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MEETING OF THE SIGNATORIES TO THE CONVENTION ON THE TRANSBOUNDARY EFFECTS OF INDUSTRIAL ACCIDENTS

MEETING OF THE PARTIES TO THE CONVENTION ON THE PROTECTION AND USE OF TRANSBOUNDARY WATERCOURSES AND INTERNATIONAL LAKES

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RECOMMENDATIONS ON INDUSTRIAL ACCIDENTS PREVENTION AND INSTALLATION SAFETY

Discussion papers transmitted by
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for the Protection of the Elbe
and for the Protection of the Rhine against Pollution
(IKSE and IKSR) */

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International Commission on the Protection of the Rhine against Pollution (IKSR)

RECOMMENDATIONS

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Definition of substances hazardous to water for the purpose of the IKSR Recommendations on Industrial Accident Prevention and Installation Safety

1. Recommendation

The IKSR recommends the Rhine countries to replace the old "List of substances hazardous to water for the purpose of installation safety" with a generally valid definition. This will make it possible in future to classify new substances, or substances with as yet unknown hazard potential, as "hazardous to water for the purpose of installation safety" without the need for constant updating of existing lists to keep pace with advances in knowledge.

2. Definition of substances hazardous to water for the purpose of the IKSR Recommendations on Industrial Accident Prevention and Installation Safety

Substances hazardous to water for the purpose of the IKSR Recommendations on Industrial Accident Prevention and Installation Safety possess at least one of the following properties within the meaning of EC Directive 67/548/EEC:

- very toxic (T^+)
- toxic (T)
- corrosive (C)
- harmful to health (Xn)
- hazardous to the environment (N)

  or harmful to aquatic organisms (R 52)

  or may cause long-term adverse effects in the aquatic environment (R 53).

The IKSR proposes to the contracting parties that the IKSR Recommendations on Installation Safety and Industrial Accident Prevention be applied for preference to such substances.

Comparison and Conclusions regarding Authorisation Procedures for Installations of Industrial Accident Relevance

Authorisation procedures for installations of industrial accident relevance in the Rhine catchment area

The Conference of Ministers of the Rhine States in Bern on 8.12.1994 requested the IKSR to give its work a greater focus on the organisational aspects of industrial accident precautions and installation safety. In response to this assignment the working group on "Industrial Accident Precautions" investigated the authorisation procedures for installations of industrial accident relevance in the member states. It was found that while these procedures display differences with regard to form and substance, there are certain essential common features in their structure and sequence. These are:

- Written application for authorisation
- Application documents include the following:
  - a description of the project
  - plans and maps
  - information on the substances handled (quantity, hazardousness etc.)
  - the technical, organisational and personnel safety measures planned
  - a description and assessment of potential impacts on the public and the environment
- Coordinating body that is responsible for the conduct of the authorisation procedure
- Exhibition of application documents for inspection by the public
- Participation of sectoral authorities and central, regional and local authorities
- Written authorisation decision
- Right of appeal for public and applicant
- Duration of authorisation procedures is usually about 6 - 8 months

In all IKSR member states, authorisation procedures provide for close cooperation between the authorities, the applicants, and the public and associations affected. This ensures among other things that the aspect of industrial accident precautions is assessed from various angles.

If new safety-relevant information is received, subsequent orders are possible.

Plant-Specific Alarm and Hazard Prevention Planning

The International Commission for the Protection of the Elbe (IKSE) and the International Commission for the Protection of the Rhine against Pollution (IKSR) recommend their member states to urge the use of the following plant-specific alarm and hazard prevention planning measures in installations with substances hazardous to water. In addition to other technical and organisational safety measures, these measures are a basic precondition for avoiding accidental releases of substances hazardous to water and for minimising the impacts of potential industrial accidents on waters.

Plant-specific alarm and hazard prevention planning is one of the fundamental safety duties of the operator of an installation of industrial accident relevance. It includes a description of the nature and sequence of the planned organisational and technical measures following the identification of a hazard situation that is capable of causing an industrial accident or that exists as a result of an industrial accident that has already occurred.

When drawing up a plant-specific alarm and hazard prevention plan against the background of an accidental release of substances hazardous to water, the following points in particular should be taken into account:

1. The alarm plan must ensure that once a hazard situation has been registered a rapid hazard alert is made to the internal and/or external body permanently designated for receiving alerts.

