

Treatment and storage of waste and combustible secondary raw materials

CFPA-E Guideline No 32:2014 F





FOREWORD

The European fire protection associations have decided to produce common guidelines in order to achieve similar interpretation in European countries and to give examples of acceptable solutions, concepts and models. The Confederation of Fire Protection Associations in Europe (CFPA E) has the aim to facilitate and support fire protection work in European countries.

The market imposes new demands for quality and safety. Today, fire protection forms an integral part of a modern strategy for survival and competitiveness.

This guideline is primarily intended for those responsible for safety in companies and organisations. It is also addressed to the rescue services, consultants, safety companies etc. so that, in course of their work, they may be able to help companies and organisations to increase the levels of fire safety.

The proposals within this guideline have been produced by VdS Schadenverhütung and the author is Hardy Rusch from Germany.

This Guideline has been compiled by Guidelines Commission and adopted by all fire protection associations in the Confederation of Fire Protection Associations Europe.

These guidelines reflect best practice developed by the countries of CFPA Europe. Where the guidelines and national requirement conflict, national requirements must apply.

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1 Introduction

These specifications substantiate the fire protection requirements and measures to be considered for recycling plants and mechanical-biological waste treatment plants from a general point of view and they are based on state-of-the-art fire protection expertise. They include specifications that help reduce fire hazards and their effects¹.

Basically, these specifications apply to plants to be established in consideration of the specific fire protection requirements. Existing plants should adjust their fire protection measures to these specifications as much as possible. It is advisable to involve the insurer in the planning of new buildings and reconstruction.

This document is based on the GDV-publication "VdS 2517", available at VdS publishing (www.vds.de).

2 Scope

These specifications apply to plants in which combustible waste products and mixed waste are sorted, processed and stored.

They also apply to plants for mechanical-biological waste treatment in which waste products of high fuel value are sorted out for energetic recycling and for the organic fraction to be stabilised by rotting and fermentation.

They also refer to the storage of combustible bulk materials in mono or mix fractions or in a compact form, and also to biogas and deposit storage.

Moreover, this recommendation applies when combustible waste products of more than 200 m³ in total in a compact form or in the form of bulk material are stored in fixed or mobile containers in warehouses and outdoors or in the line of production. Even for material quantities up to 200 m³ appropriate fire protection measures are required.

These specifications do not apply to the transport and intermediate storage in public places (e.g. car parks, railway tracks).

3 Definitions

Combustible waste products may consist of: plastics, paper, wood or textiles.

The **sorting** includes the separation of waste products from other materials, the separation of different waste products, their sorting as regards size and form and the baling process.

Domestic and industrial wastes contain very different fire loads, depending on their composition. Residual waste from municipal waste may consist of e.g. 50% fine product for processing by means of fermentation and rotting, 35% heavy product, 9% plastics, 4% metal and 2% paper. It can be shredded and sorted in mechanical-biological waste treatment plants into different fractions. Industrial waste usually contains much higher fractions of combustible waste products.

Refuse derived fuel (RDF) is usually extracted from waste of high fuel value which may originate from households, industry and trade.

A **mix fraction** is a fraction of unequal material composition or form (e.g. foils, hollows).

¹ This guideline is based on the GDV-publication "Sortierung, Aufbereitung und Lagerung von Siedlungsabfällen und brennbaren Sekundärrohstoffen; Hinweise für den Brandschutz"(VdS 2517), available at VdS publishing (www.vds.de)



The **treatment** includes the comminution, fractioning (sieving, inspection, metal deposition), cleaning, drying, grinding, melting, granulation and commissioning, depending on the materials and process technology.

Mechanical-biological waste treatment plants comprise different plant sections assembled individually according to requirements. Apart from mechanical comminution and sorting, there are systems for drying of RDF fraction, fermenter for anaerobic fermentation of biological waste, composting plants and landfill sites. Along with waste incineration plants, mechanical-biological waste treatment plants are a means of pre-treating municipal waste in accordance with the waste storage ordinance.

The so-called **rotting (composting)** is a procedure for aerobic decomposition of organic material. Different to fermentation, wooden waste (lignin) can also be used in this procedure. Different procedures are applied in the rotting process; mainly box composting, rotting tunnels and rotting halls.

The **biogas fermenter** is designed for anaerobic fermentation of the organic fraction (fine product) contained in the waste. The biogas generated during decomposition of the organic substance contains methane, is combustible and can be used for energy generation. In some plants the fully fermented substrate is mixed with untreated organic material and then goes into composting.

By means of **combined heat and power plants (CHP)** the biogas is converted into heat and electrical energy. The CHP comprises a drive motor and a generator. Drive motors are usually diesel pilot injection motors or gas motors.

Regenerative thermal oxidizers (RTO) are used for the treatment of process exhaust air, e.g. from mechanical-biological waste treatment plants.

The **line of production** includes the entire processing in one factory or on one company's premises. This also includes provision, short-term depositing and in-house conveying.

Storage is the keeping for later use or for hand-over to others, unless taking place within 24 hours or on the following weekday.

A **warehouse** is a building, an area or a room in a building or an outdoor area with or without roofing that is intended for the storage of materials. The term outdoor storage also applies to storage under a hood which is fully open on two sides facing each other.

The **storage height** is the distance between floor and upper edge of top storage unit.

A **fire compartment in buildings** is limited by fire break walls.

A **fire compartment out of doors** is limited by spaces without combustible materials or by walls constructed like fire break walls.

Intervention time is the time between detection of a loss incident and the beginning of the fire fighting by the fire brigade.



4 Fire protection concept

Effective fire protection can only be achieved by means of a comprehensive concept attuned to the company in question.

A comprehensive fire protection concept comprises measures of

- preventive fire protection consisting of structural, technical and organisational measures for the prevention of fires and the prevention of fire and smoke spread, and
- fire defence including fire fighting and averting of danger for life and property.

Often certain measures of structural fire protection as stipulated by the federal building codes – such as fire break walls at a prescribed distance – cannot be realised due to operation, technical or economic reasons. Moreover, the capacity of the fire brigade is often limited in terms of manning level, equipment, distance and transport connection between company and next fire station.

Thus, technical and organisational fire protection measures, such as the installation of automatic fire extinguishing systems and the introduction of fire safety regulations, are required to prevent fires in the scope of a fire protection concept. These measures are taken to complete structural fire protection and fire defence and to ensure fire protection even in case of high fire loads.

High fire loads

- promote fast fire spread,
- complicate fire defence,

and often they increase the fire loss considerably or even lead to total loss.

Note: For the number of escape doors and escape distances national requirements apply.

5 Protection against common fire causes

Loss experience shows that fires are either caused by the process itself (e.g. engine trouble, self-ignition, introduced ignition sources) or typically by arson, smoking, hot works, and defects of electrical devices and systems.

5.1 Protection against arson

Arson is one of the most common causes for loss. The danger of arson can be reduced by taking into account any potential threats and the appropriate reactions in advance. Thus, plant security should be part of the company safety concept.

100% protection against arson is not possible.

A good working atmosphere and motivation of the staff as well as a positive perspective for the economic success of the company have an influence on the arson risk. Moreover, various measures can help lower the risk of arson.

The staff shall be selected carefully. Thoughtful behaviour in case of in-house conflicts is recommended.



The premises shall be accessed by authorised persons only. Unauthorised persons shall be banned from entering the premises. A sign "Off limits to unauthorised personnel" shall be put up.

It is recommended to accompany visitors and any other persons not working for the company during their visit.

