

CORPORATE FIRE SAFETY STANDARD

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1. Introduction

1.1 General

The target company of this thesis work is Outokumpu Oyj. Outokumpu is an international stainless steel company whose vision is to be the undisputed number one in stainless steel production, with success based on operational excellence. Customers in a wide range of industries worldwide use Outokumpu stainless steel and services. Outokumpu operates in some 30 countries and employs more than 8 000 people.

Stainless steel is the fastest growing metal market across the world. In this market Outokumpu is well positioned: one of the world's six largest producers, and also widely recognized as world leaders in technical support, research and development.

Outokumpu has been built after mergers and acquisitions. Therefore, the whole Company as well as different departments in the head office and the sites have had various challenges in unifying and standardising practises and standards.

1.2 Aim and objectives

The aim of this thesis is to create a fire safety standard that is able to give guidelines to sites and project teams of how to build a safe working environment. The risk of fire is one of the greatest threats to health and safety as well as to property.

In this thesis, a standard is presented which is built from fire safety guidelines and experience followed by a consultation of insurers.

2. Risk Management

Corporate Risk Management operates under the Chief Financial Officer, who is a member of the Executive Board. The head of Corporate Risk Management is the Treasurer. The responsibilities of risk management consist of financial, operational, business and strategic areas. Different area have been divided in teams.

Corporate Risk Management, with its attempts to bring a degree of experience to decisions on handling and preserving corporate assets, must by necessity begin with personnel who have the knowledge of fire protection necessary to evaluate the risks facing the corporation.

Risk management can be considered as the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and impact of unfortunate events or to maximize the realization of opportunities.

Fire safety experts at the sites as well as external fire safety professionals are essential when evaluating the risks in the property area. When there is enough information available, decisions are made to retain, minimize or transfer the risk in form of insurance.

2.1 Insurance

Insurance is a means to share or transfer the risk of loss. As such, it improves level of protection from incurring financial loss. Insurers play an important role in monitoring and promoting additional fire protection measures. The level of fire protection has an influence on the insurance premium. When the sites are adequately protected, a discount in premiums may be offered in long term. On the other hand, if the sites or buildings are considered unsafe premium increases or reductions in insurance coverage can be implemented.

3. The principles and aims of fire safety standard

The fire safety standard is aimed for the sites to unify practises and to give guidelines how fire safety should be organised at the sites. This fire safety standard serves as a guide for establishing and maintaining fire safety conditions at the sites. The standard has to be communicated to everyone on a need-to-know basis with suitable training provided as required.

Every Outokumpu site is different and therefore, the implementation of fire safety has to be based on the individual site's needs, on local laws, regulations and circumstances.

The potential for loss of property, loss of life or injury from a fire related incident is one of the most serious risks a site may face. A different loss scenario has to be prepared for and plans for business continuity done. Business continuity planning is working out how to stay in business in the event of disaster, such as building fires.

This fire safety standard provides a "one stop" comprehensive document, which can form the basis of a structured approach to fire safety management. The standard has been written specifically to provide assistance to the sites and it should be regarded as the minimum standard for the sites.

4. Legal basis

Each site has to assure that all local laws, regulations and requirements are followed. Outokumpu fire safety manual presents detailed and Outokumpu Corporate specified fire safety practices. Outokumpu fire safety standard shall apply regardless of possibly lower local requirements.

5. Coverage

This manual covers all Outokumpu sites. The sites are divided in four different insurance categories A, B, C and D.

The sites belonging to category A are melting shops, rolling mills and major prefabrication units. In category B are tube mills, rod mill and bigger service centres. Category C consists of distribution units and smaller service centres. Offices are in category D.

6. Organization and responsibilities

6.1 Fire safety management

Fire safety management is a legal responsibility on having control over premises and to take reasonable measures to prevent the occurrence of a fire and to protect the lives and safety of personnel in the event of a fire. The personnel has to be aware of the significance of the responsibilities and of the appropriate action to take in the event of fire.

Every site must have a nominated person, a head of fire safety, in charge of fire safety including fire protection systems.

The Site Manager has the ultimate responsibility for establishing and maintaining fire safety for the site and provides continuing support for the person in charge of fire safety.

Supervisors must brief employees on the specific hazards of their work area, on fire safety, rescue and evacuation plans, and fire extinguishers locations.

Fire teams are taking care of initial fire fighting until fire brigade arrives at the site.

6.2 Head of fire safety

Head of fire safety is responsible of fire safety at the site. The head of fire safety makes sure that fire-fighting equipment of a suitable type for the respective area. The care and maintenance of fire extinguishing equipment are also part of his responsibilities as well as conducting fire safety inspections no less than 3-4 times a year. The head of fire safety must update the rescue plan once a year or after any changes.

