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

№ 8

Fire prevention strategy

For our Environment

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Fire prevention strategy

by

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Recommendations of the International River Basin commission on fire prevention strategy

The fire protection concept can be divided into individual measures, which significantly prevent occurrence of fire and also timely detect fire outbreaks to combat it with suitable fire fighting appliances.

The individual fire protection measures consist of:

- constructional measures and facilities,
- detection and notification of fires,
- mobile and stationary fire fighting equipment,
- provision of suitable fire fighting agents in adequate quantities,
- administrative measures such as regulations for storage facility, 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 storage, and
- facilities and measures for containing contaminated fire fighting water.

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

1 Containment facilities

1.1 Collecting basins for spilled dangerous substances must be adequately dimensioned and must be tight and resistant to the substances.

1.2 Fire fighting water retention facilities must be tight and resistant to the fire fighting water. In regard to their size, the following parameters should be considered:

- - Hazardousness of the substances stored (e.g. hazard to water, flammability),
- - Readiness of fire brigade,
- - Fire protection infrastructure (fire detection system, fire extinguishing system),
- - Total area of storage section,
- - Height of goods stored, how dense the goods were stacked in the storage and stored quantity,
- - Nature of storage facility (e.g. open-air, indoors).

If active delivery systems (e.g. pumps) are required to make the fire fighting water flow into the available fire fighting water containment facilities, such systems must comply with high safety requirements.

2. Non-combustible building materials should always be used. The building should be divided into fire cells and zones separated by fire-resistant materials.

3. The fire detectors should be installed in a way as to guarantee instant detection of fire and must be reliable. Account must be taken of factors that can influence rapid fire detection, such as the height of the room, subdivisions of the roof area (e.g. height of roof trusses), condition of the environment and all possible sources that can result in false alarms.

4. Adequate supplies of fire-fighting water must be ensured.

Checklist to monitor recommendations implementation

1. Fire Prevention Strategy

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

❒ Yes→ 1.2 ❒ No ❒ Not applicable

❒ Action ❒ No action

1.2. Are the type and design of the fire preventive facilities stipulated in cooperation with the authorities in charge of fire prevention?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.3. Are the fire preventive facilities always operational at all times? Especially the calculated amount of water required for fire fighting and cooling measures must be guaranteed.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.4. Was the required amount of water calculated for fire fighting and cooling measures?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.5. Was the required amount of water provided for fire fighting and cooling measures?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

a) Tank / plant components

❒ Yes ❒ No ❒ Not applicable

b) Pipeline

❒ Yes ❒ No ❒ Not applicable

c) Containing facilities

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.7. Have the necessary measures been taken to prevent a fire outbreak from the neighbourhood from spreading into the plant? (or)

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.8. Have the necessary measures been taken to prevent a fire outbreak from the plant itself?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.9. Are the fire preventive facilities taken according to the type and amount of combustible liquids being handled?
Are the following points taken especially into consideration?

❒ Not applicable

❒ Local and operational conditions	❒ Yes	❒ No
❒ Amount of combustible liquids	❒ Yes	❒ No
❒ The degree of danger	❒ yes	❒ No

❒ Action ❒ No action

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

❒ Stationary fire preventive facilities	❒ yes	❒ No
❒ Mobile fire preventive facilities	❒ yes	❒ No
❒ Semi mobile fire preventive facilities (identical semi-mobile fire preventive facilities are mobile fire extinguishing vehicles, which in regard to the rate of fire extinguishing agent and their storage as well as the alarm concept and response time – fully correspond to the norms of fire safety and informing in the case of fire)	❒ yes	❒ No

1.12. Which fire-extinguishing agents are used?

❒ Carbonic acid→ 1.12.1
❒ Extinguishing powder→ 1.12.1
❒ Water→ 1.13
❒ Air foam→ 1.13

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.13. Are mobile sprinkling systems used?