The premises shall be secured against unauthorised access. For this purpose, industrial fences with anti-climb protection and a height of 2,5 m have proved of value and are recommended.

Access points should be monitored permanently during operating hours. In general, accessible doors, windows, skylights, shafts and similar apertures of buildings should be protected against violent intrusion. An improved risk situation can be achieved by installing an intruder alarm system.

At night, the premises shall be illuminated sufficiently.

It is recommended to have the premises monitored during non-operating times, either by a security firm or by a sufficient number of own personnel. At regular intervals, indoor and outdoor patrols with time clock control should be carried out. For an early detection of initial fires indoor patrols are necessary at 2-hour intervals at the most.

For outdoor monitoring, a video surveillance system connected to a permanently manned location would be an alternative.

Alarm pursuit on the premises by e.g. the security firm should be regulated. A recommended alternative for indoor patrols for an early detection of fires is a fire detection and fire alarm system connected to a permanently manned location which can immediately alert a provider of assistance.

To impede arson from the boundaries of the premises, there shall be a 10 m flue between an outdoor storage and any accessible boundaries, or else an appropriate protective wall made of non-combustible materials shall be built.

Combustible materials shall not be stored at exterior building walls; the minimum distance should be 10 m. Depending on the risk conditions (e.g. construction and materials of the façade, type and storage of combustible materials), greater distances may also be necessary. This should be agreed with the insurer in the individual case. This applies analogously to vehicles parked during non-operating times.

5.2 Smoking ban

In the premises, both indoors and outdoors, a mandatory smoking ban shall be issued. The smoking ban shall be indicated distinctly and visibly by prohibition signs, especially at all access points.

A smoking ban is complied with only when it is consequently supervised and disciplinary action is taken in case of transgressions. The staff shall be instructed on the subject of fire risks due to smouldering cigarette stubs thrown away carelessly. Every member of staff shall confirm in writing that he/she has been instructed accordingly and that transgressions may lead to disciplinary action.

Smoking areas should be established to prevent surreptitious smoking. Smoking areas should be authorised by the management. They shall be clearly identified.



5.3 Hot works

For welding, burn cut, cut-off grinding and other works with open flames (e.g. roof repair works) or sparks a written procedure for authorisation of hot works shall be mandatory. Permission for hot works shall specify the conditions and safety precautions for hot works with reference to specific fire outbreak and fire spread risks on site.

This permission procedure applies to the company's own staff and to external personnel.

Note: See also CFPA-E No 12:2012 F "Fire safety basics for hot works operatives"

5.4 Equipment

Electrical equipment, e.g. drives, fans, conveyors, shall be installed and operated in accordance with established electrical engineering standards.

Chargers for electromotive ground conveyors should be accommodated in a room with at least fire-retarding separation of in minimum 90 minutes and sufficient ventilation.

If chargers cannot be accommodated centrally or if there is only one device per building, each charger shall be kept free of combustible materials within a radius of 2,5 m around and above. This area shall be identified permanently and well visibly by colour markings or barriers. Chargers shall not be placed on combustible supports and not in or close to racks.

As a matter of principle, the operation of electrical equipment such as coffee machines, refrigerators, radios, heaters, microwaves, immersion heaters etc. from private households shall be prohibited.

Such equipment, where necessary, should be provided by the company. Where possible, it is advisable to provide equipment designed for commercial use.

6 Structural fire protection

6.1 Basic legal requirements

Installation and operation of structural works and changes of use shall be authorised by the building authorities, especially as regards fire protection.

Structural fire protection shall be planned in accordance with local and operative conditions, especially regarding quantity and type of materials on site, by agreement with the authorities responsible for fire protection (e.g. regulating authority) and, if required, with the fire insurer.

The requirements for escape routes within the building including emergency exit and their location, number, permissible length, fire protection separation are specified in the provisions in accordance with the building, health and safety regulations are.



6.2 Fire compartments

6.2.1 Buildings

To prevent an immediate fire spread, operational buildings e.g. delivery, sorting, processing/drying and storage buildings shall be separate complexes or at least fire compartments. Fire compartmentation may either involve fire break walls or distances between buildings of at least 5 m.

The size of a fire compartment shall not exceed the specifications of the respective building authorities.

Moreover, it is recommended to operate the waste air purification (RTO systems) in a fire compartment with spatial and structural separation.

Where possible, the drying system in the processing unit should have a fire resistant separation.

Fire break walls shall meet the requirements of the respective building authorities. Required openings in fire break walls, e.g. gates or conveyor openings or ventilation ducts shall have fire resistant closures to prevent an early failure of the fire break walls. These fire resisting closures shall have a building authority approval or a general building authority certificate. Fire resisting closures can be held open for operational reasons by means of a hold-open system with general building authority approval; this hold-open system automatically closes the closures in case of a fire. At the end of work these closures shall be closed in any case. The closing area should be labelled and/or have floor markings or barriers.

Within the fire compartments, other operating zones with special fire risk shall be separated by fire resistant walls and ceilings with at least fire resistant closures. Such areas may be e.g. electrical operating rooms, technical operating rooms, central hydraulic systems, compressed air supply systems (compressor stations), heating systems, workshops.

Switch/control rooms shall have fire resistant separation, especially if they control also fire protection systems, e.g. foam/water cannons, fire detection, smoke control system. These central control rooms should be located as near as possible to exterior walls (e. g. < 15 m), the access through a fire resistant corridor is necessary for the fire brigade during a fire.

In individual cases it is recommended to agree the measures with the fire protection consultant of the insurer.

Note: See Annex A, Table Fire resistant separation for operating/control rooms within a fire compartment or complex

The installation of automatic fire extinguishing systems is recommended with a view to operational self-interest and business risk. A comprehensive fire protection concept may include the necessity of installing a fixed automatic fire extinguishing system both from a building law point of view and from an insurance point of view (see also section 7).



6.2.2 Outdoor storage

Outdoor storage also includes roofed warehouses which are fully open on at least two sides facing each other, with goods stored up to 2,5 m underneath the ceiling. For maximum storage heights see section 11.2.

Outdoor storage should be divided into fire compartments by non-roofed 20 m wide spaces without combustible materials or by fire break walls.

If the fire compartment size exceeds 1600 m², additional fire protection measures will be required.

As a matter of principle, the maximum permitted fire compartment size for outdoor bulk and bale storage is 2000 m². The fire compartments shall be divided into storage areas of max. 400 m² size to ensure well-directed fire fighting.

With automatic fire extinguishing equipment, other fire compartment sizes or sizes of spaces without combustible materials may be appropriate depending on the local risk conditions.

In individual cases it is recommended to agree measures with the fire protection consultant of the insurer.

Outdoor storage (fire compartment or block storage) should have the following max. width to ensure firefighting operations by the fire brigade:

- 40 m with both longitudinal sides of the storage area being freely accessible for firefighting purposes;
- 20 m with only one longitudinal side of the storage area being freely accessible for firefighting purposes.

Fire break walls for dividing storage areas should be at least 50 cm above the maximum storage height for roofed outdoor storage, 80 cm for high fire loads with roofing, and at least 1 m for storage without roof.

Moreover, these walls should exceed the storage depth on the open sides by at least 0,5 m.

6.3 Materials and components

Requirements for components should at least meet the requirements for fire retardant components.

If the use of combustible materials cannot be avoided, it is recommended from a fire protection point of view to use at least materials with low flammability.

Roof constructions that do not promote large-scale fire spread should be preferred. Those with e.g. non-combustible insulation have proved their worth. Roof sealing should preferably consist of cold-bonded or mechanically fastened strips. Roofing hot works represent an increased fire risk. For bituminous roof seals bonded with open flame or liquid bitumen see section 5.3.