6.3 Fire teams

The sites have to establish fire teams, which are responsible for their own areas. Personnel for the teams shall be employees who are normally working in the area and

are familiar with risks in all departments. The bigger sites can be divided in several areas. Each area and working shift has to have an own team.

The members of fire teams shall be trained in the use of initial fire-fighting equipment, they are to be familiar with rescue and evacuation plans and with automatic extinguishing equipment. The teams shall also be instructed about alerting and guiding the fire brigade.

6.4 Fire brigade

In case the fire brigade arrives at the scene fire fighting is conducted under the control of the officer in charge of the fire brigade upon his arrival at the scene.

7. Fire safety inspections

Fire safety is a vitally important area of concern for Corporate Management. Therefore the Company has a comprehensive fire safety inspection programme, which consists of Corporation level inspections as well as locally conducted inspections. The sites are responsible to invite fire safety authorities to conduct inspections. Careful planning, implementation and maintenance are all essential parts of a successful fire safety programme.

7.1 Internal fire safety inspections

All sites shall have a structured fire safety inspection programme. The findings arising out of the inspections must be entered to the maintenance system in order to ensure the completion of the points. In category A sites fire safety inspections can be conducted by departments.

7.2 Frequent visual inspections

Visual inspections shall be carried out weekly, by named person of floor areas and obvious faulty conditions must be reported for corrective actions. Items to be

monitored are the condition of fire doors and exit signs, access to exits, electrical cabinets, fire extinguishers, stairways, accumulation of combustibles, temporary electrical wiring, disposal of cigarette ends and other unsafe conditions and practices.

7.3 Corporate fire safety audits

In accordance with Risk Management Policy the sites are subject to regular fire audits, which are conducted by the initiative of the Corporate Treasury and Risk Management department. The audits are carried out in conjunction with the Group's insurance broker and insurance representatives following a fire safety audit programme.

The purpose of fire audits is to gather up information and to ensure the fire safety standard of a site. The primary issue is to verify that all legal requirements are being met and the sites have defined fire safety responsibilities and site management is committed to maintain and improve the standard of fire safety. It is vital that essential fire safety rules are introduced.

The frequency of audits is determined by the size and the importance of the site.

7.4 External fire safety authorities

In most countries in which Outokumpu operates, external inspections are conducted on the initiative of fire safety authorities. Normally these regular inspections are carried out once a year. In some cases it is the responsibility of the head of fire safety to call the authorities to the site. An example of a special inspection would be if there have been changes to the fire compartment structures or there have been increases of risk or any other change that needs to be approved by the authorities.

7.5 Inspections by independent third parties

Sprinkler systems must be inspected once a year by an independent and certified sprinkler inspection company where available. Any remedial actions contained within in the inspection report must be entered to the maintenance system in order to ensure

the completion of the points. All critical defects must be fixed immediately or the protected area must be monitored accordingly.

Automatic fire detection systems should also be a subject to an independent inspection where available. The frequency varies from country to country. Normally the interval is two years. ^[1]

8. Buildings

8.1 General

Every building structure shall meet the standards of building code and regulations in respect of local fire protection and prevention requirements.

8.2 Building construction

When a new construction is in the planning phase detailed information of the building and building materials shall be sent out to Corporate Risk Management. This allows insurers to be involved from early on and insurance aspects can be taken into account. Only non combustible materials are to be used in all aspects of the building's construction.

Such panels, which have polystyrene, polyurethane or any other foam plastic insulations, shall not be used in any part of the building. The same applies to other combustible materials, such as plywood, chipboard, timber or laminated timber.

8.3 Expansion of existing buildings

When constructing an extension to an existing building the standard of fire safety should be at least as high as in the existing part of the building. The current building code shall apply to expansions. This is the minimum requirement of any expansion project.

8.4 New construction

Construction materials used shall be non combustible. Frame structure shall either be made of steel or concrete. The walls of normal site facilities shall be constructed out of steel/ mineral wool/ steel structures. Bearing structure of roof construction shall be made of profile steel. Insulation of mineral wool and roof cover out of no fire propagating material such as PVC (Protan and Sikaflex) or steel. For building structures, which are exposed to molten metal, shall be constructed out of concrete or brick.

The fire rating of the bearing structure is defined based on the fire load. The definition of fire rating shall be given by the building authority and from the building code and reference to Corporate Risk Management.

There are some plastic panels in the market with fire ratings but these are not to be used at the sites.

9. Fire compartments

9.1 Fire rating of fire division walls

The fire rating of fire division walls is included in the building code. The fire division walls must have a unified fire rating without any weak points such as windows between offices and production halls. From the insurance point of view the fire rating is defined based on the fire load and the estimated maximum loss scenario. This may lead to a higher rating than the building code gives and in such a case reference to Corporate Risk Management should be made.

