

DOKUMENTATIONEN

20/2015

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

Nº 12

Basic structure of safety reports concerning hazards to
water

DOKUMENTATIONEN 20/2015

Advisory Assistance Programme (AAP) of the
Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

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

Nº 12

**Basic structure of safety reports concerning hazards to
water**

by

Gerhard Winkelmann-Oei (idea and conception)
Federal Environment Agency, Dessau (Germany)

Jörg Platkowski
R+D Industrie Consult, Adelebsen (Germany)


International Commission for the Protection of the Danube River (ICPDR),
Vienna (Austria)

On behalf of the Federal Environment Agency (Germany)

Imprint

Publisher:

Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
info@umweltbundesamt.de
Internet: www.umweltbundesamt.de

 /umweltbundesamt.de

 /umweltbundesamt

Updated:

09/2014

Edited by:

III 2.3 Plant Safety
Gerhard Winkelmann-Oei

Publication as pdf:

<http://www.umweltbundesamt.de/publikationen/checklists-for-surveying-assessing-industrial-plant-11>

ISSN 2199-6571

Dessau-Roßlau, June 2015

This publication is financed by the German Federal Environment Ministry's Advisory Assistance Programme (AAP) for environmental protection in the countries of Central and Eastern Europe, the Caucasus and Central Asia and other countries neighbouring the European Union.

The responsibility for the content of this publication lies with the authors.

Recommendations of the International River Basin commission on the basic structure of safety reports concerning hazards to water

1. Brief characteristic of the vicinity of the company

The followings should be described from the aspect of their hazard to water:

- Surface water and groundwater in the area, conductors of surface water and groundwater;
- Traffic connections and waterways;
- Existing plants/facilities for the treatment/transporting of potable water or industrial water;
- Pipes and wastewater systems in the vicinity of the plant;
- Identified water preservation areas;
- Other special environmental conditions, e.g. old improperly disposed waste, refuse disposal sites.

2. Description of hazardous substances

The following details must be provided for substances hazardous to water:

- Existing substances hazardous to water (chemical name, trivial name, UN NO., CAS NO.), overview of the substances that could potentially be formed as a result of the reactions caused by accidents;
- Amounts and conditions of the existing/produced substances, particularly:
 - The amounts of substances handled in the plant/plant units that could be released at the simultaneously.
 - Pressure, temperature, concentration, state of aggregation;
- Material data of the existing substances, particularly:
 - general physical material properties of the substances such as the melting temperature, boiling point, vapor pressure, density, solubility,
 - Safety-related material data such as flammability, reactivity with water, decomposition temperature;
- Water Hazard Classes
 - Evaluation of acute toxicity with respect to any danger for human use of the respective water resources and the functionality of the aquatic eco-system;
 - Evaluation of long-term or late commencement of any danger for human use of the respective water resources and the functionality of the aquatic eco-system;
 - Details of the hydrolytic behavior and further reactivity of the substances with water under natural conditions;
 - Existing data on substances that may potentially be formed by reactions.

3. Description of the plant and processes

Descriptions of the technical purpose of the plant, its basic structure and design as well as the fundamentals of the engineering process are the basis for any evaluation of the environmental risk from the plant and processes. The following are to be explicitly noted from the aspect of their hazard to water:

- Processing conditions, as far as they are in direct connection to existing/produced water-polluting substances;
- Supply and disposal of substances to and from the plant (auxiliary materials, wastewater, residual substances, waste);
- Stipulation of safety-relevant plant units (with due consideration of the precautionary principle):
 - Plant units handling special material content,

- Protective and safety facilities,
- Other plant units relevant to operational safety;
- Description of safety-related plant units (with due consideration of the precautionary principle), in particular:
 - Design features, design of the safety-related plant units,
 - Presentation of the process, process conditions, physical or chemical conversions,
 - Functions and reliability of the safety-related facilities for gauging, controlling and regulating the process.

