?

❒ The neighboring plants or plant components next to the burning plant must be in a position to be cooled with the required quantity of water irrespective of which Direction the wind and the smoke from the fire is blowing

❒ Yes ❒ No

❒ Connections to the water network (fire hydrants) meant for fire extinguish purpose must be sufficiently available and installed in such a way that they remain easily accessible from all direction in case of fire outbreak and also for cooling of neighboring plants and plant components.

❒ Yes ❒ No

❒ The facilities needed for cooling and the professional personnel needed for their operation must always be ready during to guarantee an effective cooling of the plants within the shortest time after the fire outbreak.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.10 Are trips or operating panels available?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.10.1. Are they installed in such a way that they remain easily accessible in case of fire outbreak at any part of the plant installations?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

8.11 Are there fire-fighting containers available?

Note: The fire-fighting containers are not required, if

- ❒ There are non-flammable liquid substances and materials used, as well as equipment, and buildings related to them also non-flammable, and if in the area of equipment they there are no stored other flammable substances; or
- ❒ fire can not appear by other reasons;
- ❒ The expected flow of water to extinguish and water soluble substances during a fire is insignificant, and if the water goes into the fire tanks and if there are along with this any documents of approval made by an authorized body responsible for the protection against fire.

❒ Yes → 8.11.1 ❒ No → 9. ❒ Not applicable

❒ Action ❒ No action

8.11.1. Is there any evidence of measuring the fire tank? (See the Checklist 8 "fire prevention plan")

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Examples of measures:

Short term:

- Regular inspection to detect leakages and leaks and possible igniting sources
- Prohibition of smoking and using of naked fire and hot objects.
- Training and instructing the personnel on fire-fighting measures and how to respond in case of fire outbreaks.
- Identify and distinguish area of the plant with an increase risk of fire and prohibition of smoking and use of open fire.
- Check and upgrade the fire fighting equipment for combating fresh fire outbreaks.
- Make sure that sufficient fire-fighting water is available and specify measures for improvement if necessary.

- Check the present methods of alarming the fire brigade and verify the response time of the fire brigade. Further measures should be specified depending on the results of this check.

Medium term:

- Issue special regulations on how maintenance and services should be implemented in these areas.
- Measures to improve the supply of fire-fighting water, e.g. increasing the flow rate of existing hydrants, installing additional fire-fighting water hydrants.
- Measures to improve the alarming of the fire brigade by installing additional telephones or manually triggered fire alarm devices.
- Specify measures to reduce the time needed before the combating takes off in cooperation with the fire brigade.
- Provide additional measures to protect structural components or limit the effects of fires by installing fire-proofed protective walls or claddings.

Long term:

- Install automatic fire alarm devices with alarm transmission to the local fire brigade.
- Provide additional measures to protect structural components or limit the effects of fires by installing fireproof protective walls or claddings.
- Provide fire sectors and fireproof partitions for storage or production areas.
- When reconstructing existing buildings or building new ones, make sure that non-combustible building materials are used.

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=70	RC=140

9 Explosion safety maintenance

❒ Relevant ❒ Not relevant → 10

9.1 Were the measures, excluding explosive environment occurrence, taken?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.2 Were the corresponding security measures taken, that

❒ Prevent danger of ignition in the explosive environment ❒ Yes ❒ No

❒ Limit danger of ignition in the explosive environment ❒ Yes ❒ No

❒ Limit explosion influence in certain degree? ❒ Yes ❒ No

❒ Action ❒ No action ❒ Not applicable

9.3 Are the expected sources of ignition in zones in which more often at normal operation there is no explosive environment in the form of a mix from air and flammable gases, steams or a smoke or arises for a short while (sources of ignition which can arise at normal, uninterrupted operation) – avoided?

❒ Yes ❒ no ❒ not applicable

❒ Action ❒ no action

9.3.1. Are the expected sources of ignition at industrial malfunctions in zones in which there is an explosive environment in the form of a mix from air and flammable gases, steams or a smoke (frequent industrial malfunctions) - avoided?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.3.1.1. Are the ignition sources at rare industrial malfunctions in zones in which it is constant or with breaks, there is an explosive environment in the form of a mix from air and flammable gases, steams or a smoke avoided?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.4 Were the devices, equipment and details installed in explosive zones, selected in such a manner that they correspond to requirements for installation sites?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.4.1. If yes, are there any proofs?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.5 Were the safety[1] systems established in explosive zones, (for example, fire extinguishers, systems preventing explosions, pressure-reducing devices, quick-closing valves) in a way suitable for exploitation?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.6 Are the ignition sources, influencing explosive zones, located in immediate proximity from zones where the explosive environment is generated by chance or permanently during usual/normal operation avoided (for example, maintenance in a serviceable condition of hearth or handling a fire or scorching details, with open and closed fire and smoke)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.7 Are the connections and preventive pipes for cables protected by walls and roofs in the areas prone to explosions, as well as holes for pipes – from penetration of flammable liquid and steams?

