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

Nº 9

Plant monitoring



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Advisory Assistance Programme (AAP) of the  
Federal Ministry for the  
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Building and Nuclear Safety

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

**Nº 9**

### **Plant monitoring**

by

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## Recommendations of the International River Basin commission for Plant monitoring

1. The plant operator must appoint responsible persons and define their terms of references within the plant operations to ensure decision making and control over safety measures:
  - The plant operator must guarantee the efficiency of the plant (this include for example, the wastewater treatment plant)
  - The plant operator must ensure a constant monitoring of the tightness of the plant and all other units and guarantee the efficiency of the safety equipments.
  - The plant operator is personally responsible for documenting in writing all regular checks that has taken place.
2. The plant operator must prepare a detailed report on the causes and consequences of an industrial accident to be submitted to the local authority. This must also state measures to prevent any repetition.
3. The plant operator must report any accidental release of substances hazardous to water to the local authority or a central office immediately. Significant failure in the normal operation of the plant must be documented and evaluated.
4. The operator should define the equipment for plant monitoring and the related instructions for action, especially with regard to the prevention of accidents on the basis of the state of safety technology and experiences. Especially the water hazard potential, the main possibilities of substance spillage, precautionary measures as well as the necessity to protect waters which will probably be affected should be considered.
5. Depending on the substance releases that could be released in the event of an industrial accident, 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 malfunction of a measuring equipment of importance for plant monitoring must be identified immediately.
6. Internal monitoring measures must primarily be used wherever there is a need to prevent releases of substances hazardous to water, to make timely detection possible for counter measures to be taken.
7. Monitoring by authorities includes:
  - Ensuring that plant operators live up to their responsibility in regard to plant monitoring,
  - verifying how often monitoring by independent experts is organised by the operator and whether other regulations would have to be specified as a result of the monitoring, and
  - Conducting in-house random checks or checks by external experts on the installations.
8. Monitoring by the local authority could also be conducted through independent experts who, for example, check certain important units of the plant before the start of operation and at regular intervals to establish that the units are in good condition.
9. The system for monitoring waters should be equipped in such a way that accidental discharges of substances hazardous to water can be detected by regional and supra regional measurements/checks.
10. Monitoring activities by the authorities and independent experts should be co-ordinated to determine monitoring time and tasks.



## Checklist for monitoring the implementation of the recommendations

### 1. Definition and control of safety measures

**1.1 Is it clear, who from personnel is responsible for setting up necessary safety measures regarding the plant monitoring?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**1.2 Is it clear, who from personnel is responsible for controlling over applied safety measures?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**1.3 Is the scope of regular inspections is documented in the program of inspections?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**1.4 Is there any time limit for undertaking those inspections?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**1.5 Are appropriate regular tests carried out to guarantee the efficiency of the plant (including the waste water treatment plant)?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No → 2    | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**1.6 Are the regular in-house tests which are carried out by the plant operator documented in writing?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

Remarks:

#### **Examples of actions:**

##### **Short-term measures:**

- Appoint an employee responsible for specifying the safety measures required for safe operation of the plant and for regular controls of those safety measures.
- Define the control program: check the efficiency of the plant daily (if necessary several times a day). Check for e.g.:
  - Unusual deviations of relevant operating parameters (pressure, temperature, concentration),
  - Unusual deviations from the admissible limits of the wastewater after treatment and before discharging into the surface waters or public sewage system,
  - Other deviations from the normal operating conditions (e.g. recognisable by unusual noises, external characteristics).

- Specify that the execution and the results of in-house tests carried out by the plant operator must be documented in writing.
- Specify a test schedule for regular in-house checks of the plant tightness.
- Specify a test schedule for regular in-house checks of the effectiveness of the safety devices.
- Specify time limit for the execution of controls.

Long-term measures:

- Continuously undertake control over status of integral units of the industrial plant involving corresponding diagnostic systems (This is related to rotating components such as engines, generators, pumps, ventilators).

### Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes

☐

RC=1

Partially

☐

RC=5

No

☐

RC=10

## 2. Reporting to the competent authorities

### 2.1. Do the plant operators prepare detailed report on the causes and effects of an accident or failure in the normal operation of the plant?

☐ Yes

☐ No → 3

☐ Not applicable

☐ Action

☐ No action

### 2.2. Do these reports include measures for preventing such accidents?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

Remarks:

### 2.3. Are these reports submitted to the competent authorities?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

### 2.4. Has it been established that the measures for preventing such accidents or failures in the normal operation of the plant are implemented?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

Remarks:

### Examples of actions:

#### Short-term measures:

The following must be documented in writing:

- The plant operator must write a report after an accident on the cause and the effects of the accident.

- The reports must contain information on measures to prevent similar accidents in the future.

### Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes

☐

RC=1

Partially

☐

RC=5

No

☐

RC=10

## 3. Reporting accidents and evaluation of operational breakdowns

See the appendix of Checklist 10 [„Checklists to be applied in case of interruption of normal plant operation and in case of emergency“](#)

### 3.1. Can the plant operator guarantee that the releases of water-polluting substances as a result of accidents are reported immediately to the competent authorities or the external hazard prevention authority?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

### 3.2. Are significant failures in the normal operation of the plant documented and evaluated?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

Remarks:

### Examples of actions:

#### Short-term measures:

- The following must be specified in writing:
  - The release of substances as a result of accidents must be reported to the competent authorities or the hazard prevention authority without delay.
  - Specify the authority or hazard prevention authority to be notified when substances are released in case of an accident mentioning name of contact person, telephone number, radio-telephone number and fax number.
  - To register and evaluate significant failures during normal functioning of the plant along with development of activities for their prevention.

### Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes

☐

RC=1

Partially

☐

RC=5

No

☐

RC=10

## 4. Specifications for plant monitoring in relation to safety precautions

Specify the technical devices in the plant which are in place for the prevention of accidents or for the limitation of the accidents impact. When specifying these devices, the present state of the art regarding safety technology and the experience of the plant operator must be taken into account.

### 4.1 Are the equipments for preventing accidents or failures in the normal operation of the plant as well as limiting the effects of an accident specified?



- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**4.2 Are there available any devices for limitation of impact caused by failures/accidents?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**4.3 During installation were the following aspects considered for the paragraphs 4.1 and/or 4.2?**

- |   |                              |                             |   |
|---|------------------------------|-----------------------------|---|
| a) Water-polluting potential  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not applicable |
| b) Fundamental possibilities<br>of substances being released        | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not applicable |
| c) Other available protective measures                              | <input type="checkbox"/> yes | <input type="checkbox"/> No | <input type="checkbox"/> Not applicable |
| d) The need to protect waters that could eventually<br>be affected. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not applicable |

Precisely, what sort of equipments?

Other checklists should be taken into consideration.

Remarks:

***Examples of actions:***

***Short-term measures:***

- Register all the technical devices for preventing accidents or limiting the effects of accidents in the plant monitoring documentation, e.g.:
  - Devices to prevent overfilling,
  - Probes to detect leaks in secondary containment or pits,
  - Safety devices to prevent excess pressure or temperature,
  - Flame protection for tanks containing liquids with a flash point below 55°C,
  - Stationary and semi-stationary fire protection devices (foam extinguishing devices, sprinkler equipment),
  - Secondary containments and retention systems,
  - Emergency stop systems,
  - Water quality monitoring systems before wastewater is discharged into surface water or the public sewage system.

***Medium-term measures:***

- Regular check of the plant monitoring documentation to make sure that the list of safety equipment is up to date.

**Determination of the real risk**

Is the sub-point of the recommendation implemented?

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

## 5. Monitoring of chemical and biological parameters

### 5.1 Are possible release of substances detected on the basis of accident scenarios

- Chemical parameters (e.g. concentrations, pH-value),

☐ Yes

☐ No

☐ Not applicable

- Physical parameters (e.g. temperature, conductivity)

☐ Yes

☐ No

☐ Not applicable

- Biological parameters (e.g. bacterial toxicity)

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

### 5.2 Can the failure of most important measuring devices for plant monitoring be detected immediately?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

Remarks:

#### Examples of actions:

##### Short-term measures:

- Identify and investigate possible accident scenarios and therewith the possible release of substances in case of an accident.
- Identify and specify the main parameters which must be monitored in case of accidental release of substances.
- Specify the locations where the parameters should be monitored.
- Specify the required monitoring technology.
- If possible, procure the measuring technology required to monitor the specified parameters (choose such devices whose failure can be detected automatically).
- Identify most important monitoring devices for preventing accidents or limiting the effects of accidents and whose failure can be detected automatically.

##### Medium-term measures:

- Procure the measuring technology required to monitor the specified parameters.
- Ensure automatic detection of the failure of relevant monitoring devices for preventing accidents at the plant or limiting the effects of accidents.

#### Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes

☐

RC=1

Partially

☐

RC=5

No

☐

RC=10

## 6. In-house monitoring measures

### 6.1 Are the in-house monitoring measures concentrated at such plant units where the release of substances hazardous to water is highly possible?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

**6.2 Are devices available for immediate detection of substance releases?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**6.3 Is there a catalogue containing all countermeasures for different accidental release scenarios? (See also [Checklist 10](#))**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

Remarks:

***Examples of actions:***

Short-term measures:

- Name devices and plant units for preventing the release of water-polluting substances
- Specify the in-house monitoring measures for devices and plant units that serve the purpose of preventing the release of water-polluting substances , e.g.:
  - Visual check of plant components for leakages (e.g. flange connections, pump seals, external state of pipelines and vessels),
  - Visual check of secondary containments and sealed surfaces,
  - checking the effectiveness of safety equipment, e.g. overfill safety device (Observe the operating instructions of the manufacturer).
- Implement monitoring measures and document the tests carried out and their results. Specify necessary measures.

Medium-term measures:

- Procure testing equipment for implementing the monitoring measures (e.g. to check the effectiveness of overfill safety device, devices for gauging the wall thickness).
- Regular check of the test schedule to make sure it covers all in-house monitoring measures.

**Determination of the real risk**

Is the sub-point of the recommendation implemented?

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

## 7. Monitoring conducted by authority

**7.1 Is the plant being monitored by competent authority?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No → 8    | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

**7.2 Has the monitoring local authority the right to establish whether the plant operator conducts regular checks of the plant and document the results?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

- 7.3 Does the scope of monitoring by the local authority include checking whether the plant operators appoint suitable experts to perform the checks on the plant?**
- ☐ Yes
                         
 ☐ No → 7.5
                         
 ☐ Not applicable  
☐ Action
                         
 ☐ No action
- 
- 7.4 Has any directives been given by the local authority due to the result of the monitoring conducted by external experts?**
- ☐ Yes
                         
 ☐ No
                         
 ☐ Not applicable  
☐ Action
                         
 ☐ No action
- 
- 7.5 Do the authorities carry out or appoint external experts to carry out random checks on the plant?**
- ☐ Yes
                         
 ☐ No
                         
 ☐ Not applicable  
☐ Action
                         
 ☐ No action

Remarks:

**Examples of actions:**

Short-term measures:

- Reach agreement with the local authority on how the monitoring measures should be conducted, e.g.:
  - Test schedule for the plant operator,
  - Test schedule for external experts appointed by the plant operator, (if available)
  - Test schedule (random checks) for the surveillance bodies,
  - Tests undertaken on the basis of the decree of surveillance bodies to control constructions (e.g. external experts if available).
- Specify time limit for conducting checks by:
  - The plant operator,
  - The external experts,
  - The local authority.
- Implement the specified monitoring measures.

**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
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## 8. Monitoring by independent expert

- 8.1 Are additional checks of very relevant plant components carried out by independent experts in addition to the monitoring conducted by the local authorities, e.g.:**
- Before commissioning?**
- ☐ Yes
                         
 ☐ No
                         
 ☐ Not applicable

**- Regular checks?**

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

Remarks:

**Examples of actions:**

**Short-term measures:**

- Ascertain if there are independent experts to conduct checks on very important components of the plant.
- Specify a test schedule for the checks conducted by independent experts:
  - conduct checks before commissioning of newly installed equipment,
  - Regular and recurrent checks of existing plant.
- Appoint independent experts to perform the test (if independent experts are available).

**Medium-term measures:**

- Appoint independent experts to perform the test (if independent experts are available).

**Determination of the real risk**

Is the sub-point of the recommendation implemented?

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

## 9. Devices for monitoring water quality

**9.1 Are water quality monitoring devices available to detect accidental release of water-polluting substances into the waters by testing on regional and sub-regional basis?**

Regionally      ☐      yes                                      Sub-regionally      ☐      yes

- |                                 |                                    |   |
|---------------------------------|------------------------------------|---|
| <input type="checkbox"/> Yes    | <input type="checkbox"/> No        | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Action | <input type="checkbox"/> No action |   |

Remarks:

**Examples of actions:**

**Short-term measures:**

- The authorities responsible for regional monitoring of the aquatic environment must identify or specify the substances or their properties which could be released into the waters as a result of accidents.
- The relevant authorities should reach a supra-regional agreement on the substances or their properties which could be released into the waters as a result of accidents and which must be detected by monitoring devices.
- The local authorities should reach a supra-regional agreement on exchange of information and the necessary alarming systems and hazard prevention measures.

- Prepare regional emergency plans with description of the monitoring systems, the information systems, information paths as well as the planned hazard prevention measures.
- Prepare supra-regional and if necessary trans-boundary emergency plans with a description of the monitoring systems, the information systems and information paths as well as the planned hazard prevention measures (transboundary accident communication).

Medium-term measures:

- Develop a regional automatic monitoring system for detecting accidentally released water-polluting substances.
- Develop a supra-regional automatic monitoring system for detecting accidentally released water-polluting substances.

**Determination of the real risk**

Is the sub-point of the recommendation implemented?

Yes

☐

RC=1

Partially

☐

RC=5

No

☐

RC=10

## 10. Monitoring authority and experts

### 10.1 Are the activities of certain authorities and experts co-ordinated by scope and time?

☐ Yes

☐ No

☐ Not applicable

☐ Action

☐ No action

Remarks:

**Examples of actions (for suggestions, see also point 7):**

Short-term measures:

- Reach agreement with the local authority on how the monitoring measures should be conducted.
- Specify the scope of the monitoring in a monitoring plan:
  - The scope of monitoring by the authority,
  - The scope of monitoring by the experts
- Specify the time limit for conducting the monitoring measures.

**Determination of the real risk**

Is the sub-point of the recommendation implemented?

Yes

☐

RC=1

Partially

☐

RC=5

No

☐

RC=10

## Summery 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	
7	1 / 5 / 10	
8	1 / 5 / 10	
9	1 / 5 / 10	
10	1 / 5 / 10	

**Average Risk of the Checklist ( ARC )**