❒ Yes→ 1.13.1 ❒ No→ 1.14 ❒ Not applicable

❒ Action ❒ No action

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

❒ Not applicable

- The neighbouring plants or plant components next to the burning plant must be in a position to be cooled the required quantity of water irrespective of which direction the wind and the smoke from the fire is blowing. ❒ Yes ❒ No
- Connections to the water network (fire hydrants) meant for fire extinguish purpose must be sufficiently available and installed in such a way that they remain easily accessible from all direction in case of fire outbreak and also for cooling of neighbouring plants and plant components. ❒ Yes ❒ No
- The facilities needed for cooling and the professional personnel needed for their operation must always be ready during to guarantee an effective cooling of the plants within the shortest time after the fire outbreak. ❒ Yes ❒ No

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.14. Are trips or operating panels available in sufficient quantity?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.16. Are the following administrative measures realised? ❒ **Not applicable**

- regulations for storage facility ❒ yes ❒ no
- fire prevention plans ❒ yes ❒ no
- training of plant personnel ❒ yes ❒ no

❒ action ❒ no action

1.17. Is the responsible fire brigade familiar with the details of the possible emergency place?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.18. Does the identified fire brigade have enough personnel to fight the fire on the emergency place?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.19. Does the identified fire brigade have enough technical capabilities to fight the fire on the emergency place?

❒ Yes ❒ No ❒ Not applicable

❒ Action

Remark:

Examples of measures:

Short term:

- Regular inspection to detect leakages and leaks and possible igniting sources
- Prohibition of smoking and using of naked fire and hot objects.
- Training and instructing the personnel on fire-fighting measures and how to respond in case of fire outbreaks.
- Identify and distinguish area of the plant with an increase risk of fire and install "No smoking" and "Naked flames are forbidden" signs where appropriate.
- Additional check and if necessary upgrade the fire fighting equipment for combating fresh fire outbreaks.
- Make sure that sufficient fire-fighting water is available and specify measures for improvement if necessary.
- Check the present methods of alarming the fire brigade and verify the response time of the fire brigade. Further measures should be specified depending on the results of this check.

Medium term:

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

Long term:

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

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes	Partially	No
❒	❒	❒
RC=1	RC=5	RC=10

2. Containment facilities

2.1. Are the collecting basins for containing discharged dangerous substances available?

❒ Yes ❒ No ❒ Not applicable

2.2. Are the collecting basins for containing discharged dangerous substances large enough?

❒ Yes ❒ No ❒ Not applicable

2.3. Are the existing collecting basins properly sealed and are they durable enough for the substances which may be discharged?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Remarks:

Examples of actions:

Short-term measures:

- Construct temporary containment devices, e.g. by building earth walls, creating other types of artificial barrier to limit the spread of substances which are released and to provide temporary covering for floor surfaces (e.g. clay or clayey earth, covering the floor surfaces with foil).
- Make sure that existing collecting basins and containment devices are large enough.
- Repair damages on and correct deficient portion of the existing collecting basins and containment devices (e.g. at the joints).
- Carry out regular checks using internal and external specialists or experts.
- Demonstrate the durability towards the substances which may be discharged and/or the fire extinguishing agents.

Medium-term measures:

- Overhaul or refurbish seriously damaged collecting basins.

Long-term measures:

- Install collecting basins and secondary containments which are large enough if hazardous water-polluting substances could be released, e.g. as a result of leakage, overfilling or other incidents.
- The tightness and resistance of the sealed surfaces of secondary containment must be guaranteed (for requirement on the tightness see Checklist Nr. 5 „Sealing systems“, recommendation 1/ paragraph 1).
- The sealed surfaces must be durable enough to withstand the released dangerous substances until their disposal. This period of time must be determined in conjunction with the hazard prevention planning specialists.