2. The plant-specific alarm plan must contain instructions for action by persons or groups of persons specifically relating to individual installations and/or installation complexes that are intended to ensure the forwarding of all alerts in a hazard situation.

3. Depending on the scale of the expected impacts, different alert levels must be laid down in consultation with the authorities responsible for disaster control. To this end there is a need for coordinated, differentiated alarm procedures (e.g. Rhine warning and alarm system).

4. The installation operator must agree with the authorities as to who is responsible for what measures in the event of an industrial accident.

5. For the plant-specific alarm and hazard prevention plan it is necessary to lay down the manning, functions, responsibilities, accessibility, meeting points and tasks for specific squads of the emergency forces. In addition specific experts must be listed and alarm/ response times laid down.

6. Details must be laid down of how the water users affected by an industrial accident are to be warned and alarmed and how the public is to be informed.

7. The following items of general information are necessary for the plant-specific hazard prevention plan:
   - List of available emergency resources
   - Description of the waters in the vicinity of the installation and any special uses (e.g. drinking water protection area
   - Nature and quantity of the substances present in the fire cells of the installations and storage facilities, including safety data sheets and plant-internal substance information

8. For every location in the installation or parts thereof where there is reason to fear special dangers in the event of an accidental release of substances hazardous to water, the following information must be provided:
   - Fire brigade plans (special danger areas, permitted fire-fighting agents etc.)
   - Water supply (e.g. firefighting water, availability of cooling water)
   - Power supply (e.g. emergency power supply, no-load switches)
   - Drainage plans (e.g. shut-off devices, retention facilities and special hazard areas)
   - In-plant alarm and warning equipment
   - Emergency shut-down of hazardous installations (e.g. reactors).

9. The key hazards for hazard prevention planning must be defined in terms of the principal substances hazardous to water and the principal hazardous technical facilities. The crucial factors here are

   - Nature and quantity of potential hazardous substances, substance impacts, spreading behaviour of substances, ways and means of controlling damage, possible further consequences
   - Nature of installation

10. Description of the industrial accident scenarios and the corresponding consideration of the impacts for accidental release of substances hazardous to water into surface waters (in terms of space and time).

11. Description of measures to contain industrial accidents (e.g. firefighting water retention facilities, collecting tanks, firefighting systems) on the basis of the relevant industrial accident scenarios such as
    - Leakage
    - Overfilling
    - Total failure of receptacles, containers, pipelines or other parts of installation
    - Fire involving firefighting water
    - In-plant accidents during transport of hazardous goods.

12. At regular intervals exercises must be held to practise behaviour in the event of industrial accidents and the measures to be taken.

13. Plant-specific alarm and hazard prevention plans are to be updated at regular intervals.

14. Steps must be taken to ensure that the competent authorities and personnel are informed about the alarm and hazard prevention plans.

Installation Monitoring

The IKSR recommends the countries bordering the Rhine to implement adequate installation monitoring by compliance with the measures described below:

In particular, installation monitoring ensures that accidental releases of substances hazardous to water from installations cannot occur.

In installation monitoring, a distinction is made between monitoring by the operator on his own responsibility and monitoring by public authorities.

The principal task here is monitoring by the installation operator on his own responsibility. Monitoring by the authorities, by contrast, is concerned with checking the monitoring undertaken by the operator on his own responsibility.

Both the installation operator and the authorities may be assisted in their monitoring tasks by recognised independent experts.

Installation monitoring may possibly be supplemented by certified audit procedures with subsequent certification.

The following requirements are intended to ensure adequate installation monitoring:

1. The installation operator must define in-plant responsibilities for the taking and checking of safety measures.

   - The installation operator must guarantee the functional safety of the installation (this, for example, includes the waste water treatment plant)
   - The installation operator must ensure permanent monitoring of the freedom of the installation and its parts from leaks and the functioning of the safety equipment.
   - The installation operator must document in writing the regular checks undertaken on his own responsibility.

2. The installation operator must prepare for the competent authority a detailed report on the causes and consequences of an industrial accident. This must also state measures for avoiding any repetition.

3. The installation operator must without delay report any accidental release of substances hazardous to water to the competent authority or alert centre. Significant disturbances of normal operation must be documented and evaluated.

4. The operator should define the equipment for installation monitoring and the related instructions for action, especially with regard to accident precautions, on the basis of the state of safety technology and of experience. Account must be taken in particular of the water hazard potential, the basic ways in which substance releases can occur, the safety precautions, and the special protection requirements of the waters potentially affected.