9.2 Size of fire compartment

Large production halls as well as sizeable warehouses shall be divided into smaller fire compartments in order to reduce the maximum foreseeable material damage losses and financial consequences of the loss.

9.3 Tunnels

When a large tunnel system is in question it has to be subdivided into smaller sections by installing intermediate walls with fire rated doors at no greater interval than 50 metres. Where tunnels intersect or join, fire separation walls should be provided. The cable and pipe outlets to the upper floor shall be sealed with fire stopping material.

9.4 Horizontal fire separation

Each floor shall form its own fire compartment. This means that there shall be no openings between the different floors. Stairways between floors, especially in departments where there are hot sparks and hot material, shall be provided by the appropriate enclosure designed to prevent such material from passing to lower floors.

9.5 Operational separation

Different main functions shall be located in their own fire compartments. Basically main functions can be divided into three categories, which are offices, production and storage. The production area may need to be divided into smaller compartments due to the type of production.

9.5.1 Offices

Preferably the offices should be in a separate building. However offices can be attached to the production building. In this case there has to be a fire section wall between the production facility and the office section.

9.5.2 Storage

The practical solution is to have storage as its own fire compartment. Fire resistance of the fire division wall has to be according to the building code. Depending on the amount of fire load the fire resistant requirement can be even EI 240R.

9.6 Areas of a special hazard

Functions that pose a special hazard shall be located in their own fire compartments. Such functions are IT rooms, programming rooms, electrical switchgear rooms, transformers, hydraulic units, air compressors, chemical stores, flammable and highly flammable liquids, packaging material storages, gas distribution and boiler room.

9.7 Transformers

Oil filled transformers must be located in their own separate fire compartment, which has to be constructed out of bricks or concrete. The area has to be equipped with a smoke detector. The transformers must have an oil catch pit or bund to retain the oil.

Air-cooled transformers are better in terms of fire safety. Smoke detectors are not necessarily needed but recommended.

9.8 Electrical and switchgear rooms

Electrical rooms must be equipped with smoke detection systems. Smoke detectors should be placed also in the electrical cabinets. Electrical rooms must be locked at all times. Electrical rooms should not be used for storage and the rooms are not to be used for other purposes. Every electrical room should be provided with suction floor tile lifters, which should be located in wall mounted clips adjacent to entry and exit doors. Powder extinguisher should not be used in electrical rooms as the powder will damage electrical installations in the room and only CO₂ units should be provided.

10. Doors

10.1 Fire doors

The purpose of fire doors in terms of fire safety is to act as a barrier to fire and smoke. Fire doors must be kept closed at all times unless they are held open by an approved automatic closing device connected to the fire alarm system. The doors shall not be wedged open. Fire doors should be a part of the regular fire inspection programme.

10.1.1 Rating of fire doors

Small fire doors for personnel shall be the rating of EI 60R. Fire rating for sliding doors shall be minimum of EI 30R.

10.2. Exits

Exits and stairways leading to and from exits must be kept free of obstructions at all times. The exit doors shall be kept closed. If exit doors are kept locked there shall be a push bar release.

11. Canopies

The standard of fire prevention shall be the same as in the adjacent building. When the building is protected with sprinklers the same applies to the canopy. There should be no combustible materials under the canopy unless it is protected with sprinklers. In case the building is only protected with detectors then canopy has to be provided with fire detectors. If the building is not protected with any fire detectors then non combustible materials can be stored under the canopy.

12. Smoke ventilation system

In the event of a fire, smoke has to be removed from the building for three primary reasons: Firstly smoke contains hot combustible gases, which can cause flashover at a certain stage of a fire. Secondly, smoke makes fire fighting more difficult, because visibility is reduced and temperature can be too high for fire fighting. Thirdly, smoke causes corrosion and contamination damage to goods, machines and building structures that are exposed to smoke.

The smoke ventilation system must be provided for all fire compartments and that applies to production halls, warehouses, electrical rooms, hydraulic rooms and offices. The numbers of smoke vents needs to be defined individually.

When a hall is equipped with automatic fire fighting system, the smoke ventilation must be designed so that the smoke ventilation system does not hamper the function of the automatic extinguishing system. Therefore, the activation temperature of extinguishing system must be lower than the set temperature of smoke ventilation system.

Smoke ventilation can be arranged by using fire rated fans or smoke can be ventilated through smoke hatches. The required flow rates of the fans or areas of smoke hatches are dependant on the commodity in the respective hall.

The design criteria of the smoke ventilation must fulfil the local Building Code. The following figures can be given as a rule of thumb.

Category 1: Steel service centres with rack storages of 5m or below, packaging materials stored in a separate building. The required area of smoke hatches is 0,25% of floor area.