[1] «Safety systems» are all the devices, which prevent explosion and/or limit contaminated area from explosion and introduced into exploitation as autonomous systems.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.8 Do oil carrying cars or other lorries drive only in those zones where at normal operation there is no explosive environment most probably or arises for short time and only there where it is necessary for operation of equipment?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.9 Are the substances and materials, which can lead to occurrence and distribution of a fire in view of their version and quantity, stored far from explosive zones?

Note: For example, storage of construction materials and other substances, which have not been intended for manufacture, is inadmissible.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

9.10 Is the compressed, liquefied suppressed solute gas stored only under the earth in zones in which at normal operation the explosive environment is formed?

Note: It is not meaningful for fire-fighting devices

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of actions:

Short-term:

- The regular control over leakage, nonhermeticity and possible sources of ignition
- Prohibition to smoke and use open fire and hot parts

Medium-term:

- Distribution of safety zones and consideration in the plan former safety zones
- Use of devices which are admitted to operation in corresponding zones
- Special rules of behavior are necessary for maintenance in the serviceable condition of these zones

Long-term:

- Installation of safety devices at explosive environment formation.

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

10 Requirements to the equipment with internal increased or reduced pressure

❒ Relevant ❒ Not relevant → 11.

10.1 Is there any equipment with a device which helps to control internal increased or reduced pressure?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

10.2 Can the working excessive pressure exceed the norm?

❒ Yes → 10.2.1 ❒ No → 10.6 ❒ Not applicable

❒ Action ❒ No action

10.2.1. Does the equipment, in which the internal increased pressure can emerge, have any preventive device to regulate a pressure?

❒ Yes ❒ No → 10.5 ❒ Not applicable

❒ Action ❒ No action

10.3 Is a liquid or steam leaking out from preventive valves being safely taken aside?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

10.4 Have there been installed any other protective devices instead of preventive valves to regulate a pressure (for example, preventive membranes)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

10.5 Is the allowed working pressure of the equipment is more then 2 bar and less then a possible pressure of a generator [$P_{equipment}$<($P_{Max\ generator\ of\ pressure}$ -2bar)]?

❒ Yes → 10.5.1 ❒ No→ 10.6 ❒ Not applicable

❒ Action ❒ No action

10.5.1 Is there a device in a pressure head pipe, which automatically reduces a pressure and does not allow exceeding admissible working pressure?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

10.6 Is it excluded that the lowered pressure will emerge?

❒ Yes → 10.7 ❒ No→ 10.6.1 ❒ Not applicable

❒ Action ❒ No action

10.6.1. Is the equipment stable in relation the lowered pressure?

❒ Yes → 10.7 ❒ No→ 10.6.2 ❒ Not applicable

❒ Action ❒ No action

10.6.2. Does the equipment have a device, which will prevent emerging of dangerous lowered pressure?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

10.7 Is every connection of the pressure head pipe equipped with a blocking device in order to switch the equipment towards safe pressure-free status during delay and repair?

❒ Yes ❒ no ❒ not applicable

❒ Action ❒ no action

Note:

Examples of activities:

Short-term:

- The personnel controls over increased and lowered pressure.
- Training and control over actions at increase or reduction of the allowed pressure.
- Regular check of working ability of preventive valves.

Medium-term:

- Installation of equipment to check internal lowered or increased pressure
- Installation of preventive valves or membranes
- To ensure safe discharge of a liquid leaking out from preventive valves (for example, towards **stand-by reservoirs**).

Determination of a real risk

Was the sub-point of recommendations implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

11 Flare system

❒ relevant ❒ not relevant→ 12

11.1 Are the pressure relief valves available for the following substances?

❒ Organic substances

❒ Hydrogen

❒ Hydrogen sulfide emission

❒ Gas emerging at starting and stopping of equipment

❒ Gas, emerging at emergency operation/troubles

❒ Yes→ 11.1.1 ❒ No → 12 ❒ Not applicable

❒ Action ❒ No action

11.1.1. Do these substances enter the process through the gas collecting system?

❒ Yes → 12 ❒ No → 11.1.2 ❒ Not applicable

❒ Action ❒ no action

11.1.2 Does this gas get burnt during burning?

❒ Yes → 12 ❒ No→ 11.1.3 ❒ Not applicable

❒ Action ❒ No action

11.1.3. If these gases cannot be used, are they processed with the flare system?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

❒ Gas

Gas, emerging

Examples of activities:

Short-term:

- Possibilities to use gas emerging at starting and stopping of equipment and at emergency operation/troubles.

Long-term:

- Use of the discharge gas or introduction of a flare system.