4. Identification and analysis of possible accidents and means of preventing them (hazard analysis)

The following are to be identified and analyzed from the aspect of their hazard to water:

- Examination of the safety management applied with respect to the handling, treatment, usage, storage, filling and transshipment of water-polluting substances, to ensure a high level of safety for both humans as well as the environment (organizational structure, areas of responsibility, behavior, methods, processes and means of, as well as the existing and/or planned monitoring systems);
- Systematic survey of the safety-related important plant units,
- Assumption of a scenario in which the largest possible amount of the active content of a plant unit is released within the plant vicinity, estimation of the possible damage to humans and the aquatic environment;
- Description of the soil layers and consideration of the possible spread of water-polluting substances in the ground;
- Working out of hypothetical accident scenarios:
 - The circulation as well as the spread of substances in surface waters and groundwater currents, with attention to the interactions with other plants and plant units as well as the domino effects;
 - Examination of the effects on the water path,
 - Determination of the interfaces of organizational measures for hazard control planning;
- Specification of priorities for the organizational and technical precautions and measures to be taken on the basis of the results of the hazard analysis.

5. Protective measures and emergency measures for preventing accidents and limiting damages

With regards to hazards water, precautions and measures should be stipulated to prevent accidental contamination or pollution:

- Identifying and avoiding the release of water-polluting substances into soil, surface and ground waters:
 - Wastewater system (plants for collecting, transporting and treating wastewater);
- Collecting and retaining systems in storage facilities, filling and transshipment of water-polluting substances on land and at sea:
 - Reporting and gauging systems (wastewater system, collecting and retaining system);
- Improving safety management and staff training/education:
 - Safety organization,
 - Development of updated internal emergency plans (alarm and preventive measures/safety plans);
- Fire and explosion prevention:

- Containment of fire-fighting water,
- Sanitary protection zone,
- Safety intervals;
- Protective facilities provided to counteract the effects of dangerous natural occurrences on plants handling water-polluting substances:
 - Protection against lightning,
 - High water,
 - Extreme weather conditions,
 - Earth-quakes;
- Incidents occurring in the vicinity and affecting the plants or plant units handling water-polluting substances.

6. Results

The results of the survey should establish that, there is no cause for concern in the event of an accident as far as hazards to water is concerned. In particular it is necessary:

- Evaluate the present safety level of the plant;
- Where applicable, identify remaining hazards, and
- Regarding these hazards to develop activities for implementation within the short, medium and long-term period of time.

Checklists for monitoring the implementation of the recommendations

SAFETY REPORT

The legal basis and the general contents of a safety report are contained in the directive 2003/105/EG of the European parliaments and council dated 16 December 2003 for reviewing the council's directive 96/82/EG on the control of major accident risks involving dangerous substances (amended Seveso-II-Directives of the EU).

To successfully undertake such comprehensive inspections it is necessary to apply this directive and exhaust all stipulations defined in the national laws and regulations on plant safety and protection of the rivers and seas of the member states.

Safety reports must be prepared for all sections of establishment that exceed the higher thresholds listed in annex I of the Seveso-II- directives. Sections of establishment includes all plants under the management of an operator, including all infrastructure and storages in an industrial site, where „dangerous substances“ are handled or can be produced in case of a failure in the normal operation of a chemical process.

The safety report is based on a comprehensive and systematic survey of all sections of a plant. A very important aspect is the "Identification and analysis of possible accidents and means of preventing them" (risk analysis; compare point 4 of the ICPR/ICPE recommendations). The risk Analysis requires the survey of the safety-relevant plant units in relation to the processes taking place in them.

The results of plant checks based on existing checklists can be used for this purpose. It is strictly stressed that **these checklists only examine the effects on the path taken by water after their disposal**. Therefore, these checklists are only used to check a section of the requirements on safety report.

0. Recording the inventory of substances (potential substances) handled in the company. The extended obligations according to article 9 of the Seveso II-directives must be fulfilled when the following thresholds are reached or exceeded using the addition rule.

Remark: Substances or group of substances on the list that appears in the rows with colored background are classified as being hazardous to water.

PART 1 Substances listed (Changed Directives Seveso-II 2003/105/EC)