Category 2: Halls with large quantities of wrapping plastic, card board, timber, pipe works made of plastic or with rack storages higher than 5 m. The required area of smoke hatches is 0,5% of floor area.

Category 3: Halls with large quantities of oils, cables and other combustible materials. The required area of smoke hatches is a subject to a detailed calculation, 1-2% of the floor area.

The rule of thumb is that the area of the smoke vents has to cover 0,5 % of the floor area. ^[2]

13. Storages

13.1 Site yard storage

Combustible materials shall be piled with due regard to the stability of piles and under no circumstances higher than 4 metres.

Driveways between and around combustible storage piles shall be maintained free from accumulation of rubbish, equipment or other articles and materials.

The entire storage site shall be kept free from accumulation of unnecessary combustible materials. Weeds and grass shall be kept down and a regular procedure provided for the periodic cleanup of the entire area.

The method of stacking has to be solid wherever possible and in orderly and regular piles. No combustible material shall be stored outdoors within 30 metres of a building or a structure. However, the distance to a concrete or brick wall with no openings such as windows or doors can be 10 metres.

13.2 Indoor storage

The best practice for storing combustible materials is to have a separate fire compartment, which shall be protected according to its fire characteristics. In case combustible materials have to be stored in the production area the level of fire prevention shall be defined according to the fire risk and exposure.

High-risk areas need to be provided with automatic water sprinkler systems. Low risk areas shall be equipped with fire detection devices. Materials shall not be stored next to critical machinery, potential ignition sources or electrical cabinets. Walkways and truck aisles shall not be blocked and there has to be a clearance of 1 metre between the material stored and aisles.

13.3 Packaging materials

Packaging areas in general are areas with increased fire risk. Basically all packaging materials are combustible materials. The amount of packaging material in the site yard and inside the building shall be kept as a minimum. If possible, the amount of

packaging materials in the packaging area shall not be more than one day's requirement. If possible the packaging materials should be transported daily from the manufacturer or transported daily from a designated warehouse for packaging materials. Special attention shall be paid to the removal of wastes and to the overall standard of housekeeping.

13.4 Storage of flammable liquids

Flammable and highly flammable liquids must be used properly and stored safely. Only approved containers shall be used for storage and handling of flammable and combustible liquids. Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of personnel.

Plastic containers of flammable liquids shall not be stored inside the buildings. Ideally flammable liquid storage shall be in a detached building.

14. Fire prevention measures

14.1 Cable penetrations

All service penetrations have to be sealed and fire stopped with approved fire resistant materials. The fire rating of the cable penetration has to meet the same standard as the surrounding structure.

During construction work or installations temporary fire stopping has to be used. Recommended solution is to use expanding fire stopping bags.

14.2 Appliances

The ideal situation is that all pressurized systems, such as compressed air and propane, must be isolated and the machinery must be completely stopped and not just turned to stand-by mode outside working hours.

14.3 Gas cylinders

Gas cylinders have to be equipped with safety valves. Acetylene and oxygen hoses have to be equipped with flame and flash back arrestors, which are next to the pressure-reducing valve. Furthermore back flash valves have to be installed next to the burners. Hoses must be suitable for the gas in question.

14.4 Storing of gas cylinders

Preferably the gas cylinders should be stored in the site area outside the buildings in a cage that has a roof on top to protect the cylinders from the sun. There should be cages or containers for gas cylinders, which shall be marked to identify their content. The gas cylinders, which are in use inside buildings, shall have a gage for full cylinders and one for empty ones. The cylinders inside the building shall have designated places, which are easily accessible in case of emergency. These positions have to be marked in the rescue plan.

14.5 Battery charging

Charging of batteries would ideally happen during the working hours, if it is not possible, then the charging place must have a clear area of 2 metres around the charging place. Charging places need to be carefully set up in clear areas and not in racked storage areas.

14.6 Heating appliances

Process related heating appliances such as immersed heating appliances shall not be kept on outside working hours.

14.7 Extension cables

The use of extension cables should be minimal and used only when a temporary connection is necessary. Extension cords should not be used as a substitute for permanent electrical wiring and these should not be tied, stapled or fastened to ceilings or walls.

The cables and outlet should be checked periodically to ensure overheating is not occurring. If electrical wiring is needed permanently it shall be installed. The use of multiple adapters is not permitted.

14.8 Home appliances

Home appliances such as coffee makers, radios etc. are not allowed in the site unless purchased by the company. Any personal appliances shall not be brought to the site. All appliances with exposed heating elements should not be left unattended when in operation. Appliances should be unplugged after use and kept away from combustible materials. All the appliances have to be subject to regular inspection in conjunction with internal fire inspections.