Determination of a real risk

Was the sub-point of recommendations implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=5	RC=10

12 Non-flammable lasting fittings

❒ Relevant ❒ Irrelevant→ 13

12.1 Is non-flammable lasting fitting available in the holes of equipment, which are opened inside?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:
Medium-term:
- *Installation of firm fittings, protecting against flame*

13 Cooling and heating installation

❒ relevant ❒ not relevant → 14

13.1 Are there cooling and heating installations, where water hazardous substances (including evaporation or condensation) are cooled or heated up?

❒ Yes → 13.2 ❒ No → 14 ❒ Not applicable

13.2 Is water used in this process (taking water from reservoirs or use of technical or potable water and their direct return to a water body or a treatment facility after cooling or heating process)?

❒ Yes→ 13.2.1 ❒ No → 14 ❒ Not applicable

13.2.1. Is water taken from water bodies, or technical, or potable and discharged to the treatment facility after the process of cooling or heating?

❒ Yes → 13.2.1.1 ❒ No → 13.2.2 ❒ Not applicable

13.2.1.1. Is the treatment facility suitable for elimination of casually dropped substances hazardous for water?

❒ Yes → 14 ❒ No → 13.2.2.1 ❒ Not applicable

❒ Action ❒ No action

13.2.2. Is water taken from water bodies, or technical, or potable and discharged to a water body after the process of cooling or heating?

❒ Yes→ 13.2.2.1 ❒ No→ 14 ❒ Not applicable

13.2.2.1. Which water hazardous substance is cooled or heated? (See the Checklist 1 „Substances“)

Water Hazardous Substances .....
WGK .....

13.2.2.2. Which of the following measures were taken?

❒ **D1** Cooling

❒ **D2** Cooling with a cooling water pressure, which enables to control significantly (cooling water pressure should fall below by hydraulic processes at any point in the cooler the during the process of pressure)

❒ **D3** Through cooling with radiator made of corrosion resistant materials and regular maintenance

❒ **Z** Caching with analytical control before discharge

❒ **E** Cooling on primary / secondary circuits

❒ **K** Circulatory cooling via cooling towers

❒ **L** Air cooler

❒ **S** Special cooling (e.g. heat pumps, absorption chillers, vapor compressors, heat transformers)

❒ **A1** Analytical or other appropriate monitoring of the cooling water

❒ **A2** Automatic analytical monitoring of the cooling water (see below)

❒ **U1** Immediate switching of the cooling water runoff to collection facilities or to a sewage treatment plant, where this is more suitable for the disposal of the substance discharged, or immediate switchover to standby or shutdown the facility's cooler part of production

❒ **U2** Automatic switching of the cooling water runoff to reception facilities or a wastewater treatment plant, where this is more suitable for the disposal of the outgoing material, or automatic switchover to standby or shutdown of the facility's cooler part of production

13.2.2.3. Were the suitable actions-combinations for WGK substances realized?

Available substance	Actions-combinations
❒ **WGK 1**	❒ D1 + A1 + U1
❒ **WGK 2**	❒ (D1 + A2 + U1) or (D2 + A1 + U1)
❒ **WGK 3**	❒ (D3 + A2 + U1) or (D2 + A2 + U2) or (Z) or (E) or (K) or (L) or (S)

❒ Yes → 13.2.2.4 ❒ No → 13.2.2.3.1 ❒ Not applicable

❒ Action ❒ No action

13.2.2.3.1. Were the actions-combinations implemented for the higher class, hazardous for water?

❒ Yes → 13.2.2.4 ❒ No → 13.2.2.3.2 ❒ Not applicable

❒ Action ❒ No action

13.2.2.3.2. Were the actions-combinations replaced by the equivalent plan?

❒ Yes → 13.2.2.3.3 ❒ No → 13.2.2.4 ❒ Not applicable

❒ Action ❒ No action

13.2.2.3.3. Was the equivalence proved?

❒ Yes ❒ No ❒ not applicable

❒ Action ❒ No action

13.2.2.4. Was the automatic analytical system (A2) introduced?

❒ Yes → 13.2.2.7 ❒ No → 14 ❒ Not applicable

13.2.2.5. Does the automatic analytical system have following features?

❒ Sufficient reliability of detecting leakage

❒ Sufficiently fast detection of leakage

Note: For this purpose, it is enough, if the analytical system will shows trends of development. Measurement of absolute degrees of concentration at such systems is not mandatory, but only - recognition of deviations from a normal condition.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

13.2.2.5.1. Is the measurement taken using sensors in the stream of cooling water?

❒ Yes→ 14 ❒ No→ 13.2.2.5.2 ❒ Not applicable

❒ Action ❒ No action

13.2.2.5.2. Is gauging done by means of automatic taking of samples continuously out of a stream of cooling water?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities:

Short-term

- Regular control of cooling/heating water.
- Development of instruction on exploitation, which should cover control and if necessary any activities for the case of water hazardous substance leakage into cooling / heating water.