6.4 Lightning and overvoltage protection

Lightning protection measures are required especially with the following:

- structural works considerably projecting above the environment;
- structural works located in areas with high lightning stroke frequency, showing distinct potential stroke points according to the so-called ball procedure.

Basic precondition for effective lightning protection is consequent potential equalisation which is also meshed inside the buildings. Potential equalisation shall include e.g.

- earth conductors of the electrical system;
- earthing system;
- deflections of the overvoltage protection equipment of power supply and information networks;
- shieldings of lines and cables;
- metal building constructions, pipes and ducts, and
- external lightning protection system.

It is necessary to make sure that

- lightning and earth conductors are not damaged or interrupted;
- lightning and earth conductors are installed with the required safety distance to all cables and lines of the power supply and information networks;
- there are no direct connections of conductible parts to the lightning protection system if there is a danger of thus conducting partial lightning currents into the building;
- any lightning protection potential equalisation and overvoltage measures are effective.

After finishing the system, the installer shall confirm in writing to the client that he has installed the system in accordance with the applicable lightning protection guidelines. He shall also submit specifications with an appropriate drawing. Correctly installed lightning protection systems are almost maintenance-free and, according to experience, can fulfil their purpose over several decades in standard environmental conditions.

After structural modifications or damage by storm, snow, violence etc. the lightning protection system shall be completed or repaired immediately by an expert.

The intervals of revision inspections depend on various factors, e.g. lightning protection class and location environmental conditions. Unless special requirements apply, e.g. official requirements or those specified by the building insurer, inspections of lightning protection systems shall be inspected at the following intervals:

Visual inspections for lightning protection classes I and II ≤ 1 year, overall inspections ≤ 2 years, for lightning protection classes III and IV the intervals are max. twice as long. The overall inspection of critical systems should be carried out at intervals of less than one year.



It is recommended to have certified experts and installers deal with any measures required in the field of lightning and overvoltage protection.

The electrical system shall be protected against overvoltage by means of overvoltage conductors. Conductors have no parts that require maintenance, but shall be checked after lightning strokes into the electrical system or information network and after heavy thunderstorms, and be replaced by an electrically skilled person in case of any defect. Conductors with an indicator of operational readiness shall be replaced when this indicator no longer functions. The effectiveness of the conductors is granted when protective equipment is re-started after response or replaced in case of any defect. The overvoltage protection measures are part of the electrical system and shall be inspected and maintained at the same intervals.

7 Fire protection systems

In all companies dealing with combustible materials, the risk of large-scale fire spread shall be counteracted effectively.

Automatic fixed extinguishing systems as well as fire detection and fire alarm systems are required to detect fires at an early stage and limit their effects such that heavy or total loss can be prevented.

Moreover, smoke and heat exhaust ventilation system support the fire brigade operations.

Each company shall be examined thoroughly to determine which fire protection systems are required and appropriate. The decision shall be made in accordance with the risk and the specific company's interests.

For this purpose, individual protection aims shall be defined and evaluated in consideration of technical, economic and insurance aspects. Important criteria are e.g.:

- fire load (type and distribution);
- compartmentation and size of compartments;
- duration of operation and equipment of the responsible fire brigade;
- extinguishing water supply;
- delivery and purchase commitments;
- competitive situation;
- assessment by the insurer.



7.1 Extinguishing systems

7.1.1 Room protection

In buildings designed for sorting, processing and storing with a fire compartment area > 1600 m², a sprinkler system or water spray system shall be installed with automatic triggering and alarm transmission to a permanently manned location, preferably the dispatch centre of the fire brigade.

The decision for sprinkler or water spray systems depends on the use of the operational area to be protected. Bulk and bale storage can be protected by both sprinkler and water spray systems. In operational areas with sorting and processing sprinkler systems are deemed sufficient.

Water spray systems for certain areas, e.g. delivery and flat bunkers, can also be activated manually, provided that service personnel is on site at all times to ensure immediate activation of the system and also provided that the flat bunker is depleted during shutdown. The activation device shall be easily and safely accessible, even in case of a fire. The extinguishing system should preferably be activated from the control room. Areas with manual activation should be monitored by an automatic fire detection system.

If the flat bunker of a mechanical-biological waste treatment plant is not emptied after the end of operation, the extinguishing system shall be activated automatically during the operating rest.

If secondary raw materials are processed which are water-repellent (e.g. plastics), a film forming foam concentrate should be proportioned to the water of the extinguishing system. It is to be agreed with the responsible fire brigade and the insurer whether automatic or manual proportioning is preferable.

The planning and design of the extinguishing system shall be in accordance with the generally recognised codes of practice. Even though fixed automatic extinguishing systems usually prevent large-scale fire spread in bulk and bale storage, hot spots have to be expected in the material even after the extinguishing system has operated successfully. To prevent re-ignition, manual damping down will be required.

- Damping down and cleanup efforts should be carried out by the responsible fire brigade only.
- For locating hot spots during and after a fire the use of portable detection system, e.g. thermographic camera, is recommended.
- For evacuating and uncompressing bulk or bale storage, an appropriate vehicle with qualified service personnel should be provided.
- The extinguishing system concept and, where applicable, further local protection measures should be agreed with the persons responsible for fire protection in the company, the engineering department of the insurer or a qualified inspection body.



7.1.2 Local protection

Procedural equipment with increased fire risk should be included in the extinguishing system concept of the building or else be protected by an object extinguishing system (local application). For details on the design please refer to the respective regulations for the planning and installation of extinguishing systems.

There are for instance:

- mechanical and pneumatic conveyors;
- separation plants;
- comminution plants (shredders, mills);
- sorting cabins;
- drying plants;
- briquetting plants;
- agglomeration plants;
- silos;
- de-dusting plants;
- screen systems / sifters;
- electrical operating rooms;
- central hydraulic and compressor systems;
- container slots;
- plastic bale storage;
- refuse derived fuels (loading).

A decision should be based on the following criteria:

- fire load;
- risk of self-ignition;
- explosion hazard;
- bad accessibility for manual firefighting;
- importance of system for continued operation.

Depending on the requirements, local protection systems can be inert gas systems, spark extinguishing system, water spray systems (with and without foam proportioning), fine water spray systems, or powder extinguishing systems for explosion suppression. When deciding on the necessity of a local protection system, the specific aspects of any procedural equipment and adjacent area shall be taken into account. Local protection should be consistent with the explosion protection measures taken.



Especially de-dusting plants such as filters and cyclones, drying systems, briquetting/agglomeration plants and silos may fulfil one or several of the above criteria.

To extinguish a fire in the delivery hall and in the flat bunker successfully, foam/water cannons may be required. They should be planned and installed by expert companies such that the entire area can be accessed for effective fire extinguishment. The performance characteristics of the foam/water cannons shall meet the requirements, e.g. required range. As needed, it shall be possible to adjust the equipment. Basic setting of foam/water cannons should be in direction of the main target area. They shall be maintained on a regular basis according to the manufacturer's specifications. For each foam/water cannon a water supply of 1600 l/min is required. Foam/water cannons should either have remote control or be controlled from a safe spot on the premises. Oscillating foam/water cannons shall overlap to ensure that every spot is reached by at least one cannon. The foam concentrate supply for foam cannons should be sufficient for an operating time of 30 min. The operating time may be reduced to 15 min, if the fire brigade also can also apply foam concentrate by means of a foam supply connection to be provided.