5. Depending on the substance releases that can potentially occur under industrial accident scenarios, chemical (e.g. substance concentrations, pH values), physical (e.g. temperature, conductivity) and biological (e.g. bacteriotoxicity) parameters in particular are to be monitored.
   Any failure of measuring equipment of importance for installation monitoring must be identified immediately.

6. In-plant monitoring measures must primarily be used wherever there is a need to prevent releases of substances hazardous to water, so that timely detection enables counter-measures to be taken without delay.

7. Monitoring by authorities shall above all embrace:
   - checking on the monitoring performed by the operator on his own responsibility,
   - verifying the extent to which monitoring by independent experts is arranged by the operator and whether orders must be issued on the basis of the monitoring findings, and
   - spot checks by the authority or checks by authorised third parties in installations.

8. Monitoring by authorities may also be ensured by independent experts who, for example, check that especially important parts of the installation are in proper condition before commissioning and thereafter at regular intervals.

9. The equipment for monitoring waters should be equipped such that accidental discharges of substances hazardous to water can be detected on a regional and supraregional basis by means of measurements.

10. Monitoring activities by authorities and independent experts should be coordinated as to time and as regards the monitoring tasks.

8. Monitoring by authorities may also be ensured by independent experts who, for example, check that especially important parts of the installation are in proper condition before commissioning and thereafter at regular intervals.

9. The equipment for monitoring waters should be equipped such that accidental discharges of substances hazardous to water can be detected on a regional and supraregional basis by means of measurements.

10. Monitoring activities by authorities and independent experts should be coordinated as to time and as regards the monitoring tasks.

Wastewater Substreams

Wastewater substreams means continuous and discontinuous industrial wastewater (such as wastewater from production installations, ancillary installations and laboratories) and cooling water and rainwater.

These recommendations relate to the necessary technical and organisational measures for wastewater systems, which are intended to prevent wastewater substreams that have been accidentally contaminated with substances hazardous to water finding their way directly or indirectly into waters.

As a basic principle, care should be taken when designing wastewater systems to ensure that wastewater is avoided as far as possible by means of suitable technology (e.g. use of air cooling, water-free vacuum systems etc.), environmentally friendly production methods and alternative process management. Open cooling water systems should be avoided.

1. Accidentally contaminated wastewater substreams must be identified at an early stage by means of monitoring measures. The timing of the monitoring measures must be geared to the necessary control measures.

2. Accidentally contaminated wastewater substreams must be retained as close as possible to the source; if necessary it must be possible to segregate the wastewater drains.

3. Accidentally contaminated wastewater substreams should not be mixed with other wastewater.

4. Steps must be taken to ensure that substances which constitute a fire or explosion risk cannot find their way into the wastewater system, unless the system is protected against such dangers.

5. Suitable retention facilities of adequate size must exist for accidentally contaminated wastewater substreams. Such facilities must be free from leaks for the expected duration of the load.

6. Measures (e.g. holding ponds, recirculation of wastewater) must be in place to prevent contamination of waters in the event of an accidental reduction in the purification capacity of the treatment plant.

7. The wastewater systems must be leakproof and resistant with respect to the expected physical, chemical, thermal and biological loads.

8. The internal and external countermeasures and the information and reporting duties in hazard prevention planning must be defined for possible accidental contamination of wastewater substreams.

9. Safe disposal of accidentally contaminated wastewater substreams must be ensured.

10. The functioning of the technical and organisational measures taken must be verified by means of regular checks.

Pipeline Safety

Scope:

Pipelines within the meaning of these recommendations are installations for transporting substances hazardous to water within a plant site. Pipelines include not only the pipes, but also in particular the fittings, valves and flanges.

1. Pipelines must safely enclose substances hazardous to water.

2. Pipelines must be adequately dimensioned in accordance with the physico-chemical properties of the substances handled. Freedom from leaks must be demonstrated by means of generally recognised testing procedures.

3. Pipelines must withstand the mechanical, thermal, chemical and biological loads that occur depending on the purpose and must be resistant to ageing.

4. Movements and inclinations of the pipelines must not endanger their safety and freedom from leaks.

5. Pipelines must be protected to the necessary extent from mechanical damage, e.g. caused by colliding vehicles.

6. Verification of freedom from leaks and corrosion resistance should be subject to repeated checks by independent experts.

