Guideline for the prevention, early detection and suppression of fires in coal mines

MDG 1032

Produced by Mine Safety Operations branch,
Industry & Investment NSW

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FOREWORD

This guideline (MDG 1032), *Guideline for the prevention, early detection and suppression of fires in coal mines,* has been compiled to assist in formulating a risk management system approach for prevention, early detection and suppression of fires in coal mines. It can be considered good industry practice for mitigating the risks associated with the fires in coal mines at this time. The guideline recommends minimum standards.

This is a 'Published Guideline'. Further information on the status of a Published Guideline in the range of OHS instruments is available through the NSW Department of Primary Industries – Mine Safety Legislation Update Number 2/2001. The range of instruments includes:

- Acts of Parliament
- Regulations made under the Act
- Conditions of Exemption or Approval
- Standards (AS, ISO, IEC)
- Approved Industry Codes of Practice (under the OHS Act)
- Applied Codes, Guidelines or Standards (under clause 14 of the Coal Mines (General) Regulation 1999)
- Published Guidelines
- Guidance Notes
- Technical Reference documents
- Safety Alerts

The principles stated in this document are intended as general guidelines only for the assistance of Coal Operators and other employers in devising safety standards for the safe working of mines. Coal Operators and other employers should rely upon their own advice, skills and experience in applying safety standards to be observed in individual coal workplaces. Adherence to the guidelines does not itself assure compliance with the general duty of care.

The State of New South Wales and its officers or agents including individual authors or editors will not be held liable for any loss or damage whatsoever (including liability for negligence and consequential losses) suffered by any person acting in reliance or purported reliance upon this Guideline.

The MDG 1032 *Guideline for the prevention, early detection and suppression of fires in coal mines* was distributed to industry for consultation and comment through the Coal Safety Advisory Committee.

Industry & Investment NSW has a review time set for each Guideline that it publishes. This can be brought forward if required. Input and comment from industry representatives will be much appreciated. The Feedback Sheet at the end of this document can be used to provide input and comment.

R Regan
Director Mine Safety Operations

TABLE OF CONTENTS

SECTION 1 PURPOSE AND SCOPE

1.1 TITLE

This is MDG 1032, the guideline for *'the prevention, early detection and suppression of fires in coal mines'*.

1.2 PURPOSE

A fire in a coal mine is considered a hazardous event.

The purpose of the guideline is to control risks to the health and safety of people, (and control risks to plant, infrastructure and the environment) from the event of a fire in a coal mine by providing guidance in –

a) undertaking a risk management approach to fire hazards; and

b) by recommending minimum standards which should be followed.

It is envisaged all fire risk scenarios in a coal mine be identified through a fire risk assessment, with appropriate risk controls being implemented to prevent, detect and suppress any fire (that may occur in a coal mine) such as to minimise risks to health and safety of people.

1.3 SCOPE

This guideline provides assistance in identifying potential fire hazard areas of the coal operation (fuel and heat sources), assessing the fire risk and implementing appropriate risk controls, refer Section 2.

The guideline applies to all coal mines in New South Wales and provides recommended minimum fire protection requirements for –

a) surface plant and infrastructure (such as buildings, offices, surface mobile plant, processing plants, coal stockpiles, conveyor belts and other fixed plant), refer SECTION 3.

b) open cut parts of a coal operation, refer SECTION 4; and

c) underground parts of a coal operation, refer SECTION 5;

Notes:

1. Compliance with the guidelines does not in itself discharge the operator's duty of care.
2. This guideline does not cover emergency escape systems (refer MDG 1020) nor spontaneous combustion (refer MDG 1006) nor other legislative requirements for the control of fires and explosions.

1.4 APPLICATION

This guideline should be used by Coal Operators and mine owners when –

a) undertaking fire hazard risk assessments to fulfil OHS obligations;

b) in developing mine emergency systems and major hazard management plans for fire and explosion;

c) in reviewing the adequacy of current fire risk controls, including following a fire event; and

d) when auditing the mines fire and explosion management plan and/or emergency management system.

1.5 APPLICABLE LEGISLATION

Principal safety legislation for coal mines includes:

- The *Occupational Health and Safety Act 2000* (OHS Act)
- The *Occupational Health and Safety Regulation 2001* (OHS Regulation)
- The *Coal Mine Health and Safety Act 2002* (CMHS Act)
- The *Coal Mine Health and Safety Regulation 2006* (CMHS Regulation)

Notes:

1. Details of the legislation can be found at www.legislation.nsw.gov.au/ or www.dpi.nsw.gov.au/minerals/safety/legislation
2. Some relevant clauses of the *OHS Regulation 2001* and the *CMHS Regulation 2006* are provided in Appendix 6.1.
3. There may be other legislation which is applicable.

1.6 REFERENCES

A partial list of references and associated documents is included in Appendix 6.1 for reference.

1.6.1 Abbreviations

AS	Australian Standard
AS/NZS	Australian / New Zealand Standard
EMS	Emergency Management System
OHS	Occupational Health and Safety

1.7 DEFINITIONS

For the purpose of this document the definitions below apply:

1.7.1 Combustibility

The ease with which a substance or material is able or likely to catch fire or burn.

1.7.2 Combustible Gas

A gas that will burn when it is within its flammable range.

1.7.3 Combustible Liquid

A liquid that has a flash point above 61^0 C.

1.7.4 Combustible Metal

A metal that will burn under certain circumstances.

1.7.5 Competent Person

For any task means a person who has acquired through training, qualifications or experience, or a combination of them, the knowledge and skills to carry out that task.

1.7.6 Designed flow rate

Means the flow rate that the fire water reticulation system is designed to deliver at each fire hydrant.

Note: This should be determined by the fire risk assessment, but is typically 10 l/s at the hydrant, which allows sufficient flow for two fire hoses to operate simultaneously.

1.7.7 Dynamic pressure

Means the water pressure under flow conditions.

1.7.8 Explosability

The ease with which a substance or device may suddenly produce a volume of rapidly expanding gas.

1.7.9 Fire hydrant

An assembly installed on a branch from a water pipeline, which provides a valved outlet to permit a supply of water to be taken from the pipeline for fire fighting.

1.7.10 Fire depot

Means a depository of fire equipment readily available and suitable for connecting to an adjacent inbye fire hydrant.

Note: Typically this provides for a quick response to fight any fire in the fire risk area intended to be covered by the adjacent fire hydrant.

1.7.11 Fire station

Means a depository of fire equipment suitable for dispatch to underground parts of a coal mine from an area on the surface of the mine adjacent to the transport entry to the mine.

Note: Typically this provides for additional fire equipment support for a fully developed fire.

1.7.12 Fire substation

Means a depository of fire equipment strategically located in specific districts throughout the mine.

Note: Typically this provides for a quick response for additional fire equipment support to that provided at the fire depot.

1.7.13 Flammability

The ease with which a substance is capable of catching fire.

1.7.14 Flash point

The lowest temperature at which a substance produces enough vapour to ignite and burn when an ignition source is applied but will stop when the source is removed.

1.7.15 Ignitability

The ease with which a substance or material is able or likely to catch fire or burn.

1.7.16 Flammable range

The range of concentrations, expressed as a percent by volume, over which a gas or vapour is flammable.

1.7.17 Must

Indicates a mandatory legislative requirements, (i.e. a requirement of an Act or Regulation)

1.7.18 Operator

Means the Coal Operator as defined by the *Coal Mines Health and Safety Act 2002*.

1.7.19 Residual pressure

The remaining water pressure measured at a point within a system at the designed flow rate.

1.7.20 Safety of people

Applies to any person who may be harmed by the effects of a fire and includes -

a) machine operators;

b) people fighting a fire;

c) people in the vicinity of a fire; and

d) people inbye or down stream of a fire who may be affected by the fire effects, refer clause 2.4.5.

1.7.21 Shall

Indicates a statement that is ‘strongly recommended’.

1.7.22 Should

Indicates a statement is ‘recommended’.

1.7.23 Static pressure

The pressure in the line at no flow.

1.7.24 Volatility

The ease with which a substance will evaporate.

SECTION 2 FIRE RISK MANAGEMENT

2.1 LEGISLATION

2.1.1 General

The OHS Act imposes a general obligation to ensure the health, safety and welfare of people at work through a process of identifying hazards, assessing risks and eliminating or control risks. In addition to the general duty of care, the OHS Regulation and the CMHS Regulation provide specific provisions in relation to fire risk management and fire risk control measures in coal mines and coal workplaces.

A brief summary of some specific provisions includes –

Note: This summary is intended as a guide only. The legislation must be referenced for exact provisions. Legislation wording is provided in Appendix 6.1.

2.1.2 Fire risk management

a) Clause 62 of the OHS Regulation requires fire risks be controlled by –

   (i) eliminating activities which have potential to generate explosive atmospheres or otherwise minimise through provision of adequate ventilation;

   Note: In a coal operation, such activities may include but be not limited to – use of cutting equipment, underground coal mining, working in confined spaces, etc.

   (ii) eliminating potential ignition sources, and providing other measures necessary to control the risks; and

   (iii) regular monitoring to ensure effectiveness of control measures taken with respect to potential ignition sources.

b) Clause 35 of the CMHS Regulation requires a fire and explosion (major hazard) management plan to provide for –

   (i) regular assessment of the fire and explosion risk; and

   (ii) control measures which effectively manage identified risks.

c) Clauses 77 & 78 of the CMHS Regulation require the assessment of risk of fire and the early detection and control of fire on any conveyor belt in a reclaim tunnel or other enclosed space.

2.1.3 Emergency management

Clause 45 of the CMHS Regulation requires the contents of the emergency management system to address –

a) fire officers and fire teams;

b) supply and maintenance of fire fighting equipment;

c) workforce training in the use of fire fighting equipment;

d) provision and supply of water storage and reticulation;

e) emergency fire procedures; and

f) reporting and replacement of damaged fire equipment.

2.1.4 Fire fighting plans

Clause 48 of the CMHS Regulation requires a fire fighting plan of the underground parts of the coal operation to be updated.

2.1.5 Control of fire risk

Clause 5 of the OHS Regulation requires risks (that cannot be reasonably eliminated) to be controlled in a particular order.

Fire risks should be minimised to the lowest level reasonably practicable and controlled in the following order:

a) Eliminate the fuel and/or ignition sources, if practicable

b) Substitute the fuel and/or ignition source to one of a lesser hazard.

c) Segregate the fuel and ignition source, (isolating the hazard).

d) Use engineering means to –

   (i) minimise the risk of initiating a fire;

   (ii) provide systems for the early detection of fires; and

   (iii) provide systems to suppress and extinguish a fire.

e) Develop emergency procedures for early warning, fire suppression and the safe egress of people.

f) Use of personal protective equipment (PPE).

Note: A combination of methods may be required to minimise the risk to the lowest level reasonably practicable.

2.2 FIRE RISK MANAGEMENT PLAN

2.2.1 General overview

The fire and explosion (major hazard) management plan must state how the health and safety of people who work at or are affected by the coal operation will be protected from a fire hazard.

The fire and explosion management plan should be based on a risk management approach to safety, and should be an integral part of the mine's Emergency Management System (EMS).

In relation to fire risk management, each of the following should be addressed:

a) Fire hazard identification – fuel sources, ignition (heat) sources, oxygen sources.

b) Fire risk assessment and risk control.

c) Safe systems of work (SWP, JSA etc).

d) Consultation with all stakeholders.

e) Provision of adequate information, instruction, training and supervision on fire hazards and fire risk controls.

f) Monitoring, review and revision of the fire risk management process.

2.2.2 Fire risk management process

A fire risk management process is the systematic application of management policies, procedures and practices to identify, analyse, control, monitor and review fire risks for –

a) plant; and

b) locations throughout the mine.

The fire risk management process should be carried out in accordance with ***Figure 1*** below and in accordance with MDG 1010, AS/NZS 4360, AS/NZS ISO 31000, or equivalent risk management standard.

Previous industry fire experiences on similar equipment and in similar circumstances should be

considered in the risk management process, refer Appendix 6.2 for details of fire incidents.