7.1.3 Extinguishing water retaining basin

In the case of fire, the extinguishing water is usually contaminated by stored goods, burnt material and extinguishant. Where the handled materials are likely to contaminate the extinguishing water, the contaminated extinguishing water shall be retained and correctly disposed of as a matter of principle. See also section 13.1.

7.2 Fire detection and fire alarm systems

Buildings for sorting, processing and storage should be monitored by an automatic fire detection and fire alarm system whose alarm is transmitted e.g. to the responsible fire brigade. To avoid unnecessary and possibly costly moving out of the fire brigade, an alarm delay of up to 180 sec is permitted for automatic detectors, provided that the pre-alarm is transmitted to a permanently manned location on the premises from which the fire brigade can be alerted immediately.

An automatic fire detection and fire alarm system increases the probability of effective extinguishment only if the following applies:

The responsible fire brigade can carry out an extinguishing attack on time and with appropriate manning.

The extinguishing water supply is appropriate for the application (see section 8.3).

The fire brigade has appropriate equipment such as film forming foam concentrate, proportioning devices and foam nozzles.

Where required, areas and procedural equipment which are used otherwise and which may represent a higher fire hazard such as waste air purification plants, gas supply and storage, drying ovens, biogas plants, block heat and power plants etc. should be



monitored by means of appropriate customised early fire detection equipment (see also "Technical equipment").

When fire is detected, the plant technology shall be triggered such that fire and smoke cannot spread into areas that are not yet affected. For instance, conveyors and ventilation systems should be disabled automatically.

Detectors shall be selected in consideration of ambient conditions such as dust, humidity, sunlight, heat radiation, exhaust gas, all of which may lead to false alarms.

Outdoor storage with fire compartments exceeding 2000 m² should be monitored by an automatic fire detection and fire alarm system appropriate for outdoor use (e.g. with combined UV/IR flame detectors or appropriate video camera system), whose alarm is transmitted to an alarm triggering station specified by the authorities or to another permanently manned location on the premises.

Long-term storage should be subjected to periodical – at least once a week – temperature measurement by means of measuring probes.

With an automatic fire detection and fire alarm system, access for the fire brigade to the premises or building should be ensured via a key depot.

7.3 Smoke and heat exhaust ventilation

Smoke and heat exhaust ventilation systems have proved their worth in buildings as they enable the fire brigade to attack fires quickly.

The triggering of smoke and heat exhaust ventilation systems can be either manual or automatic. The type of triggering shall be agreed with the competent fire protection authorities.

As these risks are prone to quick fire spread, automatic triggering (via smoke detectors, or in unfavourable conditions heat detectors) is usually preferable to manual triggering. Air inlet openings may be required depending on the size of the system.

Where the planning specifications for smoke and heat exhaust ventilation systems cannot be adhered to because of relatively small building footprints, the choice and layout of the smoke exhaust devices should be agreed with the engineering department of the insurer or a qualified inspection body.

7.4 Inspection and maintenance

All fire protection systems should be maintain at regular intervals by experts or approved experts.

Fire protection systems shall not be shut down except by agreement with the fire protection representative or the responsible local authority. During shutdown appropriate surrogate measures shall be taken such as fire pickets, reduced fire loads, hose pipes etc.



8 Fire defence

8.1 Fire brigades

As a matter of principle, it is the local fire brigade that is responsible for fire defence. This may be either a public or a voluntary fire brigade. The planning of structural and technical fire protection should take into account the intervention time (see section 3) and equipment of the responsible fire brigade.

For locating hot spots and fire pockets, the fire brigade should be equipped with portable detection devices, e.g. thermographic cameras.

8.2 Areas for the fire brigade

The premises shall have an access road for the fire brigade.

For industrial buildings $> 2500 \text{ m}^2$ and $< 5000 \text{ m}^2$ one half of all exterior walls shall be accessible for the fire brigade.

Industrial buildings $> 5000 \text{ m}^2$ shall have a fire brigade driveway around the building. It shall be possible to drive around outdoor storage with and without a roof at a width of 5 m on all sides.

The fire brigade shall find appropriate floor space and movement area for rescuing persons and for effective firefighting. This shall be ensured even on public ground by agreement with the regulatory authorities.

Dimensions of access roads, floor spaces and movement areas shall be in accordance with the authorities' regulations.

8.3 Extinguishing water supply

An appropriate extinguishing water supply shall be provided for the fire brigade. Details should be agreed with the authorities and the fire insurer.

As regards the extinguishing water quantity, a determination of demand shall be adjusted to the risk situation of the company, taking into account the following criteria:

- fire load;
- storage height;
- fire compartment area;
- fire brigade intervention time.

As a matter of principle, the minimum extinguishing water supply is 1600 l/min ($96 \text{ m}^3/\text{h}$).

Fire compartment areas exceeding 1600 m^2 require an extinguishing water supply of 3200 l/min ($192 \text{ m}^3/\text{h}$).

The extinguishing water supply shall be available for a period of two hours at a flow pressure of at least 3 bar.



Companies with fire compartment areas exceeding 3200 m² should be able to supply at least 4800 l/min (288 m³/h) for a period of three hours at a flow pressure of at least 3 bar.

The required extinguishing water can be taken from the public mains with tapping points within a radius of approx. 300 m, from an extinguishing water reservoir on the premises, or a combination of both. In case of extinguishing water reservoirs, the required water quantity shall be ensured by automatic refill equipment. Required pumps shall match the extinguishing equipment and supply pipes and have a separate main switch connected directly downstream of the current supply. The switch shall be clearly marked to prevent any accidental shutdown by the fire brigade during necessary load free controls.

In fire compartments exceeding 1600 m² it may be recommended to install an extinguishing water loop \geq DN 150 with pillar hydrants approx. every 80 m on the premises to accelerate the supply of extinguishing water.

In addition to these requirements for the extinguishing water supply for the fire brigade, any fire extinguishing systems on site shall be supplied with extinguishing water independently.

The necessity of appropriate film forming foam concentrate on the premises shall be agreed with the competent fire protection authorities. For extinguishing equipment and systems in areas with $> 30\%$ plastics, sufficient foam concentrate should be provided for 30 min.

8.4 Wall hydrants and fire extinguishers

Appropriate fire extinguishers shall be provided for in buildings and around outdoor storage areas for fighting initial fires. The number of fire extinguishers shall comply with national regulations.

Fire extinguishers only contain a limited quantity of extinguishant. In areas that are prone to quick and large-scale fire spread, wall hydrants type F according to EN 671 wet and wet-dry should be provided in sufficient number and arrangement so that every point in the room can be reached. The hose length should be limited to max. 30 m. In plants for processing refuse derived fuel it should be agreed with the fire brigade whether foam wall hydrants are required. The locations of fire extinguishers and wall hydrants should also be agreed with the fire brigade. These shall be marked and kept free at all times.

The staff should be instructed on a regular basis in operating the fire extinguishers and wall hydrants.

Fire extinguishers and wall hydrants shall be inspected and maintained on a regular basis.

Fire extinguishers are suitable only for fighting initial fires. Thus, for every outbreak of fire the fire brigade shall be called.



8.5 Company firefighting assistants

As a matter of principle, all the staff should be trained in fighting initial fires, so that fires can be fought as early as possible even before the fire brigade arrives.

Moreover, every company should have "firefighting assistants" trained to support the coordination and instruction of external firefighters.

Fire practices should be carried out together with the local fire brigade.

For evacuating and uncompressing bulk or bale storage, an appropriate vehicle with qualified service personnel should be provided.