7. Proof is required that the rate of attrition within the verification intervals does not result in any inadmissible weakening of the pipelines and in particular that localised corrosion is ruled out.

8. Where the material of the pipelines is itself not sufficiently impermeable, suitable coatings are to be applied or equivalent safety measures taken.

9. Safety aspects must be taken into account in the layout of pipelines (underground/above-ground).

10. Special safety measures are to be taken for pipelines in which the substances transported cause electrostatic charges to build up.

11. In the case of underground pipelines, any detachable connections and valves are to be located in monitored leakproof inspection shafts. The technical construction of such pipelines should comply with one of the following requirements:

- they must be double-walled; any leaks in the pipeline walls must be indicated automatically by an approved leak indicator, or
- they must be designed as suction lines in which the liquid column is interrupted in the event of leaks, or must be fitted at regular intervals with precautions against the escape of the products transported, or
- they must be equipped with a suitable external sleeve or be laid in a conduit; any escaping substances must be visible in a monitoring device.

12. Design, assembly, inspection, maintenance of and alterations to the pipelines must be properly executed and documented.

13. Pipelines must be marked appropriately.

14. The position and layout of the pipelines must be documented.

Sealing Systems

Sealing systems are the leakproof and resistant parts of collecting troughs, chambers or areas which may come into contact with substances hazardous to water in the event of accidental leaks. Sealing systems are intended to prevent such substances hazardous to water from penetrating the collecting troughs, chambers or areas.

1. They must possess an appropriate degree of imperviousness having regard to the physico-chemical properties of the substances handled, and this must be verified by generally recognised testing procedures.

2. Where the material of the collecting troughs, chambers or areas is not itself sufficiently leakproof, suitable sealing methods such as a coating, laminates or plastic sheeting are to be used or equivalent safety measures are to be taken.

3. The installation of the sealing systems must be properly executed.

4. If the substances hazardous to water are flammable liquids, the sealing systems used in the collecting chambers must be of fire-resistant design.

5. In the event of an accident, freedom from leaks must be guaranteed for at least as long as is necessary to detect the loss. remove the substance and repair the leak.

6. Verification of freedom from leaks should be subject to regular checks by independent experts.

7. When handling substances whose behaviour in relation to the sealing system is not known. the surfaces potentially affected are to be inspected regularly for substance leaks and penetration. If this is not possible. additional safety measures are to be taken.

8. Penetration of pipelines and cables through sealing systems on floors and walls is basically to be avoided.

9. When assessing the collecting trough, chamber or area, the criteria shall also apply to the joints.

Aspects of Joint Storage

Joint storage is the case if substances:

a) are stored together in the same room. or

b) when stored in the open air, are stored without a solid and fireproof wall or without an adequate safety gap (magnitude 8 - 10 m), or

c) are stored in a common collecting chamber or in a divided tank.

1. Dangerous substances and preparations[1] must be kept in orderly storage appropriate to their properties.

2. Dangerous substances and preparations may not be stored together where there is a danger that hazardous situations could arise (toxic substance releases, explosions, fires or strongly exothermic reactions).

3. The following table shows which substance categories may never be stored together:

	E	F/F+	O	T/T+	Xn/Xi	C
E	+	-	-	-	-	-
F/F+	-	+	-	-	-	-
O	-	-	+	-	-	-
T/T+	-	-	-	+	+	-
Xi/Xn	-	-	-	+	+	-
C	-	-	-	-	-	+

Legend:

E	explosive	-	may not be stored together unless special safety measures have been taken
F/F+	highly flammable/extremely flammable		
O	oxidising		
T/T+	toxic/very toxic		
Xn/Xi	harmful to health/irritant	+	may usually be stored together
C	corrosive		

[1] within the meaning of EC Directive 67/548 EEC

4. When substances are stored together the safety measures must be geared to the most dangerous substance.

5. Large quantities of combustible material (pallets, packaging material etc.) which are by their nature conducive to the rapid development and spread of fires, should be stored separately unless special safety measures have been taken.

6. Autoigniting substances and substances that form toxic, flammable or combustible gases with water must not normally be stored together with other dangerous substances.

7. Pressurised gases, cryogenically liquefied gases, and fertilisers containing ammonium nitrate must not be stored together with toxic substances.

