

FIRE AND EXPLOSION**Δ 09**

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9 FIRE AND EXPLOSION

Intent

The intent of this Protocol is to eliminate or minimise the potential for fatalities, injuries and incidents arising from risks related to unplanned or uncontrolled fire or explosion.

Related Life-Saving Behaviours

1. Always come to work drug and alcohol free.
2. Always use or wear critical safety equipment.
4. Only operate equipment if trained and authorised.
6. Never modify or over-ride critical safety equipment without approval.
9. Always report injuries and HPRIs.

Key actions

1. Conduct a risk assessment to identify potential fire and explosion risks and determine controls.
2. Develop a Fire and Explosion Management Plan.
3. Develop and implement Procedures and actions for first response and triggers for withdrawal to a place of safety and emergency response.
4. Provide, maintain and periodically test fire escapes, emergency escape lighting and/or route marking for evacuation.
5. Install, test, calibrate and maintain, fire detection, monitoring and alarm systems in appropriate locations and on relevant plant and equipment, including evacuation routes and emergency exits.
6. Install and maintain manual and/or automatic fire suppressions systems in high-risk locations, plant and mobile equipment.
7. Develop and implement management plans and Procedures for additional control where there is an ignition risk from electrical arcing, lightning, friction, spontaneous combustion or incompatible substances – such as chemicals or molten or reactive metal - or explosion risk from volatile fuel or dust.
8. Provide regular competency based fire Training for all personnel.

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9.1 General Requirements

- 9.1.1 A fire and explosion related risk assessment must be conducted and documented to identify the potential hazards, risks and controls. It must consider:
- a) Sources of ignition;
 - b) The presence of combustible or flammable material;
 - c) The presence of explosive gases and atmospheres;
 - d) The storage and treatment of incompatible and hazardous substances.
- 9.1.2 A Fire and Explosion Management Plan must be developed, implemented and maintained and, as a minimum, include:
- a) Fire and Explosion prevention measures, including ignition source exclusion zones and contraband controls;
 - b) Fire and Explosion detection, alarms, warning systems and controls;
 - c) Trigger Action Response Plans (TARPs) based on the relevant detection systems, triggers and hazardous conditions;
 - d) Fire Fighting Equipment, including type, location, availability of adequate water supply and pressure;
 - e) References to related management plans or Procedures e.g. Spontaneous Combustion and Combustible Dust Suppression Management Plans.
- 9.1.3 Fire and explosion detection, monitoring and alarm systems must be installed in appropriate locations, and on relevant items of plant and equipment, e.g. heat or smoke detectors, gas detection systems, audible and visual alarms, stench gas alarm system, etc.
- 9.1.4 A register of fire monitoring, detection, suppression, firefighting and emergency response/rescue equipment must be maintained to support inspection, testing and maintenance of the equipment.
- 9.1.5 A warning system must be provided on enclosures that could contain toxic extinguishants released from automatic fire suppressions systems – to prevent unauthorised entry and potential asphyxiation.
- 9.1.6 Portable fire extinguishers of a suitable capacity must be installed and safely accessible:
- a) On mobile equipment; and
 - b) Within close proximity (normally 20m) and where applicable, upwind of all fire risk locations.
- 9.1.7 Integrated fire detection and suppression systems (e.g. deluge, water, chemical, gas, etc.) must be provided corresponding with the risk to people and equipment. Examples include: major mobile equipment, Motor Control Centres (MCC), electrical sub-stations, transformer compounds, conveyor belt drives and winches, hazardous goods storage areas, fuel and lubricant storage depots, hoist rooms, fan houses, compressor rooms, offices and other buildings.
- 9.1.8 Inspection, testing, calibration, maintenance and replacement of fire and explosion detection, alarm and suppression systems must comply with the manufacturers' specifications, asset Procedure/s and be included in the asset's maintenance management system.