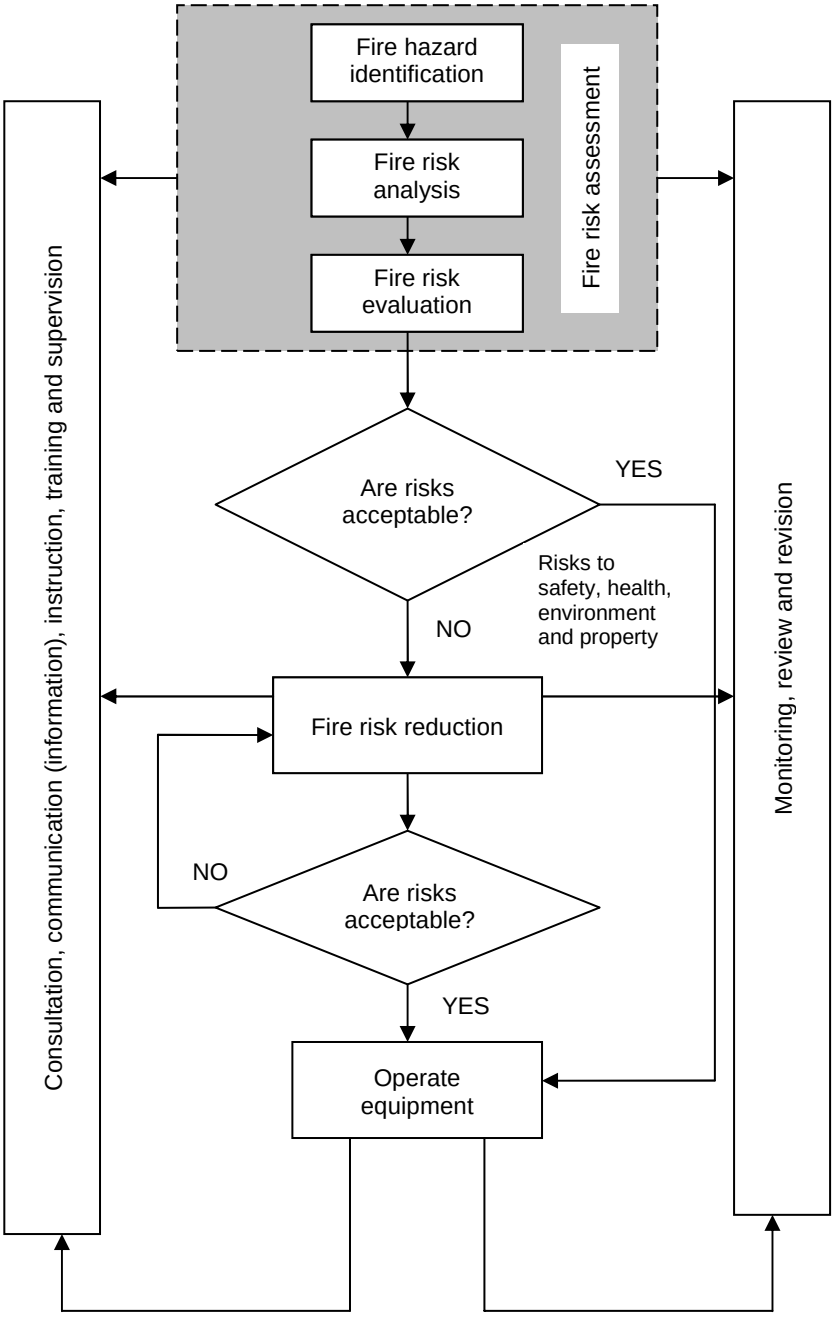

Figure 1 - Fire risk management process

2.2.3 Consultation

Employers are required by the OHS Act to consult with employees when taking steps to assess and control workplace risks.

Note: Further guidance can be obtained in Chapter 3 of the OHS Regulation and in the 'OHS Consultation' Code of Practice 2001, refer http://www.workcover.nsw.gov.au/

Consideration should be given to including the following people in the consultation process:

a) Fire officer.

b) Management.

c) Mines rescue trained people.

d) General workforce in the area.

e) Maintenance people.

f) A person competent in fire protection design.

g) Designer or supplier.

h) Insurer.

i) Site check inspector

2.3 FIRE HAZARD IDENTIFICATION

2.3.1 General

All fire hazards in a coal mine must be identified (in accordance with legislation) and dealt with so that they are effectively eliminated or otherwise controls established to minimise the risk to health and safety to the lowest level reasonably practicable.

Note: A potential fire hazard is the interaction of a fuel source and an ignition (heat) source in an oxygen rich environment.

Fire hazards should be identified in accordance with the process of ***Figure 2*** below.

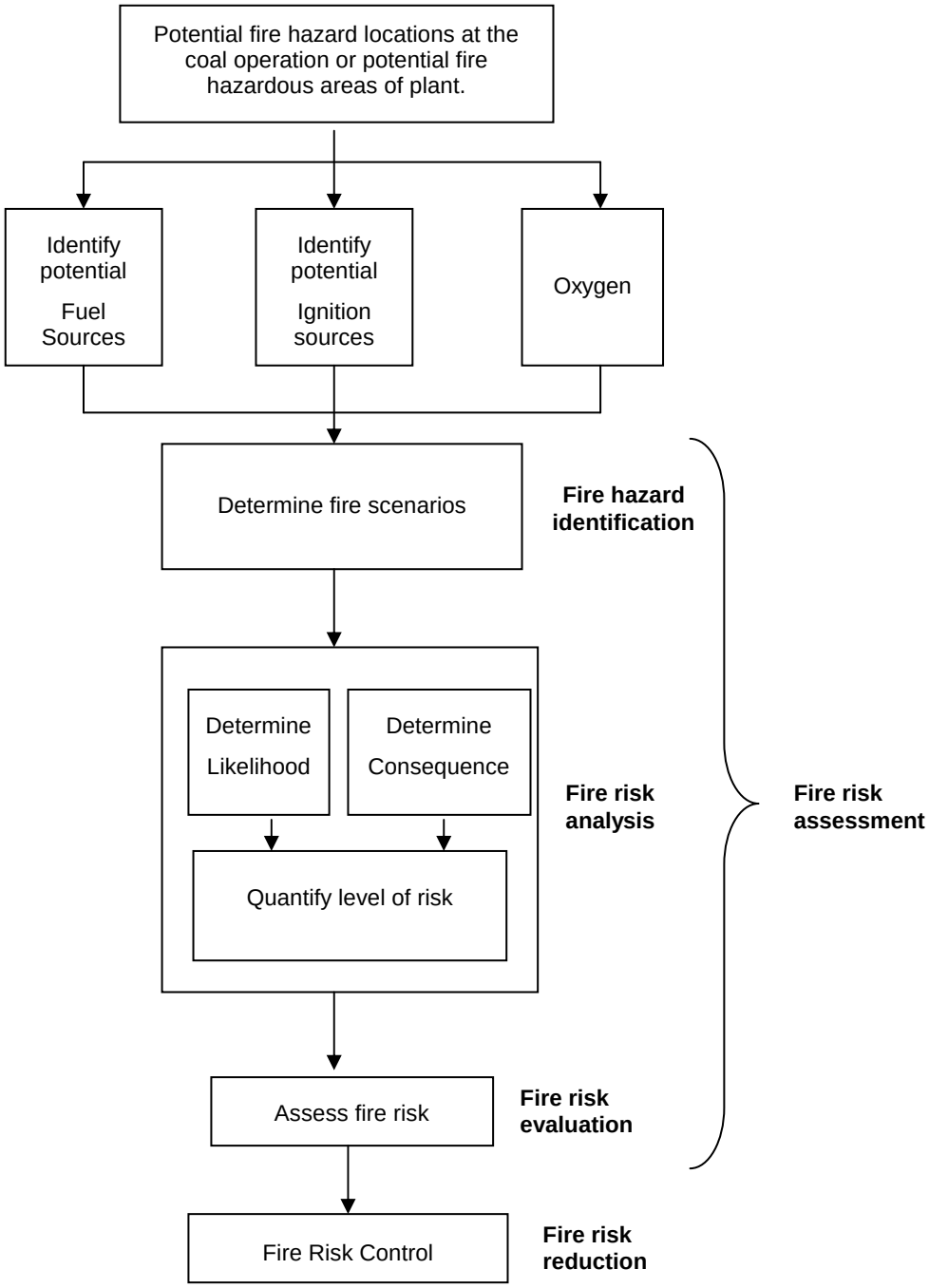

Figure 2 - Fire risk assessment

Notes:

1. Examples of typical fire hazard locations commonly found in coal mines and fire hazardous areas of plant is provided in clause 2.3.4
2. Appendix 6.2 provides information of previous fire incidents.

2.3.2 Fuels

Common fuel sources typically found in coal mines include –

a) ***Class A*** fuels involving ***carbonaceous solids***, which normally burn under the formation of a glow such as (but not limited to) –

   (i) *environmental* - coal dust, coal stockpiles and other coal deposits such as longwall goafs (spontaneous combustion);

(ii) *plant materials* – non-metallic materials such as textiles, rubber, plastics, timber, urethane, electrical insulation, fabrics, tyres, carbon, etc.; and

(iii) *Operational materials* – rags, paper, timber, plastics, etc.

b) ***Class B*** fuels involving ***flammable and combustible liquids*** such as (but not limited to) –

(i) *plant* – diesel, petrol, hydraulic oil, brake fluid, greases; and

(ii) *Operational materials* - such as solvents, degreasers, alcohol, fuel, etc.

c) ***Class C*** fuels involving ***combustible gases*** such as (but not limited to) –

(i) *environmental* - methane, hydrogen, carbon monoxide, etc;

(ii) *plant* - fuel vapour, LPG, etc; and

(iii) *Operational materials* - such as acetylene, hydrogen, etc.

d) ***Class D*** fuels involving ***combustible metals*** such as magnesium, aluminium, lithium, sodium, potassium and their alloys.

e) ***Class E*** fires involving ***electrically energised equipment*** e.g. fuels of any class.

2.3.3 Ignition (heat) sources

Common ignition sources found in coal mines include (but not limited to) –

a) ***Heat energy*** – such as diesel engines, exhaust systems, turbochargers, pumps, heat exchangers or radiators, brakes, hydraulic systems, tyres, hot work (cutting and welding), contraband in underground mines (naked flame, arcing), etc;

b) ***Electrical energy*** – such as electrical arcing, static electric discharge causing arcing/sparking, cables overheating, lightning, transformers, optical energy;

c) ***Mechanical energy*** – such as frictional heating (from failed component surfaces rubbing or bearings), frictional sparking (from failed components, impact damage, grinding, continuous miner or shearer picks), strata failure (piezo-electric or frictional);

d) ***Chemical energy*** – such as spontaneous combustion of coal, contraband, chemical reactions (chemical used on site reacting in process or with another chemical), stockpile heating's, etc.

e) ***Pressure energy*** – such as shotfiring; and

f) ***Radiant energy*** – such as welding, overheating of motors, heated surfaces.

Notes: In underground coal mines –

1. The temperature of all external surfaces should be less then 150^0C to prevent coal dust igniting; and
2. The temperature of a spark from steel striking aluminium may have potential to ignite a methane environment.

2.3.4 Fire hazard locations

Fire hazard identification should cover the whole of coal operation. Typical fire hazard locations in the coal operation may include (but not limited to) –

a) Surface plant infrastructure

(i) Surface parts – office buildings, workshops (hot work areas,), flammable material storage areas (pressurised flammable gas, fuels, oils, solvents, greases, etc.), bush fires, electrical switch rooms, overhead power lines.

(ii) Preparation plants – multi-storey buildings and structures fire hazards may pose different risks depending on the level above ground, (hot work, plant/machinery failure,

coal dust spillage/accumulations, flammable materials).

(iii) Rail and road delivery terminals – plant/machinery, haulage equipment, coal dust spillage/accumulations.

(iv) Coal handling parts – Reclaim tunnels (coal spillage/accumulations, coal dust, methane, conveyor belts, feeders, flammable materials, hot work); materials handling bins (coal dust, methane); and stockpiles (heating, mobile plant).

b) Open Cut or sections of open cuts

(i) Open cut parts – travelling roads, the cut itself.

(ii) Mobile plant - trucks, excavators, drag lines, shovels, dozers, etc.

(iii) Fixed plant - conveyor belts; coal handling machinery.

(iv) Storage areas - explosive magazines, fuels.

(v) Electrical transformers and switch rooms.

c) Underground parts

(i) Face parts – longwall, continuous mines, bolting plant.

(ii) Outbye parts – travelling roads, drifts, methane drainage lines.

(iii) Return parts – returns, sealed areas, goaf areas, auxiliary/ventilation fans.

(iv) Mobile plant – LHD, man transport.

(v) Fixed plant – Conveyor belt systems, feeders, crushers bins.

(vi) Electrical – transformers, gate end boxes, cables, battery charging stations.