Dangerous substances	Thresholds acc. to article 9 (t)	Existing thresholds (t)
Ammonium nitrate Fertilizer, which can decompose automatically on its own (see remark 1 of the amended Seveso-II- directives 2003/105/EC)	10.000	
Ammonium nitrate Quality of fertilizer (see remark 2 of the amended Seveso-II- directives)	5.000	
Ammonium nitrate Technical quality (see remark 3 of the amended Seveso-II- directives)	2.500	
Ammonium nitrate Material and fertilizer which are not according to the specification and did not pass the detonation test (see remark 4 of the amended Seveso-II- directives)	50	
Potassium nitrate Mixed fertilizer on the basis of potassium nitrate with potassium nitrate in granulate form (see remark 5 of the amended Seveso-II- directives)	10.000	
Potassium nitrate Mixed fertilizer on the basis of potassium nitrate with potassium nitrate in crystalline form (see remark 6 of the amended Seveso-II- directives)	5.000	
Arsenic pentoxide, Arsenic(V) acid and/or their salt	2	
Arsenic trioxide, Arsenious(III) acid and their salts	0,1	
Bromine	100	
Chlorine	25	
Nickel compounds in inhalable powder form (nickel monoxide, nickel dioxide, nickel sulphide, trinickel disulfide, dinickel trioxide)	1	
Ethyleneimine	20	
Fluorine	20	
Formaldehyde (concentration \geq 90 %)	50	

Dangerous substances	Thresholds acc. to article 9 (t)	Existing thresholds (t)		
Hydrogen	50			
Hydrogen chloride (liquefied gas)	250			
Lead alkyls	50			
liquefied extremely flammable gases (including LPG and natural gas)	200			
Acetylene	50			
Ethylene oxide	50			
Propylene oxide	50			
Methanol	5.000			
4,4'-Methylene-bis (2-chloroaniline) and/or salt in powder form	0,01			
Methylisocyanate	0,15			
Oxygen	2.000			
Toluylene di-isocyanate	100			
Carbonyl dichloride (Phosgene)	0,75			
Arsenic trihydride (Arsine)	1			
Phosphorous trihydride (Phosphine)	1			
Sulphur dichloride	1			
Sulphur trioxide	75			
Polychlorodibenzofurans and Polychlorodibenzodioxins (including TCDD), calculated as TCDD equivalents	0,001			
<p>The following carcinogenic substances with a concentration above 5 weight per cent:</p> <table border="1"> <tr> <td> 4-Aminobiphenyl and/or its salt, Benzotrithloride, Benzidine and/or its salt, Bis(chloromethyl)ether, Chloromethyl methylether, 1,2-Dibromoethane, Diethylsulphate, Dimethyl sulphate, Dimethylcarbamoyl chloride, </td> <td> 1,2-Dibromo-3-chloropropane, 1,2-Dimethylhydrazine, Dimethylnitrosamine, Hexamethylphosphoric triamid, Hydrazine, 2-Naphthylamine and/or its salt, 4-Nitrodiphenyl and 1,3-Propanesultone </td> </tr> </table>	4-Aminobiphenyl and/or its salt, Benzotrithloride, Benzidine and/or its salt, Bis(chloromethyl)ether, Chloromethyl methylether, 1,2-Dibromoethane, Diethylsulphate, Dimethyl sulphate, Dimethylcarbamoyl chloride,	1,2-Dibromo-3-chloropropane, 1,2-Dimethylhydrazine, Dimethylnitrosamine, Hexamethylphosphoric triamid, Hydrazine, 2-Naphthylamine and/or its salt, 4-Nitrodiphenyl and 1,3-Propanesultone	0,2	
4-Aminobiphenyl and/or its salt, Benzotrithloride, Benzidine and/or its salt, Bis(chloromethyl)ether, Chloromethyl methylether, 1,2-Dibromoethane, Diethylsulphate, Dimethyl sulphate, Dimethylcarbamoyl chloride,	1,2-Dibromo-3-chloropropane, 1,2-Dimethylhydrazine, Dimethylnitrosamine, Hexamethylphosphoric triamid, Hydrazine, 2-Naphthylamine and/or its salt, 4-Nitrodiphenyl and 1,3-Propanesultone			
Petroleum products: a. Gasoline and Naphtha, b. Kerosene (including aviation fuel), c. Gas oil (including diesel fuel, light fuel (heating) oil and gas oil mixture stream)	25.000			