8. Corrosive substances in fragile containers, polychlorinated biphenyls and organic peroxides may not be stored in tanks with a single collecting chamber together with other combustible substances unless this is done in such a way that they cannot influence each other in the event of an accident.

Overfill Safety Systems

The IKSR resolves that the following requirements for the use of overfill safety systems are necessary when filling containers with substances hazardous to water:

Scope

Containers may not be filled with substances hazardous to water unless an overfill safety system is used.

Exceptions

Exceptions to the overfill safety systems requirement may only be made if it is ensured (in the individual case) that overfilling of the container is prevented by other means (e.g. manual filling with self-closing nozzle).

Technical requirements

The overfill safety system must, before the permitted filling level is reached, either cut off the filling operation automatically or sound an acoustic alarm. (The permitted filling level must be determined having regard to the additional amount delivered during the time required for cutting off the supply.)

Inspection

Serviceability of the system must be guaranteed at all times.

Fire Protection Strategy

The IKSR recommends the adoption of the following fire protection strategy:

Basic

The fire protection strategy is divided into individual measures that make the occurrence of a fire largely improbable, ensure early detection of a fire that has nevertheless occurred, combat it by suitable means, prevent it from spreading by constructional measures, and prevent consequential damage by collecting the firefighting agent.

The individual fire protection measures comprise:

- the constructional measures and facilities,
- the detection and notification of fires,
- the mobile and stationary firefighting equipment,
- the provision of suitable firefighting agents in adequate quantities,
- administrative measures such as storage facility rules, fire prevention plans, training of plant personnel,
- a well trained and equipped fire brigade that is familiar with the special aspects, e.g. a fire in a pesticide store, and
- the facilities and measures for containing contaminated firefighting water.

Individual descriptions are given of safety measures which prevent the escape, ignition and explosion or limit the escape of substances or which serve firefighting purposes.

1. Retention facilities

1.1. Collecting troughs for escaping dangerous substances

Collecting troughs for escaping dangerous substances must be adequately dimensioned and must be leakproof and resistant.

1.2. Firefighting water retention facilities

Firefighting water retention facilities must be leakproof and resistant. Their size should take account of the following parameters:

- Hazardousness of the substances stored (e.g. hazard to water, fire risk),
- Readiness of fire brigade,
- Fire protection infrastructure (fire detection system, fire extinguishing system),
- Area of storage facility section,
- Height of goods stored, storage density and storage quantity,
- Nature of storage facility (e.g. open-air, indoors).

If active delivery systems (e.g. pumps) are required to make the firefighting water flow into the available firefighting water retention facilities, such systems must comply with increased safety requirements.

2. Constructional fire protection measures

Noncombustible building materials should always be used. The structure should be divided into fire cells and zones separated by fire-resistant means.

3. Fire detection system

The fire detectors should be arranged so they detect a fire sufficiently quickly and reliably. Account must be taken of factors that can influence rapid fire detection, such as room height, subdivisions of the roof area (e.g. height of roof trusses), surrounding conditions, and all possible sources that can result in false alarms.

4. Firefighting water supply

Adequate supplies of firefighting water must be ensured.

Transhipment of Substances Hazardous to Water

Transhipment is the link between transport and storage. The recommendations relate to the necessary technical and organisational measures at the transhipment point that are intended to prevent substances hazardous to water from entering surface waters.

The "transhipment" sector covers the stationary parts used for loading/unloading from water, road or rail vehicles to land or vice versa (storage facilities and warehouses).

1. Transhipment sites must be resistant to the expected mechanical loads and be sufficiently leakproof and resistant to escaping liquids. In assessing the adequacy of imperviousness and resistance, account may also be taken of precautions/organisational measures.

2. In cases of transhipment by means of pipelines, there must be automatic safety systems in place that shut off the substance stream in the event of an accident and thereby prevent the escape of substances hazardous to water.

3. It must be possible to identify escaping substances hazardous to water.

4. Transhipment sites must have collecting facilities capable of accommodating the volumes of liquid that can escape until
   - suitable measures or
   - automatic safety systems

   take effect.

5. Contaminated rainwater, and firefighting water resulting from an accident, must not enter waters directly. It must be subjected to suitable treatment.

6. Transhipment sites must
   - be clearly marked;
   - be identified as a safety zone while transhipment is in progress.

7. Equipment suitable for immediate use must be kept ready at transhipment sites to prevent the spread of substances. Equipment for removing the substances is also necessary.