2.4. Are containment facilities available for extinguishing agents and are they large enough?

See also “Manual of actions”, section 3

❒ Yes ❒ No → 3 ❒ Not applicable

❒ Action ❒ No action

2.5. Parameters of the containment facilities for the extinguishing agents

V_P = volume for inflammable liquids .....m³

(The estimation corresponds to the Checklist 13 „Storage" Paragraph 4)

W_L = Amount of water of the fire fighting agent is multiplied on valuations coefficients FG, FL und FF .....m³

W_B = Amount of water from spraying (cooling) .....m³

During mixing with the fire fighting agent W_L

Is multiplied on the estimating coefficients FG, FL and FF

V_{Sch} = The amount of fire fighting foam at assumed 50 % decay of the foam .....m³

P = drain inflammable liquid Towards adjoining containers or other vessels .....m³

E = Derivative water for fire fighting - is a water .....m³
from the foam or non polluted water taken for fire fighting, differentiated separately from goods in storage, towards to the other holdbacks for the fire fighting means

Reference:
The estimated coefficient for the quantity of pallets FG (FG of 0.8-1.1).
The estimated coefficient for species extinction FL / Fire Systems (FL from 1.1 for mobile fire fighting to 0.8 for a fixed automatic fire systems, including automatic notification of a fire).
Evaluative factor FF for fire fighting by the fire brigade (FF equal to 1.0 for the fire brigade at the enterprises, and 1.1 for general fire brigade)

The amount of holding water for fire suppression is calculated as follows:
VG = Vp + WL + WB + VSch - P - E .....m³

Dimensions of existing structures to keep .....m³

2.5.1. Is enough the volume of dimensions of existing structures to keep?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

2.6. Are the following options taken into account in determining sizes holdback devices to be used as means for extinguishing?

❒ not applicable

- The danger of stored substances (e.g. hazardous for water, the propensity to spontaneous combustion); Operational readiness of the fire fighting team and for example convenient driveways ❒ Yes ❒ No
- Fire fighting and technical infrastructure (fire alarm systems, fixed fire extinguishing systems, water supply for fire ❒ Yes ❒ No
- The use of alternative means of extinguishing as for example foam for fire ❒ Yes ❒ No
- Square of the storage ❒ Yes ❒ No
- The height of stored material, packing density, the number of stored ❒ Yes ❒ No

- Type of the storage (e.g. Outside of the building, Inside the building) ❒ Yes ❒ No

❒ Action ❒ No action

2.7. Are the containment facilities for extinguishing agents sufficiently sealed and durable?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Remarks:

2.8. Is the extinguishing agent transported to the containment facilities by pumps?

❒ Yes→ 2.9 ❒ No→ 3 ❒ Not applicable

❒ Action ❒ No action

2.9. Are additional technical measures taken to guarantee the efficiency of the pumps?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Remarks:

Examples of actions:

Short-term measures:

- Prove the durability of the containment facilities towards contaminated extinguishing agents.
- Prove by calculation that the facilities for containing extinguishing agents are large enough (work in cooperation with fire-fighting specialists and/or the fire brigade).
- Repair all damaged joints and cracks. Arrange regular checks by internal specialists.
- Close open joints using materials that are readily available (e.g. asphalt, bitumen).
- Regularly test the efficiency of the pumps for re-circulating extinguishing agents and document the results of the test.

Medium-term measures:

- Use appropriate jointing materials. Ensure that the joints are properly sealed.
- Renovate existing facilities for containing extinguishing agents in regard to their tightness and/or size.

Long-term measures:

- Install suitable containment facilities for extinguishing agents of enough size following border conditions, related to plant, e.g. the type of fire extinguishing agent used, the fire-fighting strategy of the fire brigade.
- The tightness and durability of the sealed surfaces of containment facilities for extinguishing agents must be guaranteed (see also Checklist No. 5 „Sealing systems“, recommendation 1, paragraph 1).
- The sealed surfaces must be durable enough to withstand extinguishing agents which may be contaminated with hazardous substances until their disposal.
- Provide monitoring devices for the power requirements and the speed of the pumps for the re-circulation of extinguishing agents.