14.9 Housekeeping

Housekeeping is an essential part of every-day fire prevention. Housekeeping shall be regarded as a natural part of efficient and high quality working. The implementation of development projects has improved the standard of housekeeping at the sites. The achieved level of housekeeping shall be maintained at all times.

14.9.1 Waste material

Waste material shall daily be removed from the buildings. Obsolete materials shall be stored in a designated place away from the production facility.

14.9.2 Walkways

Walkways shall be kept free of any items. Electrical cabinets, fire extinguishers, fire hydrants, control panels beside walkways shall be easily accessible. In case of vulnerable installations such as piping, electrical installations or special building structures, they shall be protected with a barrier.

14.9.3 Marking

There are special objects that need to be marked clearly. The reason to this is to have a fast reaction to an incident and the ability to operate efficiently and in a correct way. The marking also helps the personnel to keep the items in their designated places.

The exits shall be provided with signs that fulfil the local requirements. The location of fire fighting equipment shall be provided with signs that are visible from a distance and placed on higher level on a wall or building column. Push buttons for manually operated fire extinguishing systems and smoke ventilation systems shall be equipped with signs, which clearly show the area of activation.

Emergency shutdown valves for gas systems and hydraulic oils as well as main switches have to be marked with signs and accessible in case of an incident. Forklifts batteries shall always be charged in designated area, which has been clearly marked out. Waste bins shall also be placed in their own designated areas with painted markings. The same applies to official designated smoking places regardless are they in the buildings or in the site yard.

14.9.4 Smoking

Smoking inside the buildings is prohibited. Smoking is allowed only in designated areas, which should be preferably outside of any buildings. The no smoking policy must be introduced at every site and it has to be followed with no exceptions.

14.8.5 Usage of flammable liquids

When using flammable liquids the amount of liquid should be kept small, maximum the amount for a daily use and in dispensing cans. The cans in the production hall shall be kept in a separate cabinet made of steel. Big amount of aerosol cans have to be stored in an enclosed cabinet.

15. Hot work

15.1 Hot work permit

Hot Work permit is a document drawn up to prevent the fire and explosion hazards involved in hot work.

The purpose of a hot work permit is to provide effective control of a very hazardous operation. Hot work carried out outside permanent hot work stations must always be covered by a permit. The issue of permits needs to be done by a competent person for each hot work job area. That person understands the risks involved in the area. The permit should only be issued after a physical inspection of the site of the work to establish the conditions in the area at that time. Once satisfied that all conditions and controls will be sufficient the permit should then be issued for the shortest possible time.

15.2 Practise

The permit should not be issued for more than a single work shift or a day. Permits must relate to specific areas and jobs and not to be issued on the basis of multiple jobs in one department or site. Each job must be risk assessed and covered by its own permit. Where a job will take more than one shift or a day the permit must be re-issued by a competent person following a further risk assessment which will take into account any changes since the previous permit was issued. Interim workplace inspections should also be made by a competent person to ensure that the conditions have not changed and that the controls set down in the permit are actually being followed by the permit holder. The person issuing the permit must be made fully accountable for the job and for the risk assessment he carries out.

The definition of hot work must be fully understood by all those involved and should not just include flame cutting, welding etc. but include grinding operations producing sparks and all application of heat.

There can be means of re-validation of an existing permit by having a suitable part of the permit form available for the competent person to re-validate the permit but only for one shift/a day period and having carried out a further physical inspection of the work place to establish that the risks have not changed since the original permit was issued.

Insurers expect the highest levels of controls over hot work and would strongly resist any reduction in the permit system or allowing for multiple job sites to be included on a single permit. The issue of permits to cover for more days duration is considered to be unacceptable as the required level of control cannot be provided for that time nor will the permit take into account any changes in the physical conditions during that time i.e. oil leak or a spill. Permits allowing multiple site working and long duration do not provide any effective controls and should not be permitted.

16. Hydraulic systems

16.1 General

The hydraulic systems consist of three main parts; pumping unit, pipe work and hydraulic drives. All machines are equipped with emergency stops that isolate the machines from hydraulic, pneumatic and electrical power. Emergency stop must be accessible also in the event of a fire.

The fire risk in hydraulic oil can be prevented by using non combustible water based hydraulic liquids, such as 20/80 or 5/85 oil-water mix. If water based liquids are not suitable for hydraulic systems following prevention measures are to be used.

16.2 Small hydraulic system in a low hazard area

A small independent hydraulic system, which is in a low hazard area, is not considered as a big risk. Therefore, mineral oil can be used without any special prevention needs.

16.3 Hydraulic system in high hazard area

A hydraulic system, which is in a high hazard area or it is an extensive system the fire prevention shall be according to a special design. In this case the standard for the sprinkler protection of rolling mills shall apply using high velocity water spray protection.