8. When loading and unloading inland waterway vessels, special care must be taken to observe the checklist under 151412 ADNR.

9. Transhipment of substances hazardous to water in the riparian zone of a waterway should be avoided, especially in the case of new installations.

10. The contracting parties should advocate that in cases of transhipment of dangerous goods the transhipment receptacles (e.g. containers) are clearly marked with corresponding danger symbols.

International Commission on the Protection of the Elbe (IKSE)

Recommendations on the Basic Structure of Safety Reports with regard to Hazards to Water

1. Introduction

Located within the catchment area of the Elbe are operations which handle, treat, use, store, fill or tranship dangerous substances. Industrial accidents in installations belonging to such operations can adversely affect the drinking water supplies of entire regions or contaminate biotopes on a large scale.
In order to assess the risk of major accidents and to define and prioritise installation-specific measures to prevent and limit them on a targeted basis, systematic and holistic analyses of the safety of installations are an effective method.

The solution to such comprehensive investigations is to apply the EU "Seveso" Directive[2] while making exhaustive use of all stipulations on installation safety and protection of waters which are made in the relevant laws and regulations of the country in question.
One of the concrete requirements addressed to the operator of dangerous installations to which this directive is applicable is the preparation of a safety report.

To ensure that such a safety report, which is to analyse the potential danger sources in a holistic and cross-media approach, also takes due account of the aspect of hazards to water, the International Commission for the Protection of the Elbe (IKSE) presents to enterprises and authorities the recommendations listed in Section 2, which should be integrated in the investigations.
This safety report is at the same time a method of making it possible to implement the precautions and measures contained in the "Catalogue of Measures for Avoiding Accidental Water Contamination in the Elbe Catchment Area" (IKSE 1995) and draw up new ones on a plant-specific basis.

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[2] Joint Council Opinion (EC) of 19 March 1996 (9743/6/95 REV 6) with regard to the issue of the Council Directive on the control of risks in cases of serious accidents with dangerous substances

The objective of the investigations is in line with the overall goal pursued by the "Seveso" Directive of finding and implementing methods "... which are necessary for an effective system for preventing major accidents with far-reaching impacts and for limiting the consequences of accidents."

A safety report of this kind gives the operator a summary account of his operation as a whole and of his installations from a safety point of view. The enterprise identifies safety weak spots even while preparing the report and gains information as to how production reliability can be improved. In this process the management of the enterprise develop an awareness of the fact that the reliability and serviceability of the installations exercises a direct influence on the profitability of the operation.

The information contained in the safety report puts the authorities in a position to order short, medium and long-term measures and precautions on a targeted basis to prevent major accidents, and in consultation with the enterprise to take joint precautions and measures to minimise the impacts of major accidents.

2. Structure of Investigation

2.1 Brief characterisation of operation and context

The following points are to be described from the point of view of hazards to water:

- Surface water and groundwater in the vicinity, surface watercourses and groundwater aquifers
- Transport connections and waterways
- Existing installations/facilities for the treatment/abstraction of drinking or process water
- Designated water conservation areas
- Other special neighbourhood conditions, e.g. contaminated sites, landfill sites.

2.2 Description of dangerous substances

The following details are to be compiled for substances hazardous to water:

- Existing substances hazardous to water (chemical name, trivial name, UN No., CAS No.), overview of substances capable of resulting from reactions in the event of an accident.
- Quantity and condition of the existing/resulting substances, especially:
  - Substance quantities existing in the installation or parts thereof which could be released together,
  - Pressure, temperature, concentration, aggregate condition.
- Data on existing substances, especially:
  - General physical substance data, such as melting and boiling temperature, vapour pressure, density, solubility.
  - Safety-relevant substance data, such as combustibility, reaction capacity with water, decomposition temperature.
- Water hazard classes and assessments of
  - Acute toxicity with regard to a hazard to human use of water resources and the functional capacity of the aquatic ecosystems,
  - Long-term or delayed danger for human use of water resources and the functional capacity of the aquatic ecosystems.
- Information on hydrolytic behaviour and on the further reaction capacity of the substances with water under natural conditions.
- Existing data on substances potentially resulting from reactions.

2.3 Description of installations and processes

Describing the technical purpose of the installation, the basic structure and design of the installation, and the basic features of the processes forms the basis for subsequent assessment of the hazards to the environment arising from the installations and processes. The following are to be listed explicitly from the point of view of hazards to water:

- Process conditions, where there is a direct connection with existing/resulting substances hazardous to water.
- Supply and disposal for the installation (operating supplies, wastewater, residues, waste).