2.3.5 Hazardous areas of plant

Fire hazard identification should cover all plant in use. Typical fire hazardous areas of plant may include (but not limited to) –

a) Mobile plant – refer AS 5062 and MDG 15 for guidance.

b) Conveyor belt systems – coal spillage/accumulations, coal dust, brakes, idler/pulley failure, fluid couplings, belt rubbing, belt/pulley slippage, static charge.

c) Underground face equipment – frictional ignition of methane, bearing failures, mechanical component failures, mechanical friction, hose failures, fluid couplings, coupling failures, accumulations of coal, accumulations of oil/grease, cooling system failures.

d) Electrical – overheating, short circuit.

2.4 FIRE RISK ASSESSMENT

2.4.1 General

The fire risk assessments should be in accordance with MDG 1010, or equivalent recognised standards such as the '*National Minerals Industry Safety and Health Risk Assessment Guideline*'.

A fire risk assessment process should be in accordance with ***Figure 2*** above and should identify and document, refer 2.9 –

a) all potential fuel sources in the mine, refer 2.3.2;

b) all potential ignition sources in the mine, refer 2.3.3;

c) all potential fire risk areas of the mine and fire risk areas of plant used in the mine, refer 2.3.4 and 2.3.5;

d) all possible fire risk scenarios (what can happen?, when/where can it happen?, why/how can it happen?) for each fire risk area;

e) the fire effects, refer 2.4.5;

f) fuel properties and oxidation, refer 2.4.7;

g) the maximum reasonable consequence and likelihood for each fire risk scenario;

h) the risk to health and safety of people, refer 1.7.20 and 2.4.2;

i) the risk to property, production and the environment, refer 2.4.8;

j) the required measures to control the fire risk to the lowest level reasonable practicable, refer 2.1.5, 2.4.3 and 2.5;

k) the information requirements to employees and contractors on the mine site, refer 2.7;

l) the instruction and training requirements, refer 2.8;

m) the emergency management system requirements, refer 2.10; and

n) whether the recommendations in this guideline be adopted or rejected.

2.4.2 Risks to the safety of people

The risk assessment should consider harm to the health, safety and welfare of people through the following (but be not limited to):

a) A fire initiating a gas or coal dust explosion in an underground coal mine or otherwise confined environment.

b) A fire impeding the means for emergency escape (through impairing visibility due to smoke or loss of respirable atmosphere) of personnel from –

   (i) the underground mine or otherwise confined environment;

   (ii) mobile plant; and

   (iii) Fixed plant, building, structures and gantries.

c) Asphyxiation or poisoning of people in the vicinity and/or down stream of the fire of the products of combustion. e.g. oxygen (O_2) depletion, carbon monoxide (CO), carbon dioxide (CO_2), etc.

d) Products of fire combustion being of a toxic and/or carcinogenic nature (due to the fuel type).

e) Heat stress or heat stroke.

f) Tyre fires, fires on conveyor belts, electrical insulation fires and fire on other non-metallic materials in an underground mines or otherwise confined environment creating a toxic atmosphere.

g) Tyre fires initiating a tyre explosion.

h) A fire preventing operating plant (either fixed or mobile) being brought to rest safely.

i) Exposure to smoke carried by mine ventilation.

j) An increase in fire severity by spreading from plant or point of origin to other combustible materials in the vicinity such as timber supports, coal, etc.

k) A ventilation flow reversal due to fire induced ventilation increasing explosion risk.

l) A failure of a primary risk control such as (but not limited to), refer clause 2.5 –

   (i) a failure of the mine ventilation system and/or methane drainage system;

   (ii) antistatic discharge,(earthing) particularly in potentially gaseous areas of the mine;

(iii) a mechanical / electrical component failure (fault) or wear and tear of plant providing an ignition source;

(iv) a mechanical component failure (fault) or wear and tear of plant providing a fuel source; and

(v) materials of plant construction being combustible and potential fuel sources.

2.4.3 Outcomes of the fire risk assessment

For each identified fire risk scenario, the fire risk assessment should determine appropriate risk control measures (to control the fire risk to a level as low as reasonably practicable) for –

a) the prevention of a fire initiating;

b) the method(s) for early detection of a fire, if initiated;

c) the methods for the suppression and extinguishment of a fire, after detection; and

d) the system for emergency evacuation and egress of people in the event of a fire.

Note: The fire protection systems should be sufficiently reliable.

2.4.4 Operating environment and operating conditions

When assessing the fire risks, the operating environment and the potential for unfavourable operational conditions to increase the fire risk should be considered, including –

a) areas of the mine with flammable coal dust;

b) areas of the mine containing flammable gasses such as methane in sealed areas, goafs, gas drainage pipelines, etc.;

c) poor operational and maintenance practices; and

d) potential for the failure of, or wear and tear of plant (or components of plant).

2.4.5 Fire effects

The fire effects should be considered in the risk assessment, including –

a) fire propagation;

b) thermal radiation;

c) toxic products of combustion;

d) fire effluent;

e) impact on the environment;

f) collapsing structures; and

g) explosions.

2.4.6 Site specific considerations

Site specific constraints should be considered, such as (but not limited to) –

a) fire risk history of the coal operation;

b) history of abandoned adjacent mines;

c) seam(s) being mined;

d) other seams that have been mined;

e) methods of mining;

f) propensity of coal to spontaneously combust;

g) surface plant, equipment and location;

h) relationship between autonomous organisations occupying the one site (e.g. open cut – underground – declared plant);

i) contractors and contractor activity;

j) levels of workforce training;

k) sources of information, which may include – relevant standards, legislation, past records, relevant experience, industry practice and experience, relevant literature, specialist and expert judgements;

l) any other relevant background information;

m) geographical location and proximity to emergency services and water supply; and

n) support from external emergency services.

2.4.7 Fuel properties and oxidation

Fuel properties and oxidation which should be considered when assessing the consequence and likelihood in the risk assessment include –

a) ignitability;

b) flammability;

c) explosability;

d) combustibility;

e) quantity and continuity of supply of fuel;

f) vapour point;

g) flash point; and

h) volatility.

2.4.8 Environment, property and production

The risk assessment should also consider the risks associated with –

a) Environment –

   (i) pollution at site;

   (ii) pollution external to site;

   (iii) pollution due to fire mitigation techniques;

   (iv) noxious, toxic or explosive atmospheres; and

   (v) smoke hazard.

   Note: pollution refers to air pollution, quality of air, noise, water from fire effluent and what is used for fire suppression and control.

b) Property –

   (i) building design, size, damage or loss;

   (ii) plant damage or loss;

   (iii) possible escalation of fire due to other fuel sources (eg gas cylinders) within the plant or buildings; and

   (iv) exposures to adjacent plant, buildings and fuel sources.

c) Production –

(i) processes and raw materials; and

(ii) the economic costs of a fire on a piece of plant, including property damage, business interruption costs and costs if fire spreads beyond the point of origin.

2.5 FIRE RISK CONTROL

2.5.1 General

The control of fire should be achieved by following the hierarchy of risk reduction until the risk is minimised to the lowest level reasonably practicable, refer 2.1.5.

Risk reduction measures should be considered at each level of the hierarchy in accordance with *Figure 3* below.

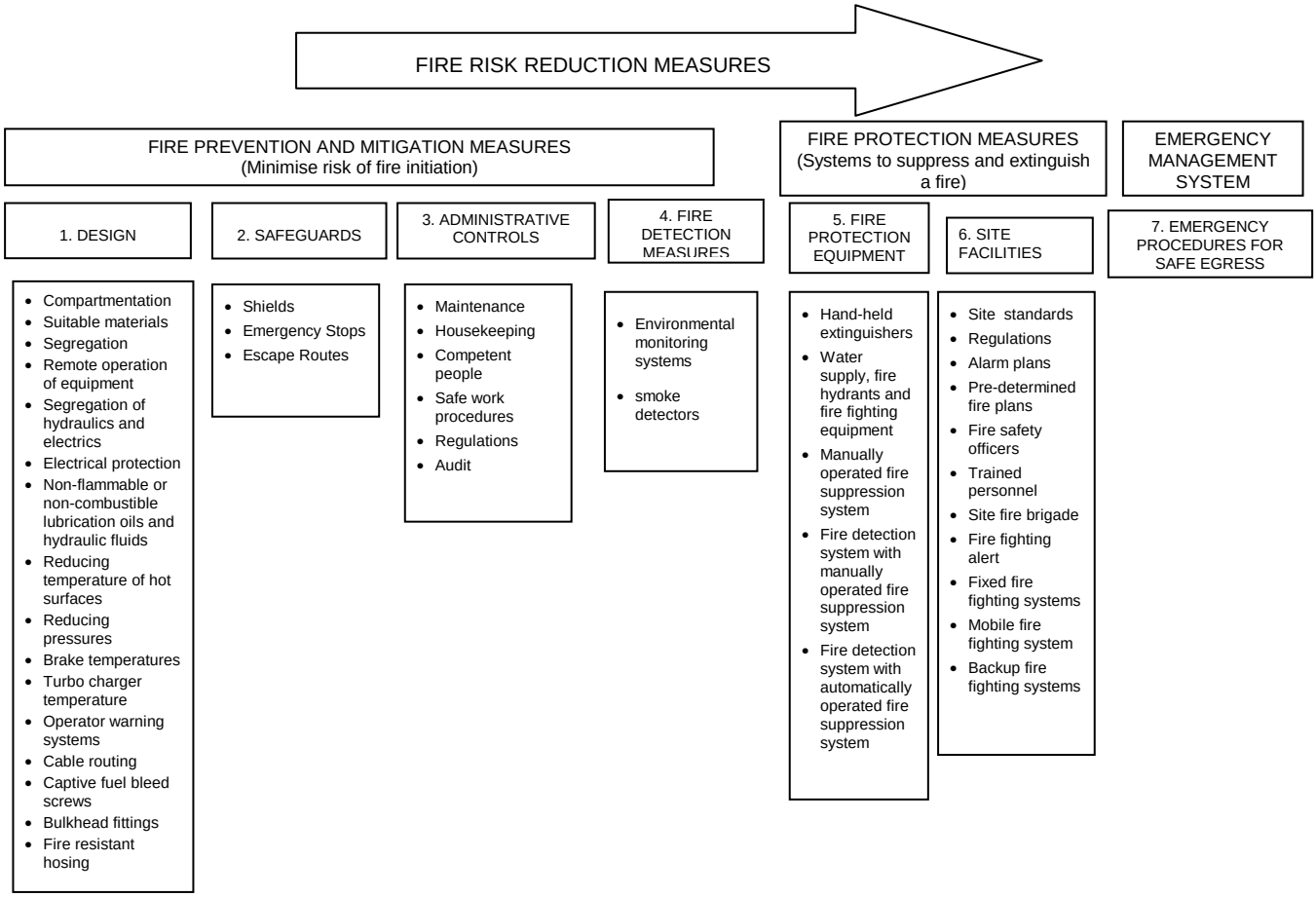

Figure 3 - Fire risk reduction measures

2.5.2 Risk control measures for fire prevention

2.5.2.1 General

Objective: Implement systems to prevent the initiation and propagation of all foreseeable fires in the coal mine.

The following risk controls for minimising the risk of a fire initiating should be considered where practicable:

a) Use of fire risk controls with robust levels of system integrity.

b) Correct storage and handling of combustible materials.

c) A high standard of plant maintenance practices and house keeping.

d) Training for maintenance and inspection of equipment.

e) Operation and use of plant under designed loads and conditions.

f) Use of tyres with correct TKPH ratings.

Note: tyre fires have been initiated from overloading tyres.

g) Electrical protection and wiring to the applicable standards.

h) Reducing the temperature of hot surfaces.

i) A comprehensive inspection regime for the mine environment.

Note: People carrying out inspections should be aware of the role one's senses play in discovering fires.

j) Segregation of fuel and ignition sources.

k) Limiting the quantity of potential fire fuels.

l) Adequate ventilation.

m) Consideration to MDG25 for hot work activities.

2.5.2.2 Underground parts of a coal mine

The following additional risk controls for minimising the risk of a fire initiating in underground parts of a coal mine should be considered, where practicable:

a) use of fire resistant and anti-static (FRAS) materials, refer MDG 3006 MTR 8.

Note: Clause 70 of the CMHR 2006 requires ventilation appliances, conveyor belts and accessories to be FRAS as gazetted, refer http://www.dpi.nsw.gov.au/minerals/safety/legislation/gazettals

b) use of FRAS air/water hoses compliant to AS 2660 and fire resistant hoses.

c) use of fire resistant fluids.