16.4 Extensive hydraulic system in low hazard area

An extensive hydraulic system, which is in low hazard area the hydraulic pumps need to be located in their own fire cell, which must be provided with automatic high velocity water spray system. The hydraulic units, which have pressurized oil accumulators, have to be equipped with block and bleed valves.

17. Automatic fire detection and extinguishing systems

17.1 General

A fire detection system is provided primarily to give an early warning of fire in the premises at all times. The aim is to reduce the loss of property in a fire by its early detection. It may also be a requirement of the insurers or authorities.

Fire detection devices are effective if the response time of the fire brigade is short enough. The delay of alerting the fire brigade and the actual response time has to be taken into account when assessing the total delay.

Automatic fire extinguishing systems are required in places where fire can develop so quickly that fire detectors are not giving a warning early enough. Automatic fire extinguishing systems are combined fire detection and extinguishing systems, therefore they have to be connected to a manned location, such as a gatehouse or a fire brigade.

Different types of fire detection devices and automatic fire extinguishing systems have their own special features. Fire prevention system used must always be suitable for the place where it is installed.

17.2 Automatic fire detection

Automatic fire detection systems can be provided to cover the entire premises or specific parts. The fire detection systems usually comprise smoke and heat detectors. Other special types of detectors e.g. flame detectors, sampling systems and beam detectors may be installed in premises to cover specific risks.

17.3 Gas extinguishing systems

Automatic gas extinguishing systems can only be used in relatively small rooms or enclosures. Gas extinguishing systems are typically used in critical areas of a business operation such as, computer / server rooms, electrical switchgear rooms, and other high-risk areas where water damage must be avoided. They are activated of a signal from fire detection system.

The commonly used agents are CO₂, Argon, Argonite, and FM200. Gas extinguishing systems are mostly activated by automatic fire detection systems. The extinguishing agents are dangerous to people. Therefore, the locations must be provided with alerting systems and exits.

The sprinkler procurement also applies to the purchasing of gas extinguishing systems.

17.4 Automatic water sprinkler systems

An automatic water sprinkler system is an active fire protection measure, consisting of a water supply system, providing adequate pressure and flowrate to a water distribution piping system, onto which fire sprinklers are connected. Sprinklers shall be installed to areas with high fire loadings. Large production halls and warehouses can only be protected by water sprinklers.

Standard sprinkler systems are of wet type. A starting fire opens up the first sprinkler head, which reduces the water pressure in the pipework that will send an alarm signal. In most cases no more than one sprinkler head opens up. Therefore the water damage

is mostly minor. Water sprinkler systems are highly effective in areas dealing with wood, cardboard, cables, plastics and mineral oil.

In areas where the sprinkler piping may get frozen dry systems are used. Deluxe systems are used in areas where fire can develop very quickly. All of the sprinkler heads activate simultaneously in a fire. Typically these systems are used in hydraulic cellars.

17.4.1 Sprinkler procurement

Different phases of sprinkler procurement shall be clearly separated. The first step is to define the design criteria, which is given by the Corporate Risk Management and Insurance parties.

Secondly is the detailed planning of the system, which is done by a certified sprinkler Design Company and approved by the Corporate Risk Management and Insurance parties.

An approved sprinkler company shall carry out sprinkler installations. After the completion of sprinkler installations, a certified independent inspection party must do final inspection. Sprinkler installations are a subject to regular inspections and testing by own personnel in accordance with national standards and by an external certified inspection party.

17.4.2 Impairment procedures

Fire protection systems shall be functional at all times. There has to be clear instructions regarding the situation when these systems have to be disconnected. In case of disconnecting any system for any reason the head of fire safety has to be informed and necessary precautions have to be taken to ensure fire safety in the area where fire protection systems have been disconnected. When the system disconnection lasts more than 24 hours a notification must be sent to Corporate Risk Management.

18. Fire safety training

Fire prevention training must be an essential part of safety training for all employees. All employees have to confirm with their signature that they have received the training in order to verify that the company has fulfilled its legal obligations regarding safety training. Safety training is covered in the following paragraphs.

18.1 Rescue plans

Every site shall have a rescue plan. A rescue plan shall include a risk assessment and preparedness in the case of an emergency, preventive measures, possibilities for evacuation and protection; organisation for extinguishing and rescue, people responsible for safety issues and the use of external rescue forces, equipment required for fire extinguishing, rescue, first aid according to the assumed case of emergency, instructions for accident, emergency and hazards and a plan how to inform the personnel.

18.2 Evacuation

The primary concern in the event of a high risk incident is to evacuate the personnel and the visitors from the building as quickly and as safely as possible. Therefore, sites must have an entrance and exit procedure. Employees must be familiar with the evacuation plan in advance. Evacuations must be practised in accordance with local regulations in order to get used to the evacuation procedures.