Medium-term

- Development of plan on cooling and heating water for implementation of recommendations.

Long-term

- Implementation of recommendations.

Determination of a real risk

Was the sub-point of recommendations implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=30	RC=60

14 Transshipment

See also the Checklist 7 „Transshipment“

❒ Relevant ❒ Not relevant → the Checklist is finished

14.1 Is the transshipment done during work under pressure?

❒ Yes ❒ No→ 14.2 ❒ Not applicable

❒ Action ❒ No action

14.2.1. Is the plant equipped with the security system for transshipment with the fast shutoff valves to automatically stop flow of material being transshipped on the board and land, and disconnect wires before such connection of wires can be destroyed because of the ship drift.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.2 Is the transshipment done during pumping?

❒ Yes ❒ No → 14.3 ❒ Not applicable

❒ Action ❒ No action

14.3.1. Is it certain, that in case of breakage at the pumping line, the feeding/supplying device will not work idle by blowing?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.3 Is the plant located at the area of water body with no current or it is slow (bay, dock)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.4 Are the water tankers moored in such way, that their cross-section and longitudinal moving remains within admissible area of fluctuation of filling pipelines at expected fluctuation of a water level?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.5 Are the dry clutches able to close automatically applied during use of hollow cables (contact land - ship), which prevent leakage of liquid at disconnection?

❒ Yes ❒ No→ 14.6 ❒ not applicable

❒ Action ❒ No action

14.5.1. Are these automatic clutches checked regularly?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.6 Was the instruction on exploitation developed along with the action plan on inspection, maintenance service and the alarm signal?

❒ Yes ❒ No → 14.7 ❒ Not applicable

❒ Action ❒ No action

14.6.1. Is it written in this instruction, that only those personnel, who attended instructional training, can undertake the transshipment?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.6.2. Are these instructions on exploitation followed?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.7 Is it possible to exclude the illegal use of the plant?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.8 Do the instructed personnel control process of filling?

❒ Yes ❒ No → 14.9 ❒ Not applicable

❒ Action ❒ No action

14.8.1. Are the hosepipe and equipment visible enough, as well as hosepipe connection if needed?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.8.2. Is the continuous hose control installed at the ship and at the place of filling, if there will be no preventive valve for the overfilling?

❒ Yes ❒ No → 14.9 ❒ Not applicable

❒ Action ❒ No action

14.8.2.1. Does the controlling personnel use corresponding technical equipment, like as video observation devices?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.8.2.2 Is there available a permission from the side of authorized authority?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.8.2.3. Is it certain that by controlling a hose the tasks named above could be executed in the equal way?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.9 During the process of filling, it is possible to see enough the movable parts of the dispenser pipeline along its full length and in dark time of the day?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.10 Is it guaranteed that the allowed nominal pressure is never exceeded?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.11 Is it possible to collect/retain the poured leftovers, which is inevitable during disconnection of joints of pipes (for example, with the help of receiving bowls)?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.12 Is the bonding substance is readily available at the every plant engaged in transshipment, to remove an overfilling in case of an accident at the land area or in a water body, which has a high bonding capacity and will stay floating after sprinkling?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.12.1. Are there any devices available to do sprinkling and pumping afterwards?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.13 Is any suitable equipment readily available at the transshipment plants (for example, hydraulic shatters against leakage to prevent distribution of substances at the surface of water or to collect them?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

14.12.1. Above this, are there other devices to remove substances from the water surface?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Note:

Examples of activities

Short-term:

- Application of the Checklist – see the Checklist 7 „Transshipment" .
- Storage in advance of bonding agents.
- Development if instruction regarding the overfill process.
- Instruct activities for the process of transshipment.
- Protect industrial facilities from illegal use (for example, to prohibit remote control).

Medium-term

- Advanced storage of hydraulic lockers against leakage.

Long-term

- Advanced storage of devices to remove substances from water surface.

Determination of the real risk

Was the sub-point of the recommendation implemented?

Yes	Partly	No
❒	❒	❒
RC=1	RC=30	RC=60

Summary of the Checklist

Sub-point of Recommendation	Possible risk category	Risk Category RC
1	1 / 5 / 10	
2	1 / 5 / 10	
3	1 / 5 / 10	
4	1 / 5 / 10	
5	1 / 5 / 10	
6	1 / 70 / 140	
7	1 / 30 / 60	
8	1 / 70 / 140	
9	1 / 5 / 10	
10	1 / 5 / 10	
11	1 / 5 / 10	
12	1 / 5 / 10	
13	1 / 30 / 60	
14	1 / 30 / 60	

Average **R**isk of the **C**hecklist **(ARC)**