C h e c k l i s t s

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

Federal Environmental Agency
Federal Republic of Germany

No. 8
Fire Prevention Strategy

Recommendations of the International River Basin commission on fire prevention strategy

The fire protection concept can be divided into individual measures, which make the occurrence of fire almost impossible, but also detect fire outbreaks in time to be able 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
- The 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. Constructional fire protection measures

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

3. Fire detection system

   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. Fire-fighting water supply

   Adequate supplies of fire-fighting water must be ensured.

Checklist for monitoring the implementation of the recommendations

0 Fire Prevention Strategy

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

0.1.1 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

0.2 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

0.3 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

0.4 Are suitable measures put in place to prevent fire outbreak from the neighbourhood from spreading into the plant or a fire outbreak from the plant itself?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

- ❒ Local and operational conditions
- ❒ Amount of combustible liquids
- ❒ The degree of danger

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

- ❒ Stationary fire preventive facilities
- ❒ Mobile fire preventive facilities
- ❒ Semi mobile fire preventive facilities (semi mobile fire extinguishing facilities are equal to mobile fire extinguishing vehicles and/or equipments which in regard to the rate of fire extinguishing agent and their storage as well as the alarm concept and response time equal to a semi mobile fire extinguishing facility)

0.7 Which fire-extinguishing agents are used?

- ❒ Air foam
- ❒ Carbonic acid
- ❒ Extinguishing powder
- ❒ Water

0.7.1 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

0.8 Are mobile sprinkling systems used?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

0.9 Are trips or operating panels (locations) available in sufficient quantity?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

0.10 Are the following administrative measures realised?

- ❒ regulations for storage facility
- ❒ fire prevention plans
- ❒ training of plant personnel

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

0.12 Is the responsible fire brigade from the staffing as well as technical prospective able to fight the fire on the emergency place?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No 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 response 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.
- 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

1 Containment facilities

1.1 Are there collecting basins for containing dangerous substances which are discharged and are they large enough?

❒ Yes ❒ No ❒ Not applicable

1.2 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 where required, 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 and/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.*

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

See also Manual of actions section 3

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.4 Were the following parameters taken into consideration when determining the size of the containment facilities for the extinguishing agents?

- How dangerous the stored substances are (e.g. water-polluting, risk of fire),
- availability of the fire brigade and e.g. taking short routes,
- technical fire-fighting infrastructure (fire alarm equipment, stationary fire extinguishing equipment, supply of fire-fighting water, use of alternative extinguishing agents such as foam),
- the floor of the storage sections,
- storage height of the substances, compactness and quantity of stored substances
- Type of storage (e.g. outdoors, within a building).

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

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

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

Remarks:

1.6 Is the extinguishing agent transported to the containment facilities with the aid of pumps?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

1.7 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).*

- *Test the efficiency of the pumps for re-circulating extinguishing agents and document the results of the test in writing.*

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 taking the following into account: plant-related factors, 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

2 Constructional fire protection measures (building materials)

2.1 Are the structureal buildings constructed with non-combustible materials?

❒ Yes ❒ No ❒ Not applicable

❒ Action ❒ No action

2.2 Are the buildings sub-divided into fire segments and/or 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, install hand fire extinguishers?*
  - *Hoses for extinguishing agents.*
- *Make sure that sufficient extinguishing agent 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 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

3 Fire detection system

3.1 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

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

These factors include for example:
- the height of the rooms,
- subdivision of the area of ,the roof e.g. with roof trusses,
- environmental conditions which can hinder fire detection by restricting the area being monitored by the fire alarm devices,
- Sources of false alarms, e.g. high humidity, unfamiliar gases when using smoke detector.

❒ Yes ❒ No ❒ Not applicable

❒ 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

4 Supply of Fire fighting water

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

Summery of the Checklist

Sub-point of the Recommendation	Possible Risk category	Risk categories
0	1 / 5 / 10	
1	1 / 25 / 50	
2	1 / 5 / 10	
3	1 / 5 / 10	
4	1 / 10	

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