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- 9.1.9 A Permit System and back-up process must be used whenever a fire or explosion detection, monitoring or suppression system is offline.
- 9.1.10 Up-to-date copies of the Fire Fighting Control Plans (i.e. showing the location of fire equipment, hydrants, escape routes, etc.) must be displayed in prominent locations, e.g. control rooms, muster areas, lunchrooms, supervisor stations, office areas, evacuation points, electrical substations and workshops, etc.
- 9.1.11 Procedures that clearly define the actions to be taken on discovering a fire or an explosion risk must be developed and communicated.
- 9.1.12 Fire escapes, emergency escape lighting and/or route marking must be provided, and periodic evacuation drills conducted in accordance with Emergency Response protocols.
- 9.1.13 Hot Work must be controlled with the following:
 - a) Designated Hot Work Locations (DHWL) must be established where required for regular hot work activities;
 - b) A Hot Work Permit System must be implemented and utilised for:
 - 1. Hazardous Hot Work within a DHWL where flammable or explosive materials have been introduced, such as a fuel tank or chemical products;
 - 2. All Hot Work outside a designated DHWL.
- 9.1.14 A Fire Watcher must be considered for all Hazardous Hot Work.
- 9.1.15 A mandatory continuous fire watch must be maintained at the following locations where Hazardous Hot Work is conducted. A Fire Watcher must be present during and for at least two hours after completion of the hot work. The post-work fire watch may be reduced to 30 minutes if the job can be completely cooled with water and/or a thermography camera is used to ensure no ignition source remains.
 - a) Hot Work on major equipment including draglines, shovels, excavators, drills and other equipment completed outside of a workshop (work on buckets, ground engaging tools and jewellery can be excepted where the risk is assessed and controlled);
 - b) Work in multi-level process plants, buildings or equipment where hot material or sparks are able to fall below or outside the work area;
 - c) Hot Work in areas determined by risk assessment as presenting a risk of immediate or delayed ignition.
- 9.1.16 Machine components that could cause a fire or explosion must be identified, e.g. turbochargers, batteries, ignition sources close to fuel sources, cables, fuel lines and hydraulic hoses that can rub, chafe and fail. Where practical, protection should be implemented to minimise the fire risk associated with these components e.g. shielding, shrouding, clamping to reduce movement, internal porting of hydraulic lines, and/or establish exclusion zones.
- 9.1.17 Incompatible substances that can potentially ignite or explode when brought into contact must be identified and specific management and control measures developed and implemented. e.g. oxygen exposure to titanium or carbon steel.
- 9.1.18 Where an explosion risk can occur, the asset's Engineering Management Plan must include standards for the purchase, installation, commissioning, use, calibration and maintenance of

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equipment (e.g. flameproof/intrinsically safe electrical equipment and diesel engine systems).

- 9.1.19 Where there is a risk of spontaneous combustion, frictional ignition or flammable gas being present, issue specific controls, processes and Procedures must be developed, implemented and maintained for each of the hazards.

9.2 Additional Requirements for Underground (or other Defined Risk Area)

- 9.2.1 Where ignition of gas and dust can be initiated, a documented technical hazard assessment (i.e. sampling and laboratory testing) must be made to determine the potential for occurrence and mitigating controls.
- 9.2.2 Refuelling stations and battery charging stations, major maintenance workshops, DHWL, permanent tyre and lubricant storage areas must be designed and equipped to minimise and contain the impact of a fire, adequately ventilated and if underground, ventilated to a return airway.
- 9.2.3 Appropriate Procedures must be established to manage and provide security for low flash point chemicals and fuel (<61°C) whilst underground.
- 9.2.4 The prevention and mitigation of electrical transformer fires must be addressed and consider relevant Codes of Practice and include:
- a) Installation and testing of electrical protection systems;
 - b) A risk based transition to the use of fire resistant or non-flammable cooling mechanisms, such as nitrogen or ester-based oils;
 - c) Detection and protection of overpressure conditions within the transformer;
 - d) Temperature protection;
 - e) Regular maintenance and testing of electrical installations (included as part of the relevant asset's Engineering Management Plan); and
 - f) Installation so that it is directly, or able to be, ventilated to the return airway where practicable.
- 9.2.5 Where a flammable gas risk exists, the controls must include:
- a) Setting of threshold levels for the monitoring of gases;
 - b) Appointment of competent persons to monitor and take action when an alarm is triggered;
 - c) Recording, verification and escalation of all alarm events;
 - d) An inspection regime for monitoring gas levels in intake and return airways and where people are required to work;
 - e) Provision of flammable gas monitors for electrical machinery and diesel vehicles;
 - f) Installation of ventilation structures, e.g. stoppings, seals, ventilation fans, that are designed, rated, constructed and verified to a standard that is adequate for the risk potential;
 - g) A Ventilation Management Plan and Procedures that document how ventilation is to be provided to remove, dilute and control explosive levels of mine gases;
 - h) Electrical and diesel equipment that is designed, approved, installed, used, inspected and