- Definition of safety-relevant parts of installation (having regard to principle of concern).
  - Parts of installation containing special substances
  - Protective and safety equipment
  - Other parts of the installation necessary for operational safety.
- Description of safety-relevant parts of installation (having regard to the principle of concern). especially
  - Constructional features, design of safety-relevant parts of installation
  - Process description, process conditions, physical or chemical conversions
  - Function and reliability of the safety-relevant instrumentation and control equipment.

2.4 Determination and analysis of possible accidents and means of preventing them (risk analysis)

The following are to be determined and analysed from the point of view of hazards to water:

- Investigation of safety management with respect to the handling, treatment, use, storage, filling and transhipment of substances hazardous to water to ensure a high standard of safety for human beings and the environment (organisational structure, spheres of responsibility, methods, procedures, processes and resources and the existing or planned monitoring systems)
- Systematic investigation of the safety-relevant parts of the installation
- Creation of a scenario for the release of the greatest possible effective contents of a part of the installation within a section of the installation, estimate of the potential harm to human beings and the aquatic environment
- Description of the soil strata and consideration of potential spread of substances hazardous to water in the soil
- Drawing up hypothetical accident scenarios
  - Substance input into and spread in surface waters and groundwater currents having regard to the interactions with other installations and parts of installations and to domino effects
  - Considering the impacts via the water path
  - Determining the interfaces for organisational hazard prevention measures
- Defining priorities for organisational and technical precautions and measures to be taken on the basis of the findings of the risk analysis

2.5 Protection and emergency measures for accident prevention and minimising damage

Precautions and measures for preventing accidental contamination of waters are to be defined from the point of view of hazards to water (cf. also "Catalogue of measures for the prevention of accidental contamination of waters in the Elbe catchment area")

- Identifying and preventing the release of substances hazardous to water to surface waters, soil or the groundwater
  - Wastewater systems (installations for collecting, removing and treating wastewater)
  - Collecting and retention systems where substances hazardous to water are stored, filled and transhipped on land and water
  - Alarm and measuring equipment (wastewater system, collecting and retention system)
- Improving safety management and staff qualifications
  - Safety organisation
  - Preparing up-to-date internal emergency plans (alarm and hazard prevention plans)
- Fire and explosion protection
  - Retention of firefighting water
  - Protection zones
  - Safety distances
- Protective facilities against the impacts of dangerous natural events on installations with substances hazardous to water
  - Lightning protection
  - Flooding
  - Extreme weather situations
  - Earthquakes
- Events in the neighbourhood having an impact on the installations or parts of installations with substances hazardous to water

2.6 Results

As a result of the investigations there should not be reason to fear an accident constituting a hazard to water. In particular,

- the existing safety standard of the installation is to be assessed,
- any residual hazards are to be stated and
- precautions and measures to be implemented in the short, medium or long term in view of the residual hazards are to be defined.

3. Definitions

For the purpose of these recommendations the expression **"operation"** means the entire field subject to supervision by the operator in which dangerous substances are present in one or more installations, including joint or associated infrastructures and activities.

"Operator" means any natural or legal person who runs or owns the operation or the installation or, if so provided in individual national legislation, to whom the decisive economic powers of disposal have been entrusted with regard to technical operation.

"Dangerous substances (substances hazardous to water)" means the substance categories listed in Annex V to the "International Warning and Alarm Plan Elbe".

"Protection and safety equipment" means all facilities that are present in the installation for the purpose of minimising the consequences of major accidents.

"Safety management" means that part of overall management which embraces the organisational structure, planning activities, responsibilities, methods, procedures, processes and resources for developing, implementing, fulfilling, assessing and maintaining the operation's installation safety policy.

Annex to the Recommendations of the IKSE and IKSR

Recommendations for Requirements to be met by Installations in Flood Plains and Areas prone to other Flooding Incidents with regard to the Handling of Substances Hazardous to Water

1. Scope

The requirements shall be applicable to installations, parts of installations (including piping) and safety equipment that may be affected by flooding, regardless whether it is caused by flood events, backwater from natural sources or the sewer system, a rise in ground-water level caused by a persistently flooded area or firefighting water escaping from firefighting water retention facilities. The requirements shall be similarly applicable to planned and existing facilities.

