

PROCEDURE

Title: **Hazardous Areas**

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Department: HSEC	Sect./Classification: Safety	Category: Electrical	Owner Role: Superintendent - Electrical Integrity	Approver Role: Manager - Engineering & Asset Integrity
				Appr. Signature:

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1.0 PURPOSE

To ensure that all activities performed in hazardous areas are done so safely.

To ensure that any access or work in a hazardous area is carried out in a safe manner; and that personnel who are required to access or work in a hazardous area have been appropriately trained.

To