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- maintained to operate safely e.g. explosion protected or intrinsically safe apparatus;
- i) The prohibition of smoking, smoking related products, or other non-approved device capable of creating a spark or flame which can ignite flammable gas;
 - j) A real time gas monitoring and analysis system for intake and return airways; and
 - k) A tube bundle system for monitoring and analysing gas concentrations in sealed or abandoned areas, or areas of the mine requiring monitoring during a power failure, e.g. longwall return, main ventilation shaft.
- 9.2.6 Where a combustible dust hazard exists, the controls must include:
- a) The minimisation of combustible dust generated by the cutting and transport of material using water suppression and/or scrubber systems and the design of equipment;
 - b) The removal (or rendering inert) of accumulations of potentially explosive dust;
 - c) Procedures and methods for the application of limestone dust or other explosion inhibitor in quantities that will prevent the propagation of a dust explosion in the mine;
 - d) The means by which the limestone dust or other explosion inhibitor is to be applied to surfaces that have been recently mined. The means by which limestone dust or other explosion inhibitor is introduced into the return airway in close proximity to the working face; and
 - e) Procedures for the examination, sampling and testing of roadway dust to ensure the incombustible content is within acceptable limits. The methods for sampling must incorporate a combination of spot and strip samples taken over set frequencies of time depending on location.
- 9.2.7 Where a frictional ignition risk exists, the controls must include:
- a) Verification that drums, picks and water sprays used on cutting machines are designed to eliminate or minimise the potential of a frictional ignition event;
 - b) Use of adequate water and sprays for suppressing sparks associated with cutting;
 - c) An inspection and maintenance program that demonstrates the effectiveness of the water sprays and that the picks, sprays and drums are maintained to an appropriate standard;
 - d) Ventilation of the cutting area to remove or dilute any accumulation of flammable gas;
 - e) Appropriate fire extinguishing equipment maintained close to the face or work area;
 - f) Face cutting Procedures that minimise the risk of frictional ignition, particularly around the intersection of gas drainage holes;
 - g) Bolting Procedures and equipment that minimise the risk of frictional ignition, particularly over-spinning or heat generation; and
 - h) Condition monitoring (including the use of thermal imaging where appropriate) of rotating plant that has the potential to heat under friction, e.g. belt rollers, idlers, pulleys, drive drums.
- 9.2.8 Where a spontaneous combustion risk exists, the controls must include:
- a) The development of a Spontaneous Combustion Management Plan, that includes: prediction, detection, sealing and inertisation;

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- b) Formal determination of spontaneous combustion propensity and characteristics;
 - c) The analysis of bag samples using a gas chromatograph;
 - d) Trigger Action Response Plans (TARPs) for indicators and ratios of spontaneous combustion;
 - e) A Procedure for managing and removing stowage from the mine;
 - f) A real time gas monitoring and analysis system for intake and return airways, specifically located on the return air side of potential spontaneous combustion hazards; and
 - g) A tube bundle system for monitoring and analysing gas concentrations in sealed or abandoned areas of the mine.
- 9.2.9 Where a risk from lightning initiated gas ignition exists, a Lightning Management Plan is required and must include:
- a) A lightning risk assessment with the participation of a subject matter expert which considers:
 1. The electrical resistivity of the ground / strata at the operation;
 2. Conductive boreholes that enter the workings.
 - b) Lightning mitigation studies considering mine infrastructure such as conveyors, pipelines, communication cables and electricity cables that enter the mine;
 - c) Identification of all possible surface connection points;
 - d) Removal of all conductive cables, pipes and other structures from areas that will become sealed if these items are greater than 20 metres in length;
 - e) Installation of specified gaps between conductive sources; and
 - f) Prohibition of shot firing during times of potential lightning activity.