9 Explosion protection

As a matter of principle, the sorting, processing and storing of combustible secondary raw materials is prone to the occurrence or accumulation of explosive dust, e.g. by abrasion.

It is recommended to remove accumulations of dust, as can occur in spite of aspirating equipment and waste air purification, from building parts or equipment on a regular basis. A cleaning procedure shall be chosen that does not whirl up dust. The cleaning intervals should be small enough to avoid dust accumulations.

In operating areas with high dust formation, operating equipment and structural works should be designed such that dust accumulations are avoided due to slants and dust hoods.

The necessity of explosion protection measures result from the risk assessment of the object/system. The issuing of the explosion protection document may require the involvement of an expert (qualified person).

When processing and storing flammable liquids, the rooms or areas and plant sections shall be divided into zones in accordance with the explosion protection regulations. The same applies to combustible dusts.

10 Technical operating equipment

10.1 Delivery/Flat bunker

The area Delivery/Flat bunker shall be appropriately protected against fire. Suitable systems are sprinkler systems, water spray systems and foam/water cannons. If service personnel are present during operation at all times and the flat bunker is depleted after shutdown, an extinguishing system with manual activation will be sufficient. Otherwise, an extinguishing system with automatic activation shall be installed.



10.2 Conveyors

It should be possible to switch on and switch off conveyors by emergency abort device on site from a safe place.

Rubber-fabric conveyor belts or PVC conveyor belts of long belt conveyors should be designed in accordance with EN ISO 340.

Belt misalignment and slip of long belt conveyors can be a fire hazard. They should be monitored automatically for these hazards and for increased load bearing, or at least controlled at regular intervals.

As a matter of principle, appropriate measures shall be taken to counteract outbreaks of fire and fire spread (e.g. protection against overheating, thermal overload protection for drives).

With conveyors, effective firefighting shall be ensured, e.g. by automatic early fire detection and early initiation of firefighting measures.

According to experience, effective firefighting can be ensured especially by means of fixed local application system. The decision for automatic or manual triggering depends on whether there is a permanently manned location to activate the extinguishing system immediately.

Where systems need to be enclosed, the enclosures shall be made of non-combustible materials.

Chain conveyors should have fire protection monitoring at the transfer points and be protected by a fixed fire extinguishing system, when indicated with manual activation.

It is recommended to protect pneumatic conveyors by a spark extinguishing system.

Pipes of pneumatic conveyors and air separators should be inspected and cleaned from dust accumulations. For explosion protection reasons, conveyors should be uncoupled and subjected to appropriate protection measures (inerting, pressure-resistant construction etc.) according to the result of the risk assessment.

To avoid electrostatic discharge, all parts of pneumatic conveyors shall be connected electroconductively with potential equalisation.

As a matter of principle, pneumatic conveyors and air separators are prone to accumulating explosive dusts due to abrasion.

10.3 Comminution plants

Mills designed for fine comminution shall be inspected by a qualified person for potential explosion hazards in accordance with the explosion protection requirements.

These depend on the construction of the mill, probability of dust accumulation, safety characteristics of the materials to be processed etc. Potential explosion hazard shall be sufficiently counteracted either by local application protection or appropriate constructive measures.



Fine mills should be equipped with automatic fill level control.

A low-expansion foam extinguishing system with manual activation or a water spray extinguishing system should be installed above the feeding hopper of bulky waste cutters. In the discharge area underneath the shearing rollers a water spray extinguishing system with manual activation and connection to the stationary water supply should be installed.

The final protection concept should be agreed with the fire protection experts of the company and the engineering department of the insurer.

10.4 Systems for mechanical processing and sorting

Systems for mechanical processing and sorting should be depleted at the end of each business day to limit the fire load.

To prevent fires from spreading to the air separator, timely detection and firefighting is necessary.

An appropriate type of early fire detection at the transfer point between sieve drum and air separator would be e.g. infrared detectors.

According to experience, effective firefighting can be ensured by a fixed water spray extinguishing system.

10.5 Drying systems

Thermal drying systems should be operated with electrically generated hot air. If the heat is generated by gas or oil firing or superheated steam, the product should be dried exclusively by heat exchange. With directly heated drying systems, excess temperatures resulting in fire should be prevented by redundant procedural safety measures such as temperature monitoring, volume flow control. In case the safety measures take action, the system shall automatically enter a safe operating condition.

At the material discharge a system for automatic fire detection and extinguishing should be installed, e.g. spark detection and extinguishing. Appropriate extinguishing agents for manual firefighting by the staff should be provided in the vicinity.

A fire and explosion inspection of the drying system carried out by a qualified person shall be documented.

Drying systems should be depleted at the end of each business day.

10.6 Filter systems

The waste air from operating rooms or procedural equipment with increased dust emission shall be purified. Usually cyclones are used to pre-filter grit. Fine dust is separated by fabric filters.

Fires in closed fabric filter systems are difficult to detect and to control because of the lack of space and the partly combustible filter media.



Filter media should preferably be "materials of low flammability".

Filter systems should be protected by spark extinguishing systems installed in the crude gas main upstream of the dust filter, so that the ignition source is extinguished before it can even enter the dust filter system.

To detect an initial fire in the filter at an early stage, fire detection on the clean gas side should be effected by smoke density measurement. For effective firefighting in the filter, the filter should be equipped with a water spray extinguishing system with manual activation.

Depending on the particle size and under certain conditions, dusts are classified as explosive. In this case, filter systems should be fitted with burst discs as pressure relief surfaces. Pressure shall be relieved only into safe areas without any hazard to life (explosion pressure resistant or explosion pressure shock resistant construction, explosion separation of the individual systems (anti-kickback)).

It is recommended to make filter systems accessible from at least two sides by means of revision openings.

Local application protection (water spray extinguishing system, medium-expansion foam system) is recommended.

10.7 RTO systems

Systems for regenerative thermal oxidation (RTO) are applied, among other things, to treat waste air from mechanical biological waste treatment plants. The waste air is highly heated (approx. 800°C), thus thermally decomposing and oxidising its chemical compounds. For systems with start-up burner, flame monitoring with interlocking is required. The temperature monitoring shall be redundant. The fire and explosion protection inspection of process technology shall be documented.

10.8 Silo installations

Certain secondary raw materials may be prone to self-ignition at too high product or storage temperatures. To ensure safe operation of a silo installation, procedural, constructive and organisational fire protection measures shall be taken. For instance, before storing the materials should be cooled down to less than 50°C. Stored goods whose self-ignition behaviour is unknown, are recommended to be tested by a competent body in order to determine the safe storage temperature.

Silos should be manufactured from non-combustible materials only. Therefore, silos made of fabrics located in buildings should be discussed separately.

Silos should be monitored at the inside by early fire detection equipment with local alarm and alarm transmission to a permanently manned location. Particularly suitable are physical CO measuring systems operating according to the principle of infrared adsorption, which safely detect CO quantities generated as early as during the beginnings of the self-heating process before the material ignites. Because of the early detection there is



sufficient time for firefighting measures before the material ignites, e.g. initiating depletion of the silo or an inerting process.

Silos should be fitted with fixed or tubed loading points for inert gas or water, either in the head or in the outlet cone, provided that the statics of the silo is appropriate. It is recommended to have the loading points fitted such that the inert gas discharge cannot be blocked by bulk cargo. A sufficient quantity of inert gas shall be stored. Operating instructions should be developed for the inerting process and the depletion of silos, taking into account the required life safety measures.

As a matter of principle, silo installations shall be earthed and outdoor installations shall have a lightning protection system. Silo vehicles shall also be earthed during loading and unloading.