Note: Clause 20(h) of the CMHR 2006 requires the use of as gazetted fire resistant fluids, refer http://www.dpi.nsw.gov.au/minerals/safety/legislation/gazettals

d) limiting the use of large quantities of non-metallic materials where toxicity of the products of combustion may create a risk in the underground environment.

e) adequate ventilation.

f) reduce surface temperatures to less than 150^0C.

g) minimise or eliminate the accumulations of coal dust, coal spillage or other combustible material.

h) limit the use of exposed aluminium in outbye areas to those applications that may be justified on ground of health or safety.

Note: Clause 66 of the CMHR 2006 prohibits the use of exposed aluminium in a hazardous zone and requires the coal operator to develop arrangement for the use of exposed aluminium in outbye areas.

i) use of explosion protected plant.

j) use of adequate water sprays on continuous miners and longwall shearers to minimise the risk of frictional ignition.

k) use of adequate water sprays to suppress coal dust, such as on conveyor transfer points.

l) use of electrical equipment to the appropriate standards and minimise the use of joints in reticulation cables.

m) use of wet braking systems on mobile and fixed plant.

n) minimise areas where mechanical friction on plant may occur.

o) use of bearings with an appropriate bearing life and appropriate seals for the underground mine environment.

p) use of plant within its rated capacity.

q) use of ventilation fans which are designed with consideration to MDG 3.

r) handling, storage, transport and use of flammable materials, such as oils, greases, diesel fuel, rags, etc.

2.5.3 Measures for fire detection

A system for the detection of any potential fire in a mine should be developed through the risk assessment process.

Notes:

1. It is important that fires are detected as early as possible such that a response can be initiated to remove people from harm and suppress the fire.
2. The fire protection systems should be sufficiently reliable to control the risk to the lowest level reasonably practicable.

In particular, in parts of the mining operation where there is a potential that fire may impede escape of people, additional systems should be provided for early real time fire detection, such as early fire detection warning in: single entry development; belt conveyors; gantries; reclaim tunnels.

The following risk controls for minimising the fire risk by early detection should be considered, where practicable:

a) Implement early warning and response systems to detect fires before they develop into a hazardous situation.

b) Install rapid and reliable environmental monitoring systems to detect fires early, (e.g. use of CO smoke or other fire detection systems).

c) Use of plant condition monitoring systems (sensors) such as - bearing temperature, vibration, infra red sensors, brake release, belt tracking, blocked chute, belt slip, etc.

d) Install systems for communications to all persons at the mine and external response agencies.

e) Implement a comprehensive and effective inspection system.

2.5.4 Measures to suppress and extinguish a fire

2.5.4.1 General

Systems should be developed for the suppression of all possible mine fires.

Note: SECTION 3, SECTION 4 and SECTION 5 provide specific requirements.

The following risk controls to suppress and extinguish a fire (once initiated) should be considered, where practicable:

a) Automatic fire extinguishing systems on mobile plant.

b) Water supply and reticulation to all fire risk areas of the mine.

c) Sufficient water supply to allow all personnel to self escape while maximum expected water usage rate is sustained.

d) Appropriate automatic fire suppression to fixed plant (e.g. belt conveyors in tunnels or pits), where practicable and applicable.

e) Portable fire extinguishers for initial attack response on fixed plant (in particular electrical switchgear) and mobile plant.

f) Competence of people potentially fighting fires. Personnel being adequately trained and educated in fire safety practices.

g) Provision of appropriate fire fighting equipment (for hydrant connection) readily available for use.

h) Availability of fire fighting personnel for rapid response.

a) Procedures and competency based training to cover all locations and all times of the day (shifts).

i) Available fire equipment and fire suppression systems (e.g. deluge systems).

j) Use of water tankers fitted with cannons.

k) Sufficient hose and appropriate fitting must be available to fight a fire on any part of a conveyor belt.

2.5.4.2 Fire extinguishers

Appropriately rated and sized extinguishers should be provided with consideration to AS 2444 and AS 1850, as required by the fire risk assessment and the intended fire risk area being protected.

The preferred minimum size extinguisher for general purpose is a dry chemical 80ABE, where practicable.

Extinguishers should be provided at (but be not limited to) –

a) all mobile plant;

b) all operators workstations on fixed plant;

c) coal preparation plants and conveyor gantries;

d) reclaim tunnels;

e) office buildings;

f) electrical switchgear; and

g) other risk areas identified in the risk assessment.

The fire extinguishers should be installed in safe locations, clearly identified and readily accessible.

All fire extinguishers should be maintained in accordance with AS 1851.

Note: Fire extinguishers are most effective where used by trained operators. However, considering the size and configuration of equipment, fires can be difficult, impossible or dangerous to fight with a hand-held extinguisher. The key to operator protection is early detection of fires to provide warning to the operator, fuel shut-off to minimize fuel for the fire, and fire suppression during its early stages.

2.6 INFORMATION

2.6.1 General

The coal operator must supply and communicate sufficient information to all employees and contractors to enable them to fulfil their duties with respect to occupational health and safety.

Such information should be determined by risk assessment and include, but be not limited to –

a) fire risk controls to prevent a fire initiating;

b) fire detection methods and communication of fire detection;

c) fire suppression methods;

d) emergency procedures;

e) withdrawal conditions;

f) evacuation;

g) isolation points for fuel / energy sources;

h) fire fighting reticulation plans;

i) energy reticulation plans; and

j) Self escape.

2.6.2 Electrical switchgear

The electrical engineering management plan must make provision for the placing of appropriate signage, notices, plans and electrical distribution diagrams at electrical switchgear and other prominent positions, being signage, notices, plans and diagrams that provide advice on what to do in the event of a fire on or in electrical plant, refer clause 19(1)(t)(ii) CHMSR.

2.7 INSTRUCTION AND TRAINING

2.7.1 General

Training needs and competencies associated with fire risk management should be identified in the risk assessment process and integrated into the training system.

In particular fire training should include (but be not limited to) –

a) The fire officer;

b) People designing the fire protection system;

c) People installing the fire protection system;

d) People inspecting and maintaining the fire protection system;

e) People testing the fire protection system;

f) General workforce in fire fighting; and

g) Fire teams in fire fighting.

2.7.2 General workforce training

The emergency management system must include the general workforce training in the use of fire fighting equipment.

Note: This should also include contractors working in the mine.

The general workforce should be trained upon commencing employment and at regular intervals commensurate to the risk, generally no more than 24 months apart.

General workforce training (relevant to place of work) should also include but be not limited to –

a) fire hazards relevant to the place of work;

b) design measures and controls to reduce the fire risk;

c) fire protection systems on plant, if fitted;

d) actions in event of discovery of a fire including ensuring personal safety;

e) what to do and who to contact;

f) reporting of faults and defects;

g) made familiar with mine emergency or evacuation procedures for their place of work;

h) how to use initial response method eg portable fire hose;

i) use of extinguishers – location, use, operation; and

j) basic hose handling.

2.7.3 The establishment and training of fire teams

The emergency management system must include the establishment and training of fire fighting teams.

The fire teams should undergo appropriate training in fire fighting and should be instructed in the use of mine plans and become familiar with the mine workings.

The fire teams should be trained upon the commencement of appointment and at regular intervals generally no more than 6 months apart.

In addition to general workforce training, training of fire teams should include, (but be not limited to) –

a) familiarity with entirety of mine;

b) fire control systems in all parts of the mine;

c) familiar with emergency response system;

d) risk from products of combustion; location and controls (outcomes of fire risk assessment);

e) risks of recirculation and explosion in underground fires;

f) strategies and tactics in fire suppression; and

g) team leader and team training (directing other workforce members in the event of a fire).

2.8 AUDIT, MONITOR & REVIEW

The fire risk management system should be audited, monitored and reviewed at –

a) appropriate periodic intervals, but not exceeding 3 years;

b) when there is a significant change to the fire risks; or

c) following a fire event.

2.9 DOCUMENTATION

Fire management record keeping should be integrated with the emergency management record system.

Accurate records should be kept of all stages of the fire risk management process, particularly –

a) fire hazard identification and risk assessments and risk controls;

b) fire fighting plans;

c) fire risk management procedures and practices; and

d) system audit and review reports.

2.10 FIRE EMERGENCY SYSTEM

2.10.1 The appointment and duty of fire officers

The emergency management system must include the appointment and duties of fire officers.

The mines fire officer(s) should undergo appropriate training and should be familiar in the use of mine plans, the workings of the mine, the systems of work at the mine and the mines emergency management system.

The fire officer(s) should oversee the mines fire hazard management plan and be responsible for the following functions:

a) Applying risk management, identifying fire hazards, assessing and controlling fire risks in the mine.

b) Implementing the fire hazard management plan at the mine.

c) Advising the coal operator of any non-compliance with the mines fire hazard management plant or legislation

d) Implementing training requirements including, fire fighting teams and general workforce.

e) Auditing and reviewing the fire risk controls to those stated in the mines fire hazard management plan.

f) Causing regular inspection and testing of the fire protection systems to verify functionality.

g) Arranging for the testing, repair and maintenance of all fire protection systems. and equipment.

h) Managing a system for the recording of the results of inspections, tests, maintenance, defects and repairs.

i) Investigating any complaints and ensure any defective fire fighting equipment is immediately replaced.

2.10.2 The supply of fire fighting equipment

Minimum standards for fire equipment are specified in SECTION 3, SECTION 4 and SECTION 5. The outcomes from a fire risk assessment should determine if these standards are adequate and identify additional requirements.

Suitable fire fighting equipment should be provided at –

(i) in or near each building on the surface of the mine;

(ii) at each place in which flammable materials is stored;

(iii) on each engine room or motor room; and

(iv) at the entrance of every shaft or means of egress.

Fire hydrants and fire fighting equipment should be clearly marked and labelled.

2.10.3 The maintenance of fire fighting equipment

The coal operator should develop a system to ensure the fire protection system and fire fighting equipment remains functional.

The system should be documented and should be in accordance with the relevant section of AS 1851, in particular –

a) Section 2 – Automatic fire sprinkler systems

b) Section 3 – Fire pumpsets

c) Section 4 – Fire hydrant systems

d) Section 5 – Delivery lay flat hose

e) Section 6 – Fire detection systems

f) Section 7 – Smoke alarms and heat alarms

g) Section 11 – Gaseous fire extinguishing systems

h) Section 13 – Fixed aerosol fire extinguishing systems

i) Section 14 – Fire hose reels

j) Section 15 – Portable and wheeled fire extinguishers

2.10.4 The provision and supply of water storage and reticulation

Outcomes from a fire risk assessment should determine the minimum requirements for the supply and water reticulation for each identified fire hazard location or fire hazardous area.

A sufficient water supply to allow all personnel to self escape while the maximum expected water usage rate is maintained should be provided.

Note: refer SECTION 3, SECTION 4 and SECTION 5 for the relevant recommended minimal requirements.

2.10.5 Emergency fire procedures

Emergency fire procedures should include, but be not limited to –

a) path of normal and emergency egress for personnel;

b) emergency reporting, communication and response procedures;

c) evacuation and withdrawl of people from harm;

d) response to fighting a fire; and

e) activating of systems such as the fire teams and external support agencies.

f) Actions to be taken by persons who discover a fire, including consideration of -

   (i) Communications to the surface for assistance and to other people downstream of the fire effects.

   (ii) Safe systems of work to provide an initial fire-fighting attack.

   (iii) Whether one person or two persons are required..

2.10.6 Reporting and replacement of damaged fire equipment

A documented system for the reporting and replacement of damaged fire fighting equipment should be provided.

2.10.7 Compatibility of fire equipment with equipment of state fire brigades and adjacent mines

For consistency throughout NSW, Storz hermaphrodite type fire hose couplings should be used on new installations.

Where a 64mm x 4.8mm pitch $\left(2\frac{1}{2}x5\frac{1}{5}TPI\right)$ type fire hose couplings are currently used at the mine site, suitable adaptors should be provided on the surface of the mine for connection to the Storz hermaphrodite type couplings.

2.10.8 The escape or evacuation of people from areas affected by emergencies

In the development of evacuation procedures consideration should be given to MDG 1020.

2.11 FIRE FIGHTING PLANS

Fire fighting plans should identify, but are not limited to –

a) the positions in which pipe mains, hydrants, isolation valves, pressure reducing stations, hydrant depots, fire stations and fire substations are situated;

b) the positions of stopping's, trap doors, prepared sealing locations, overcasts, air crossings, ventilation doors, regulators, belts conveyors, main electric supply cables, fixed electrical apparatus and telephones;

c) the direction of ventilation in the roadways;

d) the designated static water pressure at various points along the pipe mains and the water flow and pressure at each hydrant;

e) the location of fire pumpsets with the pressure and flow ratings;

f) the location of all fuel storage areas;

g) fuel/energy isolation points; and

h) The equipment contained in hydrant depots, fire stations and fire substations, refer 5.4.