9.3 Training and Competency

- 9.3.1 Identify Training needs of employees and contractors in relation to fire and explosion, and the provision of assessment to verify competency.
- 9.3.2 Provide specific Training, assessment, authorisation, and appoint personnel to fulfil roles defined in the Fire and Explosion Management Plan.
- 9.3.3 Specific competencies must be obtained by persons to be authorised to work on explosion protected or intrinsically safe equipment.

9.4 Additional Requirements for Catastrophic Hazard (PMC 5) Situations

- 9.4.1 Create separate zoning and monitoring of gaseous areas.
- 9.4.2 Provide specialist firefighting equipment for relevant hazardous locations such as low and high expansion foam and applicators; and inertisation capability for underground coal mines.
- 9.4.3 Provide specific monitoring and management of high-risk dust generating areas such as coal bins and bunkers or other locations with potentially explosive dusts.
- 9.4.4 Apply fire engineering design solutions to high-risk facilities that store large volumes of fuels, large quantities of explosives, or radioactive materials etc.

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9.5 Definitions

Defined Risk Area

Refers to a location other than underground where the risk is such that similar controls need to be established for the safety of personnel. Where such risk/s are identified within an asset's fire and explosion risk assessment, the controls are to be documented and applied.

Designated Hot Work Location (DHWL)

A DHWL is a fixed and approved location designed for conducting hot work with a minimal risk of fire, and is clear of all flammable materials and maintained in that state e.g. boilermaker's shop. It includes provision of adequate firefighting equipment.

Fire Watcher

The role of the fire watcher is to continuously monitor for a fire outbreak and must not be given other duties or leave the location unless replaced.

Hazardous Hot Work

Hot work is hazardous if it requires work on or within:

- 15 metres of flammable liquids, gases, dusts, or other flammable or explosive substances;
- Fuel or oil tanks or hydraulic components;
- A chemical, fuel, oil or gas storage area;
- A battery charging area;
- An explosive storage area;
- A confined space;
- Exposed drill patterns; and
- Areas determined by risk assessment to be hazardous in nature.

Hot Work

Any work that involves burning; welding, cutting, brazing, flame soldering or grinding of metals; using fire- or spark-producing tools, or other work that produces a source of ignition.

Management Plan

Formal process for management of a particular activity, task or are of the business which articulates management activities and roles and responsibilities.

Permit System

Formal system required for specific tasks or activities i.e. working in confined space, whereby a permit has to be issued to an operator prior to commencing work.

Procedure

Documented process detailing the requirements for conducting an activity or task.

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Training

The initial training to verify competence and subsequent refresher training to verify that the competencies have been retained.

Tools (See Glencore HSEC Intranet)

Tools provided include:

- Protocol Self-Assessment Workbook
- Protocol Third Party Audit Workbook
- Protocol Toolbox Talk.
- Guideline – Management of Oxygen related hazards

Note: Application of this Protocol must also comply with the General Mandatory Requirements outlined in Section II of the Glencore Life-Saving Behaviours and Fatal Hazard Protocols publication.

9.6 References

None.

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9.7 Accountabilities

Team	Accountabilities
Glencore Corporate	<ul style="list-style-type: none"> Maintain and update this Protocol.
Department	<ul style="list-style-type: none"> Oversee the implementation of this protocol within department and apply assurance processes.
Asset management	<ul style="list-style-type: none"> Apply the requirements of this protocol.
All employees/contractors	<ul style="list-style-type: none"> Comply with relevant requirements of the protocol. Report hazards and incidents related to energy isolation.

9.8 Control and Revision History

9.8.1 Document Information

Property	Value
Approved by:	Lucy Roberts
Document owner:	David Mellows
Effective date:	20/08/2020

9.8.2 Revision

Version	Date Reviewed	Review Team	Nature of Amendment(s)
1-0	29/10/2013	HSEC Corporate Leads	First published version.
2-0	20/07/2020	D.Reece (subject matter expert), D.Mellows, Industrial Departments representatives with detailed input from GCAA (M.Buffier, M.Winchester and A.Esdaile), Legal Department review (S.Teichner).	Removal of the three-implementation stages and adjustments based on review of HPRI's, fatalities and current industry practice. Changes/additions to fire watch, transformer oils ventilation, DHWL and fire watch, Hazardous Hot work definitions, clarification of definition of "other defined risk area".