10.9 Biogas fermenters

Residual waste fermentation plant, fermenter and gas storage shall be built in accordance with fire and explosion protection requirements. A hazard evaluation shall be carried out and documented and an explosion protection concept shall be developed.

To prevent fire spread between buildings and systems, the distance regulations specified in the safety rules for biogas plants shall be adhered to, e.g.

between gas storage and

- adjacent plants, equipment and buildings
at least 6 m
- adjacent plants, equipment and buildings higher than 7,5 m:
 $0,4 \times H + 3 \text{ m}$

For structural complex separation (insurance inspection) it is necessary to keep a minimum distance in accordance with the height of the building, at least 5 m, between equipment of the biogas plant and adjacent buildings of up to 20 m in height. In individual cases greater distances may be necessary due to heat radiation and explosion hazard.

If a spatial separation is not possible, structural separations can be erected, especially fire break walls.

Openings in structural separations shall be fitted with fire-resisting closures that have the same fire resistance time as the structural separation and are approved by the building control authorities.

10.10 Block heat and power plant

Motors used for operating block heat and power plants should be released for biogas operation by the manufacturer. Comprehensive maintenance by expert companies or trained company staff shall be ensured. Periodical maintenance shall be documented. The plant shall be monitored by an automatic fire detection and fire alarm system with



appropriate fire detectors (e.g. rate-of-rise detectors) above the modules. A gas warning system connected to a permanently manned location shall be installed.

In order to protect the electrical systems and measuring equipment required to keep up operation, these shall be installed in a room with fire resistant separation.

10.11 Rotting / Composting systems

In order to detect fire spread across fire compartments between sorting and rotting in due time, appropriate fire detectors, e.g. infrared detectors should be installed with connection to a permanently manned location. Thus, the introduction of hot spots can be prevented. The waste air ducts of the rotting system should have revision openings and be cleaned on a regular basis. It is recommended to monitor the waste air for carbon monoxide to detect initial fires at an early stage. It is advisable to fit rotting tunnels with equipment for internal firefighting. Possible firefighting equipment could be e.g. half-stationary extinguishing systems or procedural irrigation systems. A design density appropriate for the risk shall be granted. Technical means should be provided to extinguish a smouldering fire, e.g. wheel loaders for safe discharge and extinguishment of the rotting material by the fire brigade.

10.12 Ground conveyors

Forklift operators shall be selected and trained in accordance with national regulations.

Ground conveyors should be maintained on a regular basis. Vehicles with combustion engine should be inspected regularly, especially with regard to petrol tank and pipes, exhaust pipe, electrical system and all safety equipment.

Diesel operated ground conveyors should be equipped with spark arresters.

Ground conveyors with combustion engines shall be fuelled only outdoors at specially marked points.

The fuel gas tank of ground conveyors with liquid gas combustion engine shall be fixed to the vehicle such that even deformations of the vehicle frame and construction do not affect the fuel gas tank or pipe and their supports.

Removable fuel gas tanks shall be positioned horizontally. It shall be possible to change cylinders safely and easily from the outside, and only when hazardous explosive atmospheres cannot be generated.

Ground conveyors with liquid gas operation shall not be parked indoors unless these are located above ground level and have sufficient ventilation. They shall not be parked near openings to rooms below ground level. Rooms below ground level are e.g. cellar rooms, underground passages, dumps and pits. As liquid gas is heavier than air, discharging liquid gas can accumulate in lower rooms.

Each vehicle shall be fitted with a fire extinguisher to ensure early firefighting measures.

Electrical chargers for ground conveyors shall be handled in accordance with section 5.4 Equipment.



In storage areas ground conveyors with combustion engine shall not be parked unsupervised.

10.13 Electrical systems, lighting

Electrical systems shall be installed only by installation companies registered in the installation directory of a network operator. Planning and installation shall be in accordance with the generally recognised codes of practice. Load circuits should be protected by residual current operated protective devices (RCD).

Electrical systems in production and storage areas shall be protected permanently against damage, e.g. by ground conveyors.

Lighting systems shall have a safety distance of at least 0,5 m (1 m in direction of radiation) from combustible materials. Safety glass should be fitted correctly and be undamaged.

At the end of the business day electrical systems should be de-energised, where possible. For this purpose, each area or hall shall be fitted with a separate main switch.

As a matter of principle, electrical operating rooms and control rooms should have fire protection monitoring (FDAS). Depending on the availability demand regarding operating rooms and control rooms, an automatic gas extinguishing system may be appropriate. Moreover, electrical systems should be inspected regularly.

10.14 Space heating

The production and storage rooms may only be heated indirectly. Direct heating, e.g. by gas-fired IR radiators, is not permitted.

Heating rooms should have fire-resistant separation from adjacent areas.

The heating systems shall be inspected and maintained regularly.

At a safe spot shut-off devices for the fuel supply should be installed and clearly marked.

Heating rooms shall not be used as storage rooms.

No objects shall be deposited on heat sources and hot pipes.

Mobile heaters in production and storage areas can be ignition sources. They shall not be used.

10.15 Ventilation systems

The systems shall be designed such that in the case of fire they can be disabled automatically or from a safe spot. They should have provision for early fire detection. Fire dampers shall be actuated via smoke detectors. Ventilation ducts should be cleaned regularly.



10.16 Shutdown

At the end of the business day the plant should be depleted, if possible. Technical equipment should be de-energised.

11 Storage organisation

11.1 Block storage areas

Within fire compartments indoors the storage area shall be divided into blocks of 300 m² max. by spaces without combustible materials of 5 m width. Alternatively, a structural separation made of non-combustible materials may be installed, provided that it is sufficiently steady and provides sufficient space for firefighting and routes for fire attack.

Within fire compartments outdoors the storage area shall be divided into blocks of 400 m² max. by aisles of 5 m width. Instead of aisles fire-resistant walls can also be erected.

11.2 Storage height

Maximum storage height is:

- for bulk storage 5 m
- for block storage/bale storage 4 m

The maximum permitted storage heights shall be clearly marked to avoid any exceedance in operational practice and thus not unduly increase the fire hazard.

11.3 Clustering

It is recommended to clearly arrange all materials to be stored. The goods should be separated as regards their composition and type. Mixed fractions should be stored separately.

A storage plan shall be drawn up including specifications on the segmentation of the storage area and on the type and quantity of the materials stored. The plan shall be updated continuously and kept in a place that is accessible at all times. In the case of a fire the storage plan shall be handed to the fire brigade's head of operations. Any details shall be agreed with the competent firefighters.

11.4 Flammable liquids and gases

Flammable liquids and gases shall be stored separately in accordance with the applicable regulations.



12 Organisational fire protection

12.1 General

The premises shall be kept and operated in good order. The systems should be cleaned regularly. Pile-ups and other accumulations of material shall be removed every day. At the end of the business day the plant should be depleted.

During shutdown, standby duty for emergencies is required. The persons on standby duty should be able to operate all systems and devices.

In case of atypical operating conditions such as maintenance works, start-up and shutdown of the system, unplanned downtime etc. additional organisational or technical safety measures should be taken.

12.2 Fire protection regulations

Fire protection regulations shall be established. Fire protection regulations are a compendium of regulations for fire prevention and for the behaviour in the case of a fire. They are established by agreement with the competent authorities and the fire brigade.

The text shall be clear and in plain words.

The following structure of the contents is recommended:

- fire prevention;
- alarm;
- safety measures for life and property;
- firefighting measures;
- preparation for intervention of fire brigade.