The plans should be readily available, kept on a scale that is easily readable, and they should be regularly updated to reflect the current mine status.

SECTION 3 FIRE PROTECTION FOR SURFACE PLANT AND INFRASTRUCTURE

3.1 GENERAL

This section provides recommended minimum requirements for surface plant and infrastructure.

A fire risk assessment (refer 2.4.1) should identify –

a) all potential fire risk areas for surface plant and infrastructure;

b) methods to prevent, detect and extinguish any fire in those identified fire risk areas; and

c) systems to provide safe egress and emergency procedures.

All buildings, structures and fixed plant should be protected with a suitable water supply, water reticulation and hydrant system. For existing installations, an assessment against the relevant parts of AS 2419.1 should be undertaken.

For buildings and occupied facilities a fire hose system, or a fire hydrant system, and/or pump sets, should be carried out in accordance with the Building Code of Australia (BCA) for the relevant type of building, refer www.abcb.gov.au

Note: The BCA is only relevant to occupied building … classification

All new installations or any alterations to existing systems should be carried out in accordance with AS 2419.1, as far as reasonably practicable.

Fire protection pumpsets should be installed in accordance with AS 2941.

Notes:

1. The minimum safe quantity for a water source is based on a 4 hour duration at the specified flow rates.
2. Compliance with AS 2419.1 is not possible in coal stockpile areas.
3. Key points in AS 2419.1 include –
   - (i) Based on minimum 4 hrs duration of water supply at specified flows
   - (ii) Hydraulic analysis to demonstrate system performance of most hydraulically disadvantaged hydrant
   - (iii) 10 l/s per hydrant with up to 4 hydrants operating simultaneously – depends on area of protection
   - (iv) Pressure
     - Max. dynamic 1200 kPa, unless agreed by the relevant fire brigade
     - Min. dynamic 350 kPa (700kPa external when boosted)
   - (v) Max. static 1300kPa unless agreed by fire brigade
   - (vi) All points in building protected within reach of a 10m hose stream from end of 30m hose.
   - (vii) Open yard areas within reach of a 10m hose stream from end of 60m hose
   - (viii) Acceptable sources of water supply
   - (ix) Generally dedicated ring main systems

The fire risks associated with mobile plant on the surface of coal mines should be assessed and controlled in accordance with AS 5062 and MDG 15.

Maintenance of fire protection systems should be carried out in accordance with AS 1851.

SECTION 4 FIRE PROTECTION IN OPEN CUT PARTS OF A COAL MINE

4.1 GENERAL

This section provides recommended minimum requirements for open cut parts of the coal operation.
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A fire risk assessment (refer 2.4.1) should identify –

a) all potential fire risk areas for open cut parts of the operation;

b) methods to prevent, detect and extinguish any fire in those identified fire risk areas; and

c) systems to provide safe egress and emergency procedures.

The fire risks associated with mobile plant should be assessed and controlled in accordance with AS 5062 and MDG 15.

For extinguishing a fire, considerations should be given to –

a) availability of water and any time restraints (e.g. water truck empty and refill time);

b) time for external resources to arrive; and

c) pressures and flows from water trucks.

SECTION 5 FIRE PROTECTION IN UNDERGROUND PARTS OF A COAL MINE

5.1 GENERAL

This section provides recommended minimum standards for underground parts of the coal operation.

A fire risk assessment (refer 2.4.1) should identify –

a) all potential fire risk areas for underground parts of the operation;

b) methods to prevent, detect and extinguish any fire in those identified fire risk areas; and

c) systems to provide safe egress and emergency procedures for those underground at the time of a fire.

The fire risks associated with mobile plant should be assessed and controlled in accordance with AS 5062, except where the plant is explosion protected to another standard.

Supply of water storage, reticulation (including fire hydrant installations) and fire fighting equipment, should be designed in accordance with 5.2, 5.3, and 5.4.

Notes:

1. AS 2419.1 is not considered appropriate for direct application in underground parts of the coal mines.
2. This section provides minimum recommendations based on AS2419 as considered appropriate for underground coal mines.
3. NFPA15 provides guidance for *Water Spray Fixed Systems for Fire Protection.*
4. NFPA 120 provides guidance for *Fire Prevention and Control in Coal Mines.*

5.2 SUPPLY OF WATER AND STORAGE

5.2.1 Water supply

An adequate supply of water for fire fighting purposes should be available to all fire risk areas and fire risk locations throughout the mine.

Note: An adequate source of water is a fundamental consideration in the design of a fire hydrant water reticulation system.

Acceptable sources of water supply should be in accordance with SECTION 4 '*WATER SUPPLIES'* of AS 2419.1, as applicable.

5.2.2 Water storage

Water storage capacity feeding the fire water reticulation system should be the greater of –

a) a storage capacity large enough to supply water for a period of time sufficient to allow all personnel underground to self escape while the designed flow rate is maintained continuously;

Note: The fire risk assessment should identify the period required to allow people to self escape

b) a storage capacity large enough to maintain the designed flow rate for a minimum 4 hour period; or

c) the storage capacity of at least 200,000 litres.

Water storage tanks and their capacities should be in accordance SECTION 5 '*WATER STORAGE'* of AS 2419.1, as applicable.

Onsite storage should be arranged so that during maintenance at least 50% of the required volume

always remains available. Maintenance should be carried out during periods of least risk, e.g. non-production and kept to a minimum time frame.

5.3 RETICULATION OF FIRE WATER UNDERGROUND

5.3.1 Reticulation system coverage

A fire water reticulation system should extend throughout the entire mine.

The fire water reticulation system should be designed and installed so that all identified fire risk areas of the mine are within reach of a fire hydrant.

The following areas should all be within access (maximum of 190m, refer 5.3.3) of a fire hydrant:

a) Entire length of every conveyor system.

b) All face production plant.

c) All electrical installations, (isolators, switch rooms, substations).

d) All garages, service bays, charging stations or refuelling stations for mobile plant.

5.3.2 Reticulation and hydrant system design

5.3.2.1 General

There should be sufficient flow and pressure from each hydrant to –

a) safely fight any fire that may develop;

b) effectively operate two separate fire fighting hoses in parallel; and

c) operate within the specified working ranges (pressure and flow) for the types of hose and nozzles intended to be used at each fire hydrant, with consideration to the number of fire hoses intended to be used at the hydrant.

The water flow velocity in pipework should not exceed 4 m/s.

The total hydraulic loss due to friction in pipes, valves and fittings should be minimised as far as reasonably practicable.

The relevant flow rates and static/dynamic pressure for each hydrant should be specified on the fire fighting plans.

5.3.2.2 Minimum dynamic pressure and flow

The required minimum dynamic pressure and flow rate from each hydrant should be as given in ***Table 1***.

Max hose length at hydrant	Minimum hydrant flow	Minimum residual dynamic pressure
180m (6 hoses in series)	10 l/s	700 kPa
90m (3 hoses in series)	10 l/s	400 kPa

Table 1 - Hydrant residual pressure and flow requirements

Notes:

1. It is preferable for hydrants to have no more than 90m hose attached but may have up to 180m max. refer 5.3.3.
2. 10 l/s from each hydrant is recommended for two fire hoses operating simultaneously from the same fire

hydrant, refer AS 2419.1.

5.3.2.3 Maximum static pressure

The maximum static pressure at any hydrant should not exceed the rated working pressure of –

a) the main reticulation pipework; and

b) the hose and nozzles available in relevant fire depot adjacent to each hydrant.

Note: **Table 2** sets out maximum static hydrant pressures for different classes of fire hose, as set out in AS 2792.

Hose Class	Maximum static hydrant pressure (kPa)
High (H)	2,100
Medium (M)	1,400
Low (L)	1,000

Table 2 - Maximum hydrant static pressure for class of fire hose

5.3.2.4 Maximum dynamic pressure

The maximum dynamic pressure at any hydrant should not exceed –

a) the maximum safe operating pressure specified by the hose nozzle manufacturer, for the hose nozzle intended to be used at the fire hydrant; and

b) a pressure/flow rate combination that is too great for a single person to safely handle and use, where there is intended to be up to 90m of hose installed at the hydrant; or

c) a pressure/flow rate combination that is too great for two people to safely handle and use, where there is intended to be up to 180m of hose installed at the hydrant.

Note: AS 2419.1 specifies a maximum dynamic pressure of 1,200 kPa.

5.3.2.5 Other services

Where the fire water reticulation system is used to supply water to any other fire fighting system, such as deluge systems, sprinkler systems and the like, (other than hose reels) the water supply system and system design should provide for the combined fire fighting system requirements.

The system should be design according to the fire system requirements to combat any single fire.

Where the fire water reticulation system is used to supply production plant, a risk assessment should determine whether the fire reticulation system is require to provide for the additional production requirements at the same time as the fire fighting requirements.

5.3.2.6 Hydraulic analysis

An engineer should carry out a hydraulic analysis on the fire water reticulation and hydrant system. This engineer should have relevant competence.

The hydraulic analysis should -

a) be carried out in accordance with the information on the mine fire fighting plans, refer 2.11;

b) demonstrate that the system can meet the specified performance requirements at each hydrant including the most hydraulically disadvantaged hydrant and each branch line;

c) verify and record the design pressure (static and dynamic) and flow at –

(i) each branch point;

(ii) each pressure reducing station;

(iii) each pumpset;

(iv) each location where a sprinkler or deluge system is installed;

(v) every 1,500m linear length of main reticulation pipe; and

(vi) where there is greater than a 50m rise or fall in the main reticulation pipe.

Note: For dynamic pressures, assuming the most hydraulically disadvantaged hydrant is discharging.

d) Demonstrate that the residual pressure and flow available to the nozzle for each hydrant is within a suitable range.

Note: This should be based upon the maximum number of hoses in use at the hydrant to reach the fire risk area (hydrant spacing) and any other fire fighting system, such as sprinkler systems, that may be in operation at the same time.

e) Verify the system is safe to use and state any assumptions or limitation for its safe use.

5.3.3 Hydrants

5.3.3.1 Proximity to fire risk areas

Fire hydrants should be located such that access and protection to the fire risk area can be obtained within reach of a 10m hose stream issuing from a nozzle at the end of either –

a) three lengths of hose (90m); or

b) a maximum of six lengths of hose (180m) where the hydrant has sufficient residual pressure, refer 5.3.2.

Notes:

1. Six lengths of hose will require two people and requires a higher residual pressure to overcome the additional hose frictional losses.

5.3.3.2 Location of fire hydrants

Fire hydrants should be located in proximity to the fire risk area being protected. Hydrants should be located near and within a safe distance of the high risk area including but be not limited to –

a) conveyor drive heads, tripper drives, loop take-ups, transfers, tail rollers;

b) access and coverage for the full length of any belt conveyor;

Notes:

1. Fire hydrants providing access to a belt conveyor should be spaced at 100m intervals for single person operation. This would require 90m of hose at the nearest fire depot.
2. If there is sufficient residual pressure at the hydrant and if the fire risk assessment considers two person operation acceptable, the hydrant system may be spaced a maximum of 190m apart. This would require 180m hose at the relevant fire depot.
3. Fire hydrants may be installed in an adjacent heading to the belt conveyor (i.e. travelling road), provided the fire hose in the relevant fire depot will provide full access and coverage to fight a fire along the entire length of the belt conveyor.

c) garages, service bays, refuelling bays, charging bays or underground workshops;

d) bulk fuel, oil storage or combustible liquid storage areas;

e) electrical installations, (isolators, switchrooms, substations, transformers);

f) booster fans;

g) underground compressors and longwall pump station; and

h) within 190m of all face production plant.

5.3.3.3 Orientation of fire hydrants

Hydrants should face in the direction of the air flow so the hose is connected in the direction of the air flow.

There should be at least 100mm clear around the hydrant valve and at least 1m in front of the hydrant valve wheel to allow safe access to the hydrant.

5.3.3.4 Hydrant labels

The designed water flow and pressure required should be stated at test hydrants and the most hydraulically disadvantaged hydrant to facilitate testing and measurement.

Signs should be appropriately placed in a visible area such that personnel can identify all fire hydrants, fire depots, fire substations and other locations where fire fighting equipment is located.

Signs should also be located on travelling roads indicating their direction to the nearest hydrant.

Signs should be in accordance with AS 1318 and AS 1319 and AS 1614.