18.3 Fire drills

Purpose of fire drills is to provide personnel with essential information and to inform them of what action to take in the event of a fire, so that they may be evacuated from buildings in the safest possible way.

Fire drills must be arranged at regular intervals depending on the level of hazard and in the light of previous evacuation exercises carried out in the structure. Fire drills must be well prepared to obtain the maximum information while causing the minimum disruption to current activities. A report will be produced on each drill in

order to identify any shortcomings in the application of the instructions and to recommend further work in order to improve the safety of the personnel and property. The fire drills shall be organized in co-operation with local fire brigade and possibly with other external parties involved.

18.4 Proper use of initial fire fighting equipment

Initial fire fighting equipments consists of fire-blankets, fire hose reels and portable extinguishers and powder extinguishers. Personnel must be aware of the initial fire fighting equipment that is available in the buildings and they must know the capabilities of the different types of extinguishers.

18.5 Emergency regime

There has to be a pre-prepared emergency regime for the machines, which pose special high risks. The emergency regime shall consist all the necessary isolation and shutdown procedures of the machinery and process. Emergency regimes shall be practised in regular intervals to make sure that the personnel are familiar with emergency routines and equipment is functional. The emergency power isolation, cooling systems and extinguishing systems shall also be included in the emergency regime.

19. Category specific instructions

19.1 Category D and C

19.1.1 Fire safety responsibility

The responsible person for fire safety has to be nominated. He will conduct fire safety inspections, which can be done either internally or jointly with a local fire chief.

19.1.2 Integrity of building structures

The building has to be divided in fire sections so that different functions are located in separate fire compartments. Sprinkler protection is not always required in these facilities.

19.1.3 Automatic fire alarm system

Automatic fire alarm system has to be installed. The system shall be a certified one and it has to cover all areas. Alarms shall be connected either straight to the fire station or to the security company. Response time must be evaluated.

19.1.4 Water supply

A water supply of sufficient volume shall be available to maintain a fire protection system at full rated capacity when combustible materials are present.

The best practice is to have a fire post on site but it is also accepted if the fire post is in the street next to the site. Flow rate of the city mains is required to be at least 1500 l/minute. The expected flow rate for initial fire fighting to the site is the need of two fire posts at the same time, which is 500 l/min.

19.1.5 Fire hose and connections

An approved hose valve shall be provided at each outlet for attachment of fire hoses.

19.1.6 Portable fire fighting equipment

Adequate number of fire extinguishers shall be provided and type of extinguisher has to be determined according to the area in question. Powder extinguishers cannot be used in electrical rooms due to corrosive reaction. CO₂ extinguishers are preferred in these areas. Portable fire extinguishers shall be inspected periodically and maintained.

19.2 Category B specific instructions

19.2.1 Water supply

A water supply of sufficient volume shall be available to maintain a fire protection system at full rated capacity when combustible materials are present.

The best practice is to have a fire post on site but it is also accepted if the fire post is in the street next to the site. Flow rate of the city mains is required to be a minimum of 1500 l/minute.

The expected flow rate for initial fire fighting to the site is the need of two fire posts at the same time, which is 500 l/min.

19.2.2 Fire hose and connections

An approved hose valve shall be provided at each outlet for attachment of fire hoses.

19.2.3 Fire detection systems

It is recommended to install an automatic fire detection system to the production hall and to the offices. In some areas it may be impossible to install a fire detection system. In these areas monitoring cameras shall be considered.

19.2.4 Automatic fire alarm system

Automatic fire alarm system has to be installed and it has to cover all areas. Alarms shall be connected either straight to the fire station or to the security company.

19.2.5 High hazard machines and production lines

Protection of high hazard machines shall be defined based on a risk assessment. The level of fire protection shall be consulted with Corporate Risk Management.

19.3 Category A specific instructions

19.3.1 Water supply for fire fighting

Ideally water supplies should be taken from a dedicated inexhaustible fire main.

Water supplies should be secure for a minimum of one hour.

Where electric pumps are used to boost the pressure and flow of the water supply, electric power should be secured through alternative supply, including on site generation. Where power supply is interruptible, then diesel engine driven pumps should be provided as a backup.

19.3.2 Sprinkler water supply

Where stored water is available, the storage capacity should be for a minimum of one hour. However, where a reliable infill can be established, this may be taken into account in calculating the total capacity. Electrical pumps must be backed up with diesel pumps.

Where water for water based extinguishing systems, fire fighting and emergency cooling is taken from the same water system the maximum flow rate must be sufficient to feed all the functions at the same time.

Preferably firewater pipelines should be a looped system with division valves. This allows temporary by- pass.