The clauses shall be filled with text, plans, drawings etc. according to local conditions.

Reflecting their significance, the fire protection regulations shall be put into force by the management and brought to the attention of all supervisory staff. The residual staff shall be instructed where appropriate. Notices (multilingual) should contain only information relevant for the staff present in the respective area.

It is highly recommended to keep the fire protection regulations updated at all times. Especially changes resulting from an extension or amendment of process engineering, operating sequence and structural specifications should be taken into account.

All members of staff, even from outside companies, shall undertake in writing that they will adhere to the fire protection regulations.

Regular controls shall be carried out to ensure that the fire prevention measures are adhered to.



12.3 Behaviour in case of fire and emergency response procedures

Information on the behaviour in the event of a fire should be published in the languages of the staff in several copies in all departments. These short instructions should be restricted to the following:

- ☐ KEEP CALM
- ☐ SAVE LIVES
- ☐ REPORT THE FIRE
 - next manual call point [info on location]
 - next phone [info on location; indication of max. 2 phone numbers recommended]
 - Where is the fire?
 - What is on fire?
 - Are any persons injured or in danger?
- ☐ SWITCH OFF ELECTRICITY IN CASE OF FIRE IN ELECTRICAL SYSTEMS
- ☐ FIGHT THE FIRE
- ☐ CLOSE FIRE-RESISTING CLOSURES
- ☐ KEEP ATTACK ROUTES FOR FIRE BRIGADE FREE
- ☐ INSTRUCT FIRE BRIGADE
- ☐ FOLLOW INSTRUCTIONS OF OFFICER IN COMMAND
- ☐ IN CASE OF IMMINENT DANGER:
 - Leave danger zone
 - Help handicapped persons
 - Go to collection points
- ☐ INFORM ADJACENT COMPANIES

Apart from short instructions for the staff's behaviour in the case of a fire, an emergency plan shall be drawn up depending on the size of the company. This plan shall be handed to the supervising staff and, where applicable, to the porter. An emergency plan includes the following important information:

- ☐ phone numbers of fire brigade, emergency rescue service, doctor, police, plant manager



- ☐ phone numbers of other responsible persons (safety engineer, fire protection representative)
- ☐ phone numbers of in-plant technical services (gas, electricity, water)
- ☐ internal alarm signals, collection points for evacuation of buildings, use of escape routes, first aiders
- ☐ responsibilities for instruction and guidance of fire brigade

12.4 Pre-determined fire plan

For each larger plant section a pre-determined fire plan shall be established.

The fire plan shall be developed based on a plant inspection together with the competent fire brigade.

The fire plan shall be handed to the competent fire protection authorities and to the fire brigade or to the porter, so that he can hand it to the officer in command.

The plan shall be checked for correctness and practicality on a regular basis and, if required, adjusted to modified conditions.

It includes the main hazards and the safety equipment provided for fire prevention and firefighting.

It should include the following information:

- ☐ all buildings designating their use and fire compartments, storage areas and stored goods
- ☐ access and attack routes for fire brigade
- ☐ escape and rescue routes
- ☐ outdoor collection points for staff
- ☐ location of fire detection and fire alarm system and/or fire brigade control panel
- ☐ rooms or systems with fire and explosion hazard
- ☐ rooms in which firefighting with water is not permitted
- ☐ high voltage and other power supply equipment
- ☐ outdoor and indoor extinguishing water tapping points
- ☐ fixed fire extinguishing systems, their feed-in, locations of fire extinguishers, wall hydrants and other extinguishing equipment, control panels for smoke and heat exhaust ventilation systems
- ☐ details on retention of extinguishing water



12.5 Safety instructions, Instructions of staff

The employer shall draw up safety instructions in accordance with the special conditions on site. These instructions shall be comprehensible and clear and published in all departments together with the fire protection regulations.

The fire protection regulations should be part of the safety instructions. It shall also include instructions on first aid.

All the staff shall be instructed with regard to the nearest locations of fire extinguishers and manual call points, as well as on escape and rescue routes. They shall also be instructed regularly on measures of fire prevention, the correct behaviour in the case of fire, and on the use of extinguishing equipment. Moreover, they shall be informed of the special fire hazards on site.

The safety instructions shall be issued before the employee starts his job, then regularly, at least once a year and with reference to the workplace in question.

Contents and time of the instructions shall be fixed in writing and confirmed by the employee with his signature.

12.6 Responsibility for outside companies

It is advisable to commit outside companies to adhere to the fire protection regulations on site, to observe smoking bans and the permit procedure for hot works. The outside companies are responsible for instructing their staff on the required fire protection measures and for making sure that the jobs are done correctly.

12.7 Fire practices

At least once a year a fire and rescue practice should be carried out on site. The staff shall be informed of the protection and firefighting possibilities and of the correct behaviour in the case of fire. This fire practice can be carried out in cooperation with the public fire brigade.

Irrespectively, fire practices of the public fire brigade on the premises are recommended, as they enable the fire brigade to gain knowledge of the place and business.

12.8 Fire protection control

The company shall be inspected on a regular basis for fire safety in the scope of a safety walkabout. This may be either the fire protection representative or another person responsible for fire protection, each together with another supervising member of staff.

These controls may be based on a plan specifying the dates and the objects and areas to be inspected.

The result of these inspections and the measures to be taken for the rectification of deficiencies should be documented in writing. The dates and persons responsible for rectifying the deficiencies should also be specified.

It is recommended to have the insurer inspect the premises on a regular basis.



In larger companies regular fire inspections should be carried out by agreement with the fire brigade.

12.9 Documentation

The following occurrences should be documented in writing:

- ☐ fires, even if they can be extinguished, and their causes
- ☐ additions to and disposals of fire extinguishing equipment
- ☐ inspections of fire extinguishing equipment and automatic fire extinguishing as well as fire detection and fire alarm systems
- ☐ instructions and fire practices
- ☐ modifications of the fire protection regulations
- ☐ operational changes increasing the fire hazard
- ☐ modifications of fire protection systems
- ☐ fire protection controls and inspections carried out by authorities and experts, any deficiencies and the time of rectification
- ☐ sweeping of chimneys, deficiencies verified by the chimney sweep regarding firing systems and heating devices and the time of rectification
- ☐ periodical inspections, e.g. of electrical systems, lightning protection systems, gas and oil firing systems, any deficiencies verified and the time of rectification
- ☐ attempted intrusion, sabotage, vandalism

12.10 Construction and conversion measures and changes in use

Any construction activities and substantial changes in use should involve the fire protection representative or another person responsible for fire protection, the fire brigade and the insurer, all of them as early as in the planning phase. Fire defence shall be ensured even during construction at all times. Existing fire protection measures and safety equipment shall be fully functional and adjusted to the modified hazard.

12.11 Cleaning of machines

Machines or machine parts should be cleaned on a regular basis. Only non-combustible cleaning agents should be used.

If combustible cleaning agents need to be used, special safety instructions should be published and adhered to.

Cleaning rags, cloths etc. which are oily, greasy or soaked in combustible liquids shall be kept in non-combustible containers with tightly closed lid. At the end of the business day such cleaning articles should be stored outdoors at a safe distance from the buildings.



12.12 Shutdown of fire protection systems

Any shutdown of a fire protection system requires the agreement of the fire protection representative or the responsible local authority.

In case of a shutdown – even a temporary one – of fire protection systems (e.g. disablement of fire detection and fire alarm systems, shutoff of sprinkler systems), fire protection shall be otherwise ensured by agreement with the competent fire protection authorities and the insurer, e.g. by fire pickets, reduced fire loads, hose pipes etc.