5.3.3.5 Hydrant valves

Fire hydrant valves should –

a) be in accordance with AS 2419.2;

b) have a 64mm x 4.8mm pitch or Storz hermaphrodite type fire hose couplings, refer clause 2.10.7; and

c) be equipped with protective caps and retaining chains.

Aluminium fittings should not be used in underground parts of the coal mine.

5.3.3.6 Hydrant testing

A device or system for testing pressure and flow at each hydrant should be provided.

Hydrant testing should be carried out periodically to verify the pressure and flow meets that determined by the hydraulic analysis.

Testing should be conducted on the most hydraulically disadvantaged hoses and at the end of every branch line.

5.3.4 Main reticulation pipe-work

5.3.4.1 Test Points

The main fire reticulation pipework should have test points placed along the entire reticulation system commencing from the surface of the mine or the bottom of the shaft and at intervals of approximately 50m vertical depth (500 kPa head) and at each branch point.

Each test point should be provided with a means for using a pressure gauge and flow test meter.

Notes:

1. A hydrant may be used as a test point.
2. This is not required for shafts.

5.3.4.2 Pressure gauges

A pressure gauge which complies with AS 1349 should be installed –

a) at either side of pressure reducing valves;

b) at the end of branch lines; and

c) at intervals not exceeding 1500m in length.

All pressure gauges should have a scale compatible to the static and dynamic pressure range required to be measured.

5.3.4.3 Pipe system

All pipes, pipe fittings and valves used in fire hydrant installations should comply with the following:

a) The relevant requirements of SECTION 8 '*PIPEWORK AND VALVES*' of AS 2419.1.

b) The pipe system should be sectionalised such that branch lines can be isolated to allow maintenance without interrupting supply to the entire system.

c) Plastic pipes valves and fittings should not be used for reticulation systems. Hydraulic hoses should not be used except in particular circumstances where it is not practical to use solid pipes, such as longwall monorails.

d) Steel pipes, fittings and supports should be galvanised in accordance with AS 4792 or AS 4680 (as applicable), or otherwise treated for corrosion.

e) Pipe systems should not be less than DN100, unless the frictional losses of the section of pipework is less than 10m equivalent hydraulic length; in which case the pipe system shall not be less than DN 80.

f) Pipes and pipe fitting should comply with the relevant standards. AS 2419.1 nominates :

   (i) Steel tubes and pipes – AS 1074, AS 1579, AS 1769 and ASTM A135.

   (ii) Ductile iron pipes – AS 2280.

   (iii) Cast iron fittings – AS/NZS 2544.

   (iv) Systems designed for pressure piping application – AS 4041

5.3.4.4 Supports

All pipework, pipe fittings and valves should be supported by galvanised steel supports. Combustible pipework supports should not be used.

Supports should be designed by a competent person to withstand –

a) two times the mass of the pipework filled with water plus a mass of 115kg at each point of support;

b) the stress and load that may be imposed from all external forces;

c) transmission of vibration;

d) effects of corrosion; and

e) designed to prevent swaying.

5.3.4.5 Stop valves

Sufficient isolation valves shall be provided –

a) at suitable intervals for maintenance, testing and emergency purposes;

b) in the branch of each branch line; and

c) at pressure reducing stations.

Isolation valves shall be capable of being locked in the off position.

5.3.5 Pressure reducing stations

Pressure reducing stations or other methods of controlling the water pressure should be installed where necessary to maintain the designed fire system static and flow pressure.

Pressure reducing valves should be duplicated to facilitate the removal of either valve for servicing. Pressure reducing valves shall be of the type in which the controlling mechanism is operated by water flow through the valve from –

a) the low pressure side; or

b) the differential pressure across the valve.

Isolation valves should be installed on either side of each pressure reducing valve and non-return valve.

Facilities should be provided to test pressure reducing valves.

5.3.6 Sprinkler and deluge systems

Fire suppression systems fixed sprinklers, foam/water, should be installed in accordance with the AS 4587.

Automatic systems should be considered at high risk areas.

5.3.7 Pumpsets

Where pumpsets are required to meet the specified pressure and flow requirements they should comply with AS 2941, as far as reasonably practicable.

There shall be at least two pumpsets installed. One of those pumps should be for standby with automatic operation between each pumpset.

If following a power failure a minimum residual pressure and flow of 250 kPa and 5l/s respectively cannot be maintained at the end of the fire hose nozzle attached to the most hydraulically disadvantaged hydrant on each branch line, then a backup power supply or 3rd pumpset, from an alternative power supply which automatically operates shall be installed.

Notes:

1. A compressed air pumpset or a diesel pumpset may suffice as an alternative.
2. The 250kPa / 5l/s is at the hose nozzle, the residual pressure at the hydrant will be dependent on the hose resistance, i.e. whether there is required to be six or three hoses attached to the hydrant and the hose diameter.

5.3.8 Commissioning testing

After the initial installation of every hydrant, it should be opened and the presence of water proved at each point. The static pressure at each hydrant should be recorded and verified against design requirements.

The most hydraulically disadvantaged hydrant on each branch line should be opened to verify the flow rates and pressures required by 5.3.2.

5.4 FIRE FIGHTING EQUIPMENT

5.4.1 Fire hose

Mine sites should determine the maximum number of 30m length hoses required at each hydrant in order to reach the fire risk area.

However there should be no more than six 30m hoses in series at any hydrant, (i.e.180m length).

Notes:

1. Six hoses require two men for safe and effective operation of the fire hose. Consideration should be given to immediate fire fighting by one man while assistance or support is being sought.
2. It is preferable for hose length to be 90m or less when one person operation is required.

The fire hose and fittings should comply with AS 2792 and should be rated at the maximum static pressure for each hydrant, refer 5.3.2.2.

Fire hose should have standard fittings which should have a 64mm x 4.8mm pitch or Storz hermaphrodite type fire hose couplings, refer clause 2.10.7.

5.4.2 Extinguishers

Appropriately rated and sized extinguishers should be provided with consideration to AS 2444 and AS 1850, as required by the fire risk assessment and the intended fire risk area being protected.

Extinguishers should be provided at every hydrant depot, on all mobile plant and at electrical switchgear.

The preferred minimum size extinguisher for general purpose is a dry chemical 80ABE, where practicable.

5.4.3 Hydrant depot

Hydrant depots should be located on the intake side of hydrants and adjacent to hydrants located to cover the following areas:

a) Conveyor drive heads, tripper drives, loop take-ups, transfers, tail rollers.

b) Garages, service bays, refuelling bays, charging bays or underground workshops.

c) Bulk fuel, oil storage or combustible liquid storage areas.

d) Electrical installations, (isolators, switchrooms, substations, transformers).

e) Booster fans.

f) Underground compressors and longwall pump station.

g) Within 190m of all face production plant.

For all other parts of the water reticulation system (including along belt conveyors) depots should be located such that an effective response to a fire in the shortest practicable time can be provided.

Notes:

1. It is preferable to install hydrant depots at every hydrant for a rapid response but may be extended to cover more than one hydrant.
2. Consideration should be given to the response time to place and assemble hoses and the environmental conditions such as ease of access, roadway conditions, transport access, etc.

Where fire depots cover more than one hydrant they should be capable of being easily moved between hydrants by one person. Serviceability of equipment should be maintained at all times.

Non-metallic hydrant depots should be antistatic or otherwise protected from the potential of a static electric charge build-up, refer MDG 3006 MTR 8.

5.4.4 Hydrant depot equipment

The hydrant depot should contain enough hose to cover a point past the next hydrant or the furthest point to be covered.

Depot equipment should be contained in a fit-for-purpose container. Depots should contain –

a) a controlling dividing breeching piece which incorporates a shut-off valve that allows you to use two hoses in parallel;

b) sufficient hose to run two separate hose lines in parallel to the fire risk area, covered by the hydrant;

Note: If the hydrants are 180m apart, then 360m of hose is required,

c) a 64-38mm adaptor if required;

d) spanners as required;

e) jets and a diffusing nozzle; and

f) two branches.

5.4.5 Fire station

The fire station should be located on the surface in close proximity to transport entry into the mine to enable ready dispatch of fire fighting equipment underground.

A fire station should be designated as such and be a defined area with entries kept clear.

The fire station should contain the following equipment as a minimum:

a) Foam generating equipment.

b) Foam stock and supplies.

c) Fire hoses, branches, tools, nozzles, fittings and breaching pieces.

d) Fire extinguishers.

e) Fire fighting plan.

f) A list of minimum equipment to be kept in the station.

g) Other emergency equipment as specified by the mine or as identified through the hazard management plan.

5.4.6 Fire substation

Fire substations should be located throughout the mine periodically such that they are readily accessible to each and every district in the mine as determined by the fire risk assessment and hazard management plan.

Each fire substation shall be located near a travelling road and clearly signposted so that it is easily identifiable by any mineworker. Travelling roads into all parts of the mine serviced by the substation shall be sign-posted so that people may navigate the route without delay.

The fire substation shall be maintained, have clear access and be located adjacent to the travelling road in an intake roadway.

Suitable means of communication should be available at each substation.

Fire substations should be designed and constructed so they are portable and capable of being rapidly transported to a part of the mine where required for use.

The fire substation should contain the following equipment as a minimum:

a) The contents of three hydrant depots.

b) Five dry chemical fire extinguishers (80BE).

c) Low Expansion foam and applicator.

d) A list of minimum equipment to be kept in the substation.

e) Other emergency equipment as specified by the mine.

f) A mine fire plan.

5.4.7 First aid fire fighting

At suitable intervals to cover the entire length of every belt conveyor roadway have 25mm outlet valves. There should be sufficient hose, readily available, of minimum 20mm internal diameter to cover to the next 25mm outlet.

Note: Previous incidents have indicated this hose has provided the quickest initial response to belt conveyor fires.

5.5 MAINTENANCE

Maintenance of the fire fighting system and associated equipment shall be carried out with consideration to AS 1851.

5.6 OTHER FIRE RISK CONTROLS

5.6.1 Underground garages

Where plant is regularly refuelled, serviced, repaired or charged in a designated area of the underground mine, MDG 25 and the following risk controls should be considered:

a) Two means of egress from the area provided.

b) Adequate ventilation provided to dilute any exhaust gasses or battery gases to harmless level.

Note: each diesel engine system has a specified minimum ventilation quantity.

c) The area is constructed or lined with a non-flammable material.

d) Has a smooth floor to allow ease of clean up for fuel, oil, grease spillage.

e) Is provided with non-flammable absorbent material for clean up.

f) Has a fire hydrant and sufficient fire equipment located on the intake side of the garage and within close proximity.

g) Has fire extinguishers of an appropriate type and located for ease of use.

h) Has a fireproof receptacle to dispose of any flammable material.

i) Provision of foam extinguishant.

j) Mine environmental monitoring inbye of garage.

5.6.2 Combustible liquid storage

The storage and handling of combustible liquids should comply with AS 1940.

Where a container having a capacity of more than 60 litres is used to store combustible liquids or fluids (such as grease, or lubricating or hydraulic oil), there should be –

a) adequate provision to minimise spillage;

b) adequate provision for the collection of spilled oil in trenches, trays or pits filled with dry sand or some other non-inflammable, absorbent material;

c) systems to remove any spillage as frequently as is necessary to keep the area in which the oil is stored or held free from spillage, and in any case not less often than once every 7 days;

d) no fixed machinery, cutting or welding equipment, or portable electric tools operated within 10 metres of the grease or lubricating or hydraulic oil or fluid; and

e) fire extinguishers of an appropriate type and capacity to deal with an oil fire provided nearby so as to be readily accessible.

5.6.3 Flammable materials

Flammable material with a flash point of 23° Celsius or less should not be stored in the underground parts of the mine except in a fireproof room, compartment or box.

Any building or structure on the top of a shaft or outlet at the mine should not be made of, or should not comprise, flammable material with a flash point of 61° Celsius or less.

Pressurised flammable gas should not be stored underground on a long term basis (over 1 day).

5.6.4 Diesel fuel

Diesel fuel should –

a) be taken underground only in a safe container; and should

b) not be kept underground unless in a fuel tank or otherwise in a safe container.

The total quantity of fuel in the underground parts of the mine at any one time should be minimised and should not exceed the likely total fuel consumption of transport at the mine (with normal operation) over the ensuing 7 days.

5.6.5 FRAS materials

Ventilation appliances and conveyor belting, accessories and components shall be flame resistant and anti-static (FRAS). Other non-metallic materials should be assessed for their fire risk.

Note: MDG 3006 MTR 8 provides guidance on the use of non-metallic materials in underground coal mines.