19.3.3 Areas of sprinkler protection

High-risk areas, where water-extinguishing systems are suitable, sprinkler protection is required. The most important areas are the mill stand and grinding lines. In addition to these other areas where sprinkler protection is to be used, consist of high bay storages, oil filled transformers, cable tunnels, interleaving paper storages, hydraulic rooms and LPG (Liquid Petroleum Gas) tanks.

19.3.4 Operational activation of sprinkler systems

All water based fire fighting systems shall be automatically activated with some exceptions in special applications. Manually activated systems can be installed in areas where operators are continuously present and an automatic system is impossible to install.

20. Protection of mill stands

20.1 General

It is important to develop procedures covering both the actions to be taken and those that should not be taken, in the event of a fire on a rolling mill. Delays can be expensive, both in terms of structural damage to the plant and to the equipment and also in terms of business interruption.

20.2 Hydraulic systems

All hydraulic systems should be isolated immediately if a significant fire is discovered on the plant. Hydraulic pipe/hose bursts and atomised oil can result in a very rapid fire spread over a large area.

The facility to isolate hydraulics should be available in the mill pulpit. Clearly the safety implications of isolating hydraulics must be considered but must also be weighed against the likely increase of the severity of the fire if no such actions were taken.

Always a preferred option on any mill is the use of 80/20 high water content hydraulic fluids rather than standard mineral oils. ^[4]

20.3 Lubrication systems

Whilst lubrication systems operate at lower pressures than hydraulic systems, they can contribute to the intensity of fire and should also be isolated immediately when a fire is discovered. Isolation facilities should be provided in the mill pulpit.

20.4 Roll coolants

Where the roll coolants are mineral oils (as on Z Mills), again isolation facilities should be provided in the main pulpit and isolation should be carried out immediately after a fire is discovered.

Where the coolants are water or largely water (97% water 3% oil for example) then the pumps should be left running. High water content fluids will inevitably result in a build up of oil deposits on the mill structure, which increase the overall fire loading and will burn readily in a major fire.

It is important in the event of a fire to keep the high water content roll coolants pumping through the rolls and down the mill stand as it provides valuable supplementary cooling. ^[4]

20.5 Manual operations of sprinkler systems

Where the facility to operate the separate zones of a deluge system manually from the pulpit has been provided, precise instructions should be issued before the facility is used and then only with the authority of an authorized person.

Operation of too many zones may result in poor water distribution and consequential failure of the protection.

20.6 Maintenance

During down days for maintenance, hydraulic lubrication and roll cooling systems will all be isolated. In the event of a fire during a maintenance period, an immediate action should be taken to start the pumps to the roll cooling systems (where high water content fluids are used) in order to provide valuable protection to the rolls and lower parts of the mill stand. Where the facility to manually operate fire shutters in mill fume extract ducting has been provided, it is recommended that the shutters to be closed during maintenance periods in order to reduce the speed of a fire spread. ^[4]

20.7 Bearing monitoring regimes

Where possible, the monitoring of the temperature and particularly the vibration, should be provided on all bearings, with a connection back to alarms in the pulpit.

Whilst it is recognized that this may be difficult to achieve, particularly on work rolls, it is a valuable early warning system and should be considered. ^[4]

20.8 Hydraulic hoses

Serious consideration should be given to the provision of reinforced fire rated hoses on all hydraulic systems on mills.

20.9 Housekeeping

Regular housekeeping inspections should be carried out particularly in areas to the rear of the stands and in coil car and roll change pits. Poor housekeeping standards can have a major impact on fire loadings and the intensity of a fire.

20.10 Mill fume extraction ducting

Mill fume extraction ducting should be cleaned regularly to avoid the build up of oil deposits. The fire shutters in any such ducting should also be exercised regularly to ensure that they are maintained in a safe working order.

21. Conclusions

Over time, an increased understanding of the many factors that contribute to the risk of fire has led to many developments in the fire protection. Improvements in fire protection systems, as well as increased use of systems through fire protection and loss control engineering have resulted in an overall decrease in the severity and costs of fires.

The factors affecting insurance premium rate demonstrates that, although building construction is one of the factors, there are many other equally important considerations when determining a property, its fire risk, and hence its insurance premium. A similar level of fire safety can be achieved by various means. The sum effect of all fire safety factors should be weighed, and a variety of fire protection measures can be assessed and market factors considered, optimising both fire safety and overall cost for a building.

Preventing fire losses has always been more important to the insured than to the insurer. Although a particular fire loss may not be significant to an insurance company, to the owner involved such a loss is not only a direct financial issue but it also impacts many other important business aspects, such as company image.

This Corporate fire safety standard is designed to assist sites to plan, implement, develop and improve fire safety. The long-term ambitious goal is to achieve a good level of fire safety at all sites according to Outokumpu standard. The Corporate Risk Management is prepared to provide the support necessary to achieve this goal.

22. References

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