12.13 Motor vehicles

Motor vehicles shall not be parked in production and storage buildings.

Loading and unloading of motor vehicles in production and storage areas is to be avoided and shall be carried out in the outdoor ramp area. If occasionally loading and unloading of motor vehicles is necessary indoors, special safety measures shall be taken, e.g. sufficient distances between vehicle and stored goods.

The loading area should be clearly separated from the storage area by floor markings. The loading area shall not be used for interim storage.

Even in the loading area compliance with the smoking ban shall be enforced.

In non-operating times motor vehicles should not be parked at exterior walls of buildings.

13 Environmental protection

13.1 Retention of extinguishing water with stationary or mobile means

Secondary raw materials as covered in these Guidelines are mostly water-insoluble and are seen as not hazardous to water, comparable to a large number of other organic materials. However, for reasons of preventive water and soil protection, it may be recommendable to keep the extinguishing water from entering open waters, groundwater or soil. In the case of fire, even substances classified as non-hazardous can generate hazardous fire products contaminating the extinguishing water.

The term “retention of extinguishing water” is meant to include any measures appropriate to prevent the extinguishing water used for firefighting from draining in an uncontrolled manner.

“Retention systems for extinguishing water” are open or closed basins, dens or other comparable rooms or containers designed and appropriate to retain extinguishing water until it can be disposed of correctly.

As a matter of principle, retention systems for extinguishing water shall operate automatically, if possible, and shall have lining that is sufficiently impermeable to liquid. They shall not impair any firefighting measures. Moreover, the discharge of contaminated extinguishing water shall not increase fire spread. The retention concept shall be part of



the company's hazard control plans, so that in the case of loss any measures to be taken are sure to go smoothly.

The retention of extinguishing water can be either stationary or mobile. Stationary solutions may be:

- ☐ structuring of floor space of warehouse as collection tray (upturn beams, thresholds, ramps, barriers, collecting channels)
- ☐ use of existing sewage system (dam constructions in channel system)
- ☐ impoundment volumes in retention basin of sewage treatment plants (sufficiently dimensioned storm water overflows)
- ☐ liquid-tight open depots and loading zones with downgrade, secured against uncontrolled drain by circumferential upturn beam; drainage should be via a collecting pit with slide valve
- ☐ impoundment volumes within buildings (e.g. basement) and of special retention ponds (e.g. underneath ramps and tanks); with flammable liquids, sufficient powered ventilation is required
- ☐ retaining basins for extinguishing water connected to the storage and installed especially
- ☐ empty tanks
- ☐ retaining cups and basis for retaining partial quantities

Mobile solutions may be:

- ☐ gully covers
- ☐ cover hoods and sealing cushions (filled with water or sand)
- ☐ magnetic foils
- ☐ inflatable sealing cushions (e.g. holding back device "Gully-Ei")
- ☐ extinguishing water barriers in front of gates and doors
- ☐ safety containers with integrated extinguishing water retention
- ☐ fire brigade measures with tanks, pumps and liquid aspirators
- ☐ mobile collection containers (collapsible containers, containers etc.)
- ☐ double chamber hoses for liquid barrier



In any case the effectiveness of the retention systems shall be ensured by checking that the underground is liquid-tight and that there is no direct floor drain into the sewage system. Certain water-hazardous substances require special coatings and materials.

13.2 Extinguishing water disposal

By way of precaution, it is recommended to draw up a concept for the disposal of extinguishing water by agreement with the competent authorities. Prior to any discharge of extinguishing water, the operators of the sewage treatment plant should be consulted, especially if special extinguishant or foaming agent has been used.

13.3 Fire residues

Fire residues shall be collected and disposed of by agreement with the authorities and in accordance with the applicable national regulations.

13.4 Fire gases

As a matter of principle, it is recommended to draw up an emergency concept with regard to the hazard in question and to potential hazards for the environment, together with the competent bodies (e.g. fire brigade, police). In any fire, fire gases are generated from organic materials such as wood, textiles or plastics. These may contain toxic substances, irrespectively of whether "natural materials" or synthetic materials are concerned.



14 Guidelines

Fire

- Guideline No. 1:2002 F Internal fire protection control
- Guideline No. 2:2013 F Panic & emergency exit devices
- Guideline No. 3:2011 F Certification of thermographers
- Guideline No. 4:2010 F Introduction to qualitative fire risk assessment
- Guideline No. 5:2003 F Guidance signs, emergency lighting and general lighting
- Guideline No. 6:2011 F Fire safety in care homes for the elderly
- Guideline No. 7:2011 F Safety distance between waste containers and buildings
- Guideline No. 8:2004 F Preventing arson – information to young people
- Guideline No. 9:2012 F Fire safety in restaurants
- Guideline No. 10:2008 F Smoke alarms in the home
- Guideline No. 11:2005 F Recommended numbers of fire protection trained staff
- Guideline No. 12:2012 F Fire safety basics for hot work operatives
- Guideline No. 13:2006 F Fire protection documentation
- Guideline No. 14:2007 F Fire protection in information technology facilities
- Guideline No. 15:2012 F Fire safety in guest harbours and marinas
- Guideline No. 16:2008 F Fire protection in offices
- Guideline No. 17:2008 F Fire safety in farm buildings
- Guideline No. 18:2013 F Fire protection on chemical manufacturing sites
- Guideline No. 19:2009 F Fire safety engineering concerning evacuation from buildings
- Guideline No. 20:2012 F Fire safety in camping sites
- Guideline No. 21:2012 F Fire prevention on construction sites
- Guideline No. 22:2012 F Wind turbines – Fire protection guideline
- Guideline No. 23:2010 F Securing the operational readiness of fire control system
- Guideline No. 24:2010 F Fire safe homes
- Guideline No. 25:2010 F Emergency plan
- Guideline No. 26:2010 F Fire protection of temporary buildings on construction sites



- Guideline No. 27:2011 F Fire safety in apartment buildings
- Guideline No. 28:2012 F Fire safety in laboratories
- Guideline No. 29:2013 F Protection of paintings: Transport, exhibition and storage
- Guideline No. 30:2013 F Managing fire safety in historical buildings
- Guideline No. 31:2013 F Protection against self-ignition and explosions in handling and storage of silage and fodder in farms
- Guideline No. 32:2014 F Treatment and storage of waste and combustible secondary raw materials

Natural hazards

- Guideline No. 1:2012 N Protection against flood
- Guideline No. 2:2013 N Business Resilience – An introduction to protecting your business
- Guideline No. 3:2013 N Protection of buildings against wind damage
- Guideline No. 4:2013 N Lightning protection
- Guideline No. 5:2014 N Managing heavy snow loads on roofs

Security

- Guideline No. 1:2010 S Arson document
- Guideline No. 2:2010 S Protection of empty buildings
- Guideline No. 3:2010 S Security system for empty buildings
- Guideline No. 4:2010 S Guidance on key holder selections and duties
- Guideline No. 5:2012 S Security guidelines for museums and showrooms



15 Annex A

Fire-resistant separation for technical rooms within a fire compartment or complex – Fire resistance time

Technical rooms	Ceilings	Partition walls ²	Protection of openings
Compressed air supply systems	90 min	90 min	90 min
Electrical operating rooms			
Heating systems			
Control room, if water cannons are controlled from there			
Screw compressors			
Workshops			
Central hydraulic systems			
Block heat and power plant			
Storage room for flammable liquids			

² Bearing walls towards adjacent operating zones shall consist of bearing and bracing components with a fire resistance time of 90 minutes