2. Requirements

2.1 Underground storage facilities

2.1.1 Care must be taken to prevent any shifting of underground tanks and pipelines through the forces of buoyancy, e.g. by

- increasing height of soil cover
- covering with a concrete slab dimensioned to tank size

or

- anchoring the tank in a concrete slab by means of band-armoured steel supports.

Resistance of the completely submerged tanks against the forces of buoyancy must be demonstrated (with a minimum safety factor of 1.3 as compared with the buoyancy of the empty tanks)

2.1.2 Underground tanks and piping must safely withstand external pressure from water, i.e. relevant flood events or flooding incidents must be anticipated in the static design of the tanks. This must be demonstrated by means of a specific certificate from the manufacturer.

2.2 **Above-ground facilities in the open**

2.2.1 Drifting of tanks and parts of installations as well as mechanical damage caused by any drifting objects must be avoided.

2.2.2 Tanks and parts of installations must not impede the proper discharge of flood water.

2.2.3 Tanks must be located above the water level to be anticipated within the framework of a statistical recurrence interval of 'HQ_{100}'.*

2.2.4 Pipelines must be laid out so that they are located above the water level to be anticipated within the framework of a statistical recurrence interval of 'HQ_{100}'.

2.3 **Above-ground facilities in buildings and constructions**

2.3.1 Tanks must be placed so as to prevent any shifting caused by the forces of buoyancy. This can be achieved through, for example,

- anchoring in the floor, using band-armoured supports
- anchoring in the walls, using band-armoured stays
- use of steel struts to keep the tanks at a fixed distance from the ceiling of the storage facility.

2.3.2 Floor, walls and ceiling of the storage facility must be such as to safely withstand the forces of buoyancy. This must be assessed and confirmed by a statics specialist.

2.3.3 If tanks are placed in coated retention facilities anchoring on coated surfaces should be avoided if possible. In cases where this is not possible, care must be taken to ensure the surface is made impervious again in this zone.

2.3.4 If tanks are protected against any shifting due to buoyancy by anchoring them in the walls or by using steel struts to keep them at a fixed distance from the ceilig of the storage facility, care must be taken to exclude any tilting of the tanks.

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2.3.5 Resistance of the completely submerged tanks against the forces of buoyancy must be demonstrated (with a minimum safety factor of 1.3 as compared with the buoyancy of the empty tanks).

2.3.6 The tanks must safely withstand external pressure from flooding, i.e. relevant pressures must have been anticipated in the static design of the tanks. This must be demonstrated by means of a specific certificate from the manufacturer.

3. **Parts of installations**

3.1 Ventilation pipes must be placed so that the vent openings cannot be submerged. Care must be taken to ensure full-length firm anchoring and to design the vent pipes so that they cannot be damaged by external pressure from water nor through driftings. If the vent piping is to be extended it should be checked by a specialized firm whether the static design of the tank enables the tank to withstand internal overpressure resulting from overfilling. Where vent piping must be designed so that its outlets are above the admissible level (e.g. more than 3 m above the bottom of the tank in the case of 0.3 bar testing pressure) specific options are required (e.g. use of tanks designed for higher admissible testing or operating pressures). Any shut-off of ventilation pipes is not admissible.

3.2 Filling pipes - as far as they are prone to flooding - must be appropriately sealed. Sealing rings, gaskets etc. must only be removed during the filling operation.

3.3 Full-length firm anchoring must be provided for pipelines (filling, connecting and discharge pipes), and they must be designed so that they are damage-proof.

3.4 All openings of tanks and pipes, as far as they cannot be laid out so as to prevent any flooding, must resist to water.

- Convex (domed) lids must be provided with tight sealing rings by a specialized firm. Any re-tightening of screws is not sufficient where sealing rings have been placed inappropriately (e.g. if they are overlapping). Provision of tightly fitting sealing rings must be confirmed by a relevant certification from the manufacturer.

- Convex (domed) lids provided without any screws must be fixed so that they cannot be displaced by any water currents that may occur. In case of doubt, appropriate screws should be fitted.

- Indicating level meters in plastic casing directly fitted on the tank (float-type level gauges) can be assumed to be sufficiently tight. Such devices must be removed if there is a risk that the tank may be completely submerged. The connecting pipe must be closed by means of a tight screw-in stopper. As an alternative, a pneumatic volumeter may also be used.