PART 2 Categories of substances and preparations not listed in part 1

Dangerous substances		Thresholds acc. to article 9 (t)	Existing thresholds (t)
1.	Very toxic	20	
2.	Toxic	200	
3.	Oxidizing	200	
4.	Explosive If the substance, preparation or matter falls within the UN/ADR-risk sub-class 1.4	200	
5.	Explosive If the substance, preparation or matter falls within the UN/ADR- risk sub-classes 1.1, 1.2, 1.3, 1.5 or 1.6 or within the risk phrases R 2 or R 3	50	
6.	Flammable	50.000	
7 a.	Highly inflammable substances	200	
7 b.	Highly inflammable liquids	50.000	
8.	Extremely Highly inflammable	50	
9.	Dangerous for the environment (in connection with risk phrases):		
	R50: "very toxic for aquatic organisms" (including R 50/53)	200	
	R 51/53: "toxic for aquatic organisms; on a long-term it can have harmful effects on the seas and rivers"	500	
10.	Any other substances, not covered by categories mentioned above, in combination with mentioning risk phrases:		
	R14: "react violently with water" (including R14/15)	500	
	R29: "contact with water liberates toxic gas"	200	

Are the specified thresholds reached or exceeded and/or is the total sum ≥ 1 after applying the addition rule?

Addition rule: check the directive 2003/105/EG OF THE EUROPEAN PARLIAMENT AND COUNCIL dated 16. December 2003 about the amendment of directive 96/82/EG of the council for controlling major accident risks involving dangerous substances (amended Seveso-II- directives of the EU)

- Yes → Security advice is needed No → security advice is not needed
 Action No action

Remarks:

1. Does any safety report exist?

- Yes No → the list is finished Not applicable
 Action No action

1.1.1. Was the safety report subjected to a check by the competent authority, specialist or other experts?

- Yes No Not applicable
 Action No action

Remarks:

Example of measures:

Short-term:

- Prepare sections 1, 2 and 3 of the safety report according to the recommendations of the international committee for the river basin on structure of safety reports

Medium-term:

- Perform a risk analysis and document the results in compliance with Section of recommendations of River Basin Commissions for writing Safety report,
- Complete sections 5 and 6 of the safety report

Long-term:

- Reviewing and continual updating of the safety report whenever there are relevant changes

1.1.2. Are the substances listed in point 1 hazardous to water?

Remark: Substances or group of substances from the paragraph 1 of the Table with colored background are classified as being hazardous to water. Group of substances without colored background should be checked individually on their risk to water (compare with the [Checklist 1](#))

- Yes → 4 No → the list is finished There is no any data to this → 4
 Action No action

Remarks:

Example of measures:

Short-term:

- Prepare an overview of the substances with water hazard potential (see [Checklist 1](#)).

1.1.3. Selected prioritized questions on the content and quality of a safety report in respect to endangering of water!

1.1.4. Was a short characterization of the company given and the environment described?

The following should be described from the point of view of risk to water	Sufficient	Insufficient	Not available
Surface and ground water in the area, upper aqueduct and aquifer;			

Traffic connections and waterways			
Pipelines and wastewater system within the factory;			
Defined nature reserve and water protection area			
Other special environmental conditions, contaminated site, landfill. Available plants/facilities for treating /transportation of drinking or industrial water; other economical use of surrounding water resources			

Remarks:

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes <input type="checkbox"/>	Partially <input type="checkbox"/>	No <input type="checkbox"/>
RC=1	RC=5	RC=10

2. The following information should be made available for substances hazardous to water

The following information should be compiled for substances hazardous to water	Suffi- cient	In- sufficient	Not available
Substances hazardous to water present (chemical name, trivial name, UN-Nr., CAS-Nr.),			
Amount of substances and the condition of the substances present, especially			
➤ Amount of substances present in the plant/plant components, which can be released at the same time,			
➤ Pressure , temperature, concentration, physical state			
Water endangerment category of substances present			
Water Risk Index The water Risk Index (WRI) corresponds to the degree 6 of the base 10 equal to the value of WRC-3. That means e.g. a substance of 1000 ton of a substance (10 ⁶ Kg) classified as a WRC-3 substance correspond to a WRI equals to 6 (log 10 ⁶), a WRC-2 substance correspond to a WRI equals to 5 and a WRC-1 substance correspond to a WRI equals to 4.			

Remarks:

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes <input type="checkbox"/>	Partially <input type="checkbox"/>	No <input type="checkbox"/>
RC=1	RC=5	RC=10

3. Were the plant and the process described?

The following should be defined explicitly from water endangering point of view	Sufficient	Insufficient	Not available
Process conditions, as far as there is a direct connection with the available/generated substances hazardous to water;			
Material supply to the plant disposal of waste from the plant (auxiliary product, wastewater, residual material, waste);			
Defining significant plant components in regard to their technical safety (on the principle of “always being in a state of alarm”):			
➤ Plant components handling special substances,			
➤ Protection and safety devices,			
➤ Other plant components necessary for safe operation of the plant;			
Description of the safety relevant plant components (on the principle of “always being in a state of alarm”), especially:			
➤ Constructive characteristic features, designing the safety relevant plant components,			
➤ Description of process, process conditions, physical and chemical conversions,			
➤ Function and reliability of safety relevant devices for measuring, controlling, regulating.			