5.6.6 Operation of belt conveyors

Belt conveyors should –

a) comply with AS 1755, ;

b) be installed and maintained so as to prevent contact between the belt and any stationary items or materials (excluding those specifically allowed for in the design of the conveyor);

c) have roof of sufficient height to allow the contour of the maximum load and the largest fragments carried by the conveyor to clear the roof and roof supports;

d) have roadway of sufficient width to provide a suitable passageway on at least one side of the conveyor to facilitate inspection and maintenance;

e) have sufficient clearance on each side of the conveyor to allow any spillage of coal to fall clear of the conveyor; and

f) have a minimum clearance of 300 millimetres from the floor to the underside of the return belt (except at the most inbye loading point of the conveyor system if the mine manager establishes that such clearance is impracticable).

A belt conveyor used in an underground roadway shall not be operated if any belt fabric material is in contact with the shaft of any idler or pulley.

The mine should have a system in place to identify defective rollers and bearings in the conveyor system and change-out components before they constitute a fire hazard.

Note: Stone dust or clean dry sand may provide assistance in first response to extinguishing small fires.

5.6.7 Cleaning of underground roadways

All underground roadways in which belt conveyors are installed should be cleaned and kept free from spillage, loose coal and rubbish.

5.6.8 Hot work

Hot work should be carried out in accordance with MDG 25

5.6.9 Fire resistant fluids

All hydraulic oil or fluid used for the following purposes should be of the fire resistant type:

a) Fluid couplings and hydraulic torque converters except where designed to operate integrally with an oil filled gearbox.

b) Hydraulic self-advancing roof supports used in connection with longwall or shortwall faces

c) Hydraulic breaker line supports.

d) Hydraulic braking systems where the friction surfaces are designed to operate in a dry state.

Note: It is preferable to use wet brakes.

Testing should be carried out in accordance with MDG 3006 MRT2.

SECTION 6 APPENDICES

6.1 APPENDIX A – ASSOCIATED DOCUMENTS

6.1.1 Occupational Health and Safety Regulation 2001

5 Meaning of "control" of risks

(1) For the purposes of this Regulation, an obligation to ***control*** *a risk to health or safety (in any case in which the elimination of the risk is not reasonably practicable) is an obligation to take the following measures (in the order specified) to minimise the risk to the lowest level reasonably practicable:*

(a) firstly, substituting the hazard giving rise to the risk with a hazard that gives rise to a lesser risk,

(b) secondly, isolating the hazard from the person put at risk,

(c) thirdly, minimising the risk by engineering means,

(d) fourthly, minimising the risk by administrative means (for example, by adopting safe working practices or providing appropriate training, instruction or information),

(e) fifthly, using personal protective equipment.

(2) A combination of the above measures is required to be taken to minimise the risk to the lowest level reasonably practicable if no single measure is sufficient for that purpose.

(3) Any obligation in this Regulation to control a risk by taking specific risk control measures, or by taking specific risk control measures in a particular order, is in addition to the obligations referred to in subclauses (1) and (2).

Note. *For an example in which the above clause applies, see clause 11 (general obligation of employers and self-employed persons to eliminate risks or, if not reasonably practicable to do so, to control the risk).*

62 Fire and explosion—particular risk control measures

(1) An employer must ensure that risks associated with fire or explosion at a place of work are controlled by:

(a) eliminating activities that have the potential to generate flammable or explosive atmospheres from the work process or, if elimination is not possible, minimising the potential for flammable or explosive atmospheres by providing adequate ventilation, and

(b) eliminating potential ignition sources, including naked flame, hot work and electrical equipment, and sources of static electricity, including friction, welding and slipping belts, from proximity to flammable substances, combustible dusts or waste materials, and

(c) enclosing work areas containing flammable or explosive atmospheres, and

(d) removing waste materials and accumulated dust on a regular basis, and

(e) providing for adequate storage, transportation and disposal of flammable substances, and

(f) any other measures necessary to control the risks.

(2) If flammable substances, combustible dusts or waste materials are present at a place of

work, an employer must monitor the place regularly to ensure:

(a) the removal, on a regular basis, of waste material, including dust, that could pose a fire or explosion hazard, and

(b) the continued effectiveness of control measures taken with respect to potential ignition sources.

6.1.2 Coal Mines Health and Safety Regulation 2006

35 Contents of major hazard management plan: fire and explosion management plan

For the purposes of section 36 of the Act, a major hazard management plan in relation to a major hazard comprising hazards arising from fire and explosion must make provision for the following matters:

(a) regular assessment of the fire and explosion risk at the coal operation,

(b) implementation of control measures to effectively manage risks identified,

(c) the means by which the requirements of Subdivision 1 of Division 1 of Part 4 relating to fire and explosion risk are to be implemented at the coal operation.

45 Contents of emergency management system

For the purposes of section 47 (2) (h) of the Act, an emergency management system for a coal operation must adequately address the following matters in addition to those specified in section 47 of the Act:

(a) fire and emergency provisions for both the surface part and the underground part of the coal operation, including the following:

(i) general emergency procedures,

(ii) provisions for the treatment and transport of sick or injured people,

(iii) the appointment and duties of fire officers,

(iv) the establishment and training of fire teams,

(v) the supply and maintenance of fire fighting equipment,

(vi) general workforce training in the use of fire fighting equipment,

(vii) the provision and supply of water storage and reticulation,

(viii) emergency fire procedures,

(ix) reporting and replacement of damaged fire equipment,

(x) compatibility of fire equipment with equipment of State fire brigades and adjacent mines,

(b) fire and emergency provisions for the underground parts of the coal operation, including the following:

(i) the actions and procedures to be taken by a person who discovers a fire at the mine,

(ii) the escape or evacuation of people from areas affected by emergencies,

(iii) the procedures to be adopted when emergency services external to the mine are required,

(iv) at least 2 means of egress from each production area or other part of the mine to the surface part of the mine so that, in the event of any roadway becoming impassable, another is always available,

(v) the effective communication to all people required to work or travel in the underground parts of the coal operation of the paths of egress from each underground part of the mine,

(vi) a means by which people who may need to use paths of egress are made familiar with them,

(vii) the marking of paths of egress so that people can safely travel on them in conditions of poor visibility,

(viii) sufficient transport or alternate means of escape, in combination with escape plant, to allow the safe evacuation of people,

(ix) the appointment of competent persons to be on duty on the surface part of the coal operation whenever anyone is in the underground parts of the coal operation, with effective means of communication to people in the underground parts of the coal operation,

(x) the rapid and effective sealing of the mine (while at the same time allowing for re-entry to the mine),

(xi) the keeping by the operator of an accurate record of the people underground at the coal operation at any time, and their likely location, and the making available of that record at any time,

(c) in relation to both the surface parts of the coal operation and the underground parts of the coal operation—regular testing as to the effectiveness of the provisions,

(d) first aid arrangements, including the provision of appropriate facilities, competent people and procedures having regard to the nature of the work undertaken at the coal operation and the work environment (both on the surface part of the coal operation and in the underground parts of the coal operations),

(e) arrangements for the treatment of electric shock and fluid injection injuries together with the effective training of people providing such treatment.

48 Fire fighting plan

*(1) An operator of a coal operation must cause a plan (**a fire fighting plan**) of the underground parts of the coal operation showing the positions of the fire fighting equipment and installations, together with infrastructure for fire control and ventilation arrangements, to be prepared.*

(2) The operator must:

(a) cause copies of the plan to be updated at least once every 3 months, and

(b) so often as it becomes outdated, defaced or destroyed, cause it to be replaced.

77 Assessment of risk of fire on belt conveyor

The operator of a coal operation must assess the risk of fire on any belt conveyor in a reclaim tunnel or other enclosed space on the surface of the coal operation.

78 Detection and control of fire on belt conveyor

The operator of a coal operation must ensure that any fire on any belt conveyor in a reclaim tunnel or other enclosed space on the surface of the coal operation is detected as soon as

possible and is effectively brought under control as soon as possible

6.1.3 DPI Guidelines

MDG 25	Guideline for safe cutting and welding operation at mines
MDG 3006 MRT 2	Material testing for hydraulic fluid and aerosol products
MDG 3006 MRT 8	DRAFT – Testing of non-metallic materials for use in underground coal mines

6.1.4 Australian Standards

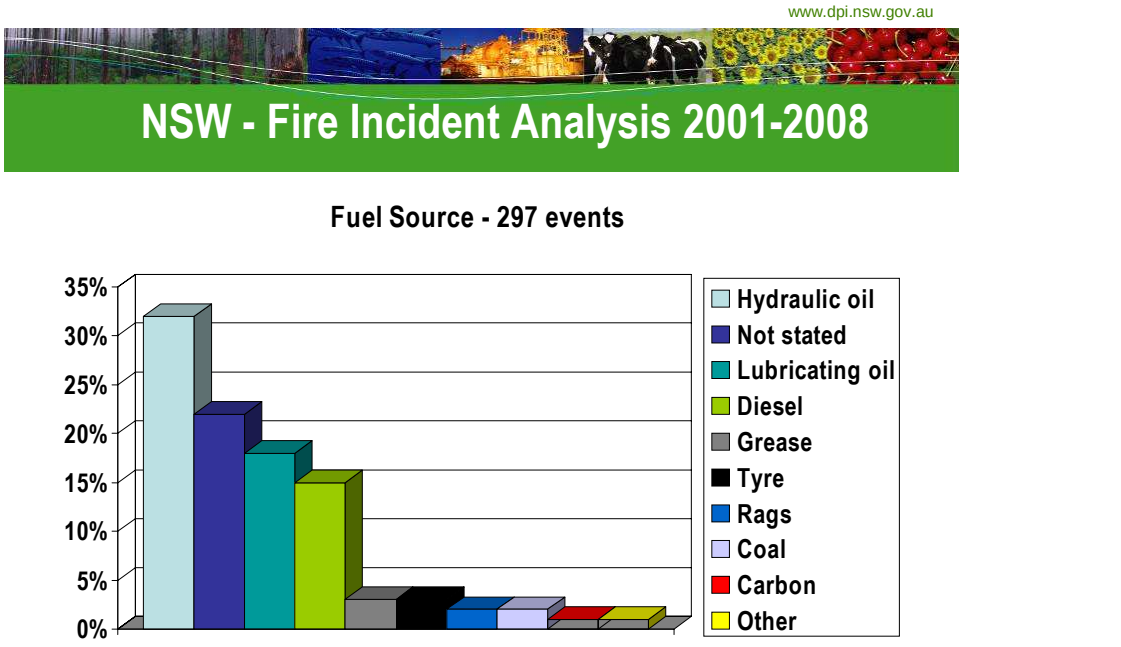
AS 1074-1989	Steel tubes and tubulars for ordinary service
AS 1318-1985	Use of colour for the marking of physical hazards and the identification of certain equipment in industry (known as the SAA Industrial Safety Colour Code)
AS 1319-1994	Safety signs for the occupational environment
AS 1349-1986	Bourdon tube pressure and vacuum gauges
AS 1579-2001	Arc-welded steel pipes and fittings for water and waste-water
AS 1755-2000	Conveyors - Safety requirements
AS 1769-1975	Welded stainless steel tubes for plumbing applications
AS 1851-2005	*Maintenance of fire protection systems and equipment*
AS 1940-2004	The storage and handling of flammable and combustible liquids
AS 2118.6-1995	Automatic fire sprinkler systems - Combined sprinkler and hydrant
AS/NZS 2280:2004	Ductile iron pipes and fittings
AS 2419.1-2005	Fire hydrant installations - System design, installation and commissioning
AS 2419.2-1994	Fire hydrant installations - Fire hydrant valves
AS 2441-2005	Installation of fire hose reels
AS 2444-2001	Portable fire extinguishers and fire blankets - Selection and location
AS/NZS 2544:1995	Grey iron pressure fittings
AS 2792-1992	Fire hose - Delivery layflat
AS 2941-2002	Fixed fire protection installations - Pumpset systems
AS 3786-1993	Smoke alarms
AS 4041-2006	Pressure piping
AS/NZS 4360:2004	Risk management
AS 4587-1999	Water mist fire protection systems - System design, installation and commissioning
AS/NZS 4680:2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4792:2006	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
AS 5062-2006	Fire protection for mobile and transportable equipment