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes	Partially	No
❒	❒	❒
RC=1	RC=25	RC=50

3. Constructional fire protection measures (building materials)

3.1. Are the construction facilities are made of non-combustible materials?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

3.2. Are the buildings sub-divided into fire segments and sections separated by fireproof partitions?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Remarks:

Examples of actions:

Short-term measures:

- Training and instructing the personnel on fire-fighting measures and how to respond in case of fires.
- Identify and distinguish area of the plant with a high risk of fire and install "No smoking" and "Naked flames are forbidden" signs where appropriate.
- Check and if necessary upgrade the fire fighting equipment for combating fresh fire outbreaks, e.g.:
  - Appropriate hand fire extinguishers,
  - Hoses for extinguishing agents.
- Additional check whether sufficient extinguishing agent is available and specify measures for improvement.
- Additional check of possibilities to announce alarm for the fire fighting brigade and verify the response time of the fire brigade. Further measures should be specified depending on the results of this check.

Medium-term measures:

- Measures to improve the supply of extinguishing agents, e.g. increasing the flow rate of existing hydrants, installing additional fire-fighting hydrants.
- Take steps to improve the alarming of the fire brigade by installing additional telephones or manually triggered fire alarm device.
- Specify measures to reduce the time needed before the combating takes off in cooperation with the fire brigade.
- Provide additional measures to protect structural components or limit the effects of fires by installing fire-proofed protective walls or claddings.

Long-term measures:

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

Determination of the real risk
Is the sub-point of the recommendation implemented?

Yes	Partially	No
❒	❒	❒
RC=1	RC=5	RC=10

4. Fire detection system

4.1. Are there automatically fire alarming systems?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

4.2. Are the automatic fire alarm equipment installed in such a way as to ensure a quick and reliable detection of fire outbreaks.

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

4.3. Are important factors which can influence the fire alarm device taken into consideration?

These factors include for example:

- The height of the rooms, ❒ Not applicable
- Subdivision of the area of the roof e.g. with roof trusses, ❒ Yes ❒ No
- Environmental conditions which can hinder fire detection by restricting the area being monitored by the fire alarm devices ❒ Yes ❒ No
- Sources of false alarms, e.g. high humidity, unfamiliar gases when using smoke detector. ❒ Yes ❒ No

❒ Action ❒ No action

Remarks:

Examples of actions:
Short-term measures:
- Change the position of the fire alarm devices.
- Avoid false alarms by improving the environmental conditions or reduce the sources of disturbance.
- Avoid false alarms by using fire alarm devices based on another measuring principle.
- Improve fire detection by upgrading the fire alarm system and installing additional detectors.

Medium-term measures:
- Upgrade the fire alarm system by installing additional fire detectors.
- Eliminate the source of disturbance which can lead to false alarms.
- Improve fire detection by upgrading the fire alarm system and installing additional detectors.

Determination of the real risk
Is the sub-point of the recommendation implemented?

Yes	Partially	No
❒	❒	❒
RC=1	RC=5	RC=10

5. Supply of Fire fighting water

5.1. Can the supply of sufficient fire-fighting water be guaranteed?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Remarks:

Examples of actions:

Short-term measures:

- Check and demonstrate the effectiveness of the fire fighting water supply and each fire fighting hydrants.
- Find out to know if the existing supply of fire-fighting water is sufficient in collaboration with the local fire brigade.
- Make required changes and improvements on the existing supply of fire-fighting water in collaboration with the local fire brigade.

Medium-term / long-term measures:

- Implement the specified measures.

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes ❒ RC=1 No ❒ RC=10

Summary of the Checklist

Sub-point of the Recommendation	Possible Risk category	Risk categories
1	1 / 5 / 10	
2	1 / 25 / 50	
3	1 / 5 / 10	
4	1 / 5 / 10	
5	1 / 10	

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