Remarks:

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes

RC=1

Partially

RC=5

No

RC=10

4. Were a systematic analysis of possible accidents conducted and the means of preventing them determined?

The following should be defined and analyzed from water endangering point of view	Sufficient	Insufficient	Not available
Examining the safety management in respect to operation, treatment, storage, filling and transshipment of substances hazardous to water, so as to guarantee a high level of protection of man and environment (organizational structure, areas of responsibility, methods procedure, processes and material as well as existing			

and/or foreseen monitoring systems);			
Systematic examination of significant plant components in respect of their technical safety,			
Assuming accidental scenarios whereby the highest possible harmful content of a plant component within a plant complex is released, Assessment of possible danger for man and aquatic environment;			
<ul style="list-style-type: none"> ➤ Discharge of substances as well as their spread in surface water bodies and groundwater streams in respect to the interactions with other plant and plant components as well as the domino effects, 			
<ul style="list-style-type: none"> ➤ Conducting a survey of the effects on water path, 			
<ul style="list-style-type: none"> ➤ Determine the interface between organizational measures and hazard prevention planning; 			
Define priorities for organizational and technical precautions and measures to be taken on the basis of the results of the risk analysis.			

Remarks:

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes <input type="checkbox"/> RC=1	Partially <input type="checkbox"/> RC=5	No <input type="checkbox"/> RC=10
---	---	---

5. Were the preventive and emergency measures for accident prevention and limitation of consequences of accidents described?

Precautions and measures for the prevention of accidental pollution of rivers and seas should be defined from water endangering point of view	Sufficient	Insufficient	Not available
Detecting and preventing the discharge of substances hazardous to water into the surface of water bodies, into the ground or into the groundwater:			
<ul style="list-style-type: none"> ➤ Wastewater system (facilities for collecting wastewater, transporting and treatment); see Checklist 6 „Split-flows wastewater“ 			
Description of the soil layer and assessing of possible spread of substances hazardous to water in the ground; see Checklist 5 „Sealing systems“			
Collecting and containing facilities for storage, filling and transshipment of substances hazardous to water on a site			

and on the sea: see Checklist 13 „Storage facilities“			
Fire prevention and prevention of explosion:			
➤ Containing of fire fighting water, see checklist 8 „Fire prevention strategy“			
➤ Protected area, see Checklist 13 „Storage facilities“			
➤ Safe distance; see Checklist 13 „Storage facilities“			
Safety devices against the effects of dangerous natural incidents on plants handling substances hazardous to water:			
➤ Lightning protection, see Checklist 13 „Storage facilities“			
➤ Flooding, see checklist 11 „Flooding“			
➤ extreme weather situations,			
➤ Earthquakes;			

Remarks:

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes <input type="checkbox"/>	Partially <input type="checkbox"/>	No <input type="checkbox"/>
RC=1	RC=5	RC=10

6. Which results were formulated in the safety report?

There should be no case of accident which can endanger water as a result of this check. The following should be checked in the safety report:	Sufficient	Insufficient	Not available
whether the existing technical safety level of the plant has been assessed according to west European standards;			
Whether the remaining dangers were mentioned and as a result short-, medium- and long-term precautions and measures to be realized were defined.			

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes <input type="checkbox"/>	Partially <input type="checkbox"/>	No <input type="checkbox"/>
RC=1	RC=5	RC=10

1.1.5. Which results were formulated after inspection by the competent authority, specialists or other experts?

Action
 No action

Short-term measure

Medium-term measure

Long-term measure

Remarks:

Summary of the Checklist

Sub-point of the Recommendation	Possible Risk category	Risk categories
1	1 / 5 / 10	
2	1 / 5 / 10	
3	1 / 5 / 10	
4	1 / 5 / 10	
5	1 / 5 / 10	
6	1 / 5 / 10	

Average Risk of the Checklist (ARC)