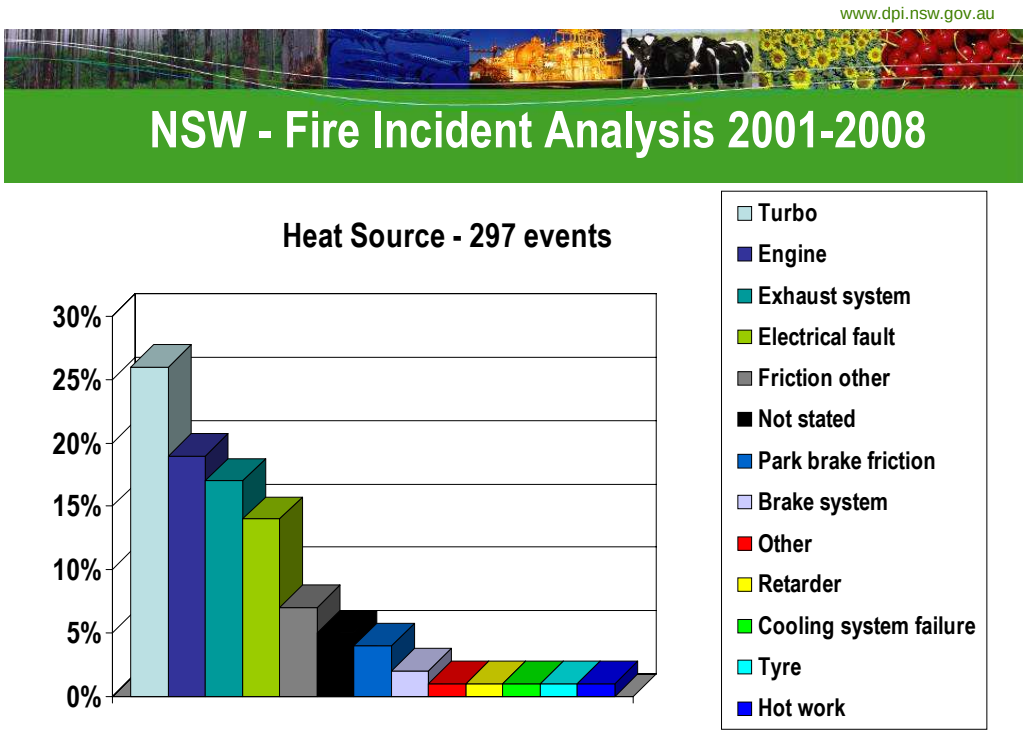
6.2 APPENDIX B – FIRE INCIDENTS

A summary of incidents that relate to fires can be found at:

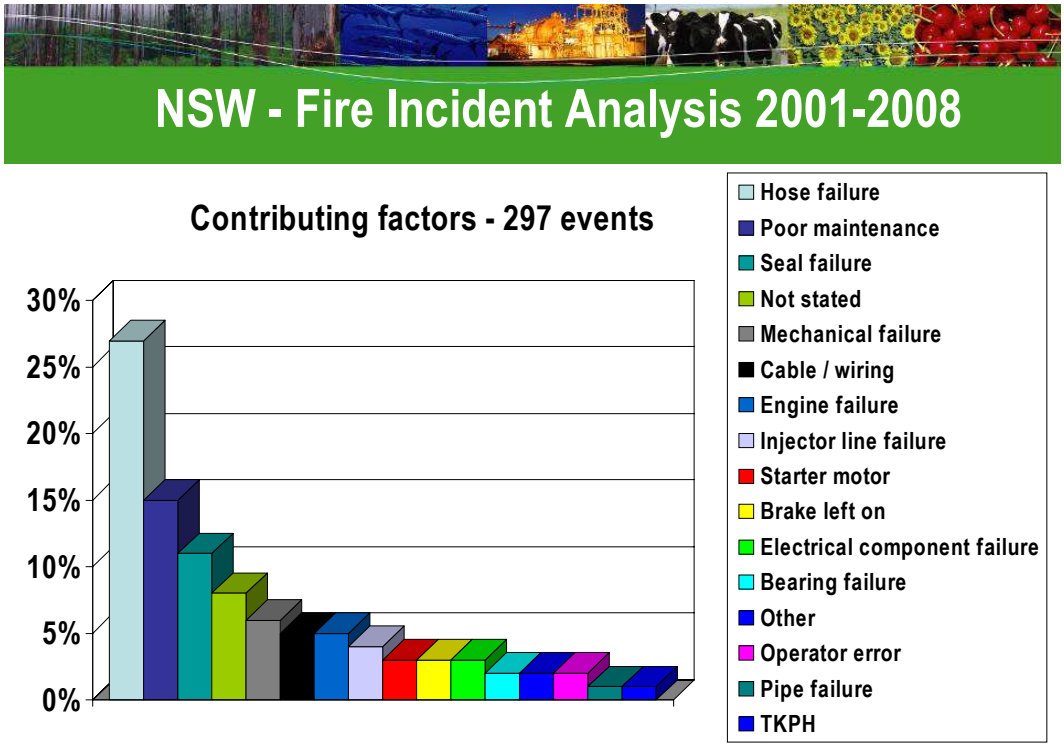
http://www.dpi.nsw.gov.au/minerals/safety/publications/statistical-publications

A summary of fire incidents in NSW between 2001 and 2008 includes-





www.dpi.nsw.gov.au



6.3 APPENDIX C - EXAMPLES

6.3.1 Example table of considered areas underground mine

Area of Mine	Considerations (but not limited to)
Development	Conveyor
	Mobile Electrical Equipment
	Fixed Electrical Equipment e.g. TX DCB Aux fan
	Diesel vehicles
	Cutting and welding
	Face Equipment
	Chemicals
	Drill rigs
	Gas drainage
	Compressed air
	Coal
	Portable electrical apparatus
	Air driven equipment
	Contraband
	Atmosphere
	Coaldust
Longwall	Conveyor
	Mobile Electrical Equipment
	Fixed Electrical Equipment e.g. TX DCB Aux fan
	Diesel vehicles
	Cutting and welding
	Face Equipment
	Chemicals
	Drill rigs
	Gas drainage
	Hydraulics
	Compressed air
	Coal
	Portable electrical apparatus
	Air driven equipment
	Contraband
	Atmosphere
	Coaldust

Area of Mine	Considerations (but not limited to)
Outbye Areas	Conveyor
	Mobile Electrical Equipment
	Fixed Electrical Equipment e.g. TX DCB Aux fan
	Diesel vehicles
	Cutting and welding
	Battery charging station
	Chemicals
	Drill rigs
	Gas drainage
	Compressed air
	Workshop
	Fuel pods
	Service bay
	Reticulation cables
	Rail vehicles
	Coal
	Portable electrical apparatus
	Air driven equipment
	Contraband
	Atmosphere
	Coaldust
Goafs and Sealed areas	Atmosphere
	Coal and coal dust
Drifts and shafts	Conveyor
	Mobile Electrical Equipment
	Fixed Electrical Equipment e.g. TX DCB Aux fan
	Diesel vehicles
	Cutting and welding
	Chemicals
	Gas drainage
	Compressed air
	Reticulation cables
	Rail vehicles
	Coal
	Portable electrical apparatus
	Air driven equipment
	Contraband
	Atmosphere
	Coaldust
Surface	Conveyor

Area of Mine	Considerations (but not limited to)
	Mobile Electrical Equipment
	Fixed Electrical Equipment
	High voltage switch yard
	Diesel vehicles
	Cutting and welding
	Chemicals
	Gas drainage plant
	Compressed air and compressors
	Reticulation cables
	Rail vehicles
	Coal
	Workshop
	Air driven equipment
	Contraband
	Atmosphere
	Coaldust
	Explosives magazine
	Winders
	Bushfires
	Hazardous materials stores
	Coal stockpiles
	Reclaim Tunnel
	Coal Bins
	Rail Receival Terminal
	Preparation plant
	Mine ventilation fan
	Surface buildings
	Car Park

6.3.2 (B) Example table of considered areas open cut mine

Area of Open Cut	Considerations (but not limited to)
Car park	Mobile equipment
	Chemicals
Office Buildings	Fixed electrical equipment
	Contraband
	Chemicals
Preparation Plant	
Road network	
Open Cut	
Stock piles	

Area of Open Cut	**Considerations (but not limited to)**
Reclaim Tunnel	
Coal Bins	
Rail Receival Terminal	
Overland conveyor system	
Workshop	
Hazardous materials store	
Explosives magazine	

6.4 RISK RESULTS TABLE EXAMPLE

Note:

1. Refer to 2.4.1 for detailed list.
2. All of these events are situations that have the capacity to cause a fire.
3. The example used are those events that may occur in a Face zone
4. This table may be expanded to include a risk assessment of all areas of the underground mine. (E.g. travelling roads, returns, sealed areas, drifts etc.)
5. Consideration to be given to the fire risk potential of conveyor belt systems.

(A) Underground Fires in Development Face Zone										
Ref	**Potential Fire Risk Areas of the mine / Plant[1]**	**Fuel Source[2]**	**Ignition Source[3]**	**Fire Risk Scenarios (what/how/when can it happen?)[4]**	**Current Controls**	**P**	**C**	**Risk to health and safety of people, (property, production, environment)[5]**	**Proposed Controls[6]**	**New RR**
	Face Zone Conveyors			Frictional heating						
	Face Zone Conveyors			Overheating of motors						
	Face Zone Conveyors			Cables overheating						
	Face Zone Conveyors			Electrical arcing						
	Face Zone Conveyors			Static electrical discharge						
	Mobile Electrical Equipment			Overheating of motors						
	Mobile Electrical			Cables overheating						

[1] refer 2.3.4 and 2.3.5

[2] refer 2.3.2

[3] refer 2.3.3

[4] refer 2.4.4 to 2.4.7;

[5] refer 1.7.20, 2.4.2 and 2.4.8

[6] refer 2.1.5, 2.4.3, 2.5; 2.7; 2.8; and 2.10

(A) Underground Fires in Development Face Zone										
Ref	**Potential Fire Risk Areas of the mine / Plant[1]**	**Fuel Source[2]**	**Ignition Source[3]**	**Fire Risk Scenarios (what/how/when can it happen?)[4]**	**Current Controls**	**P**	**C**	**Risk to health and safety of people, (property, production, environment)[5]**	**Proposed Controls[6]**	**New RR**
	Equipment									
	Mobile Electrical Equipment			Electrical arcing						
	Mobile Electrical Equipment			Impact damage compromises fire-safe integrity of apparatus						
	Fixed Electrical Equipment			Impact damage compromises fire-safe integrity of apparatus						
				Electrical arcing						
				Chemicals						
				Overheating of motors						
				Cables overheating						
				Heated surfaces						
	Diesel vehicles			Overheating of motors						
	Diesel vehicles			Impact damage compromises fire-safe integrity of apparatus						
	Diesel vehicles			Frictional heating of brakes and other components						
				Methane present						
	Cutting and welding			Methane present						
	Cutting and welding			Coal dust present						
	Face equipment			Frictional sparking						
				Impact damage compromises fire-safe integrity of apparatus						
				Electrical arcing						

(A) Underground Fires in Development Face Zone										
Ref	**Potential Fire Risk Areas of the mine / Plant[1]**	**Fuel Source[2]**	**Ignition Source[3]**	**Fire Risk Scenarios (what/how/when can it happen?)[4]**	**Current Controls**	**P**	**C**	**Risk to health and safety of people, (property, production, environment)[5]**	**Proposed Controls[6]**	**New RR**
				Overheating of motors						
				Cables overheating						
				Frictional heating						
				Heated surfaces						
	Chemical reaction (polymer)			Ignition of chemical						
	Drill rigs			Frictional sparking						
				Impact damage compromises fire-safe integrity of apparatus						
				Electrical arcing						
				Overheating of motors						
				Cables overheating						
				Frictional heating						
				Heated surfaces						
	Gas drainage			Impact damage						
				Methane present						
	Compressed air			Frictional heating						
				Static electricity causes arcing and sparking						
	Coal			Spontaneous combustion						
				Heated surfaces						
				Frictional heating						
	Portable electrical apparatus			Impact damage						
				Electric arcing						
				Overheating of motor						

(A) Underground Fires in Development Face Zone										
Ref	**Potential Fire Risk Areas of the mine / Plant[1]**	**Fuel Source[2]**	**Ignition Source[3]**	**Fire Risk Scenarios (what/how/when can it happen?)[4]**	**Current Controls**	**P**	**C**	**Risk to health and safety of people, (property, production, environment)[5]**	**Proposed Controls[6]**	**New RR**
				Cables overheating						
	Air driven equipment			Overheating of motor						
				Static electrical discharge						
				Frictional heating						
				Frictional sparking						
	Contraband			Naked flame						
				Arcing						
	Atmosphere			Methane						
	Coal dust			Frictional sparking						
				Shotfiring						
				Electrical arcing						
				Overheating of motors						
				Cables overheating						
				Frictional heating						
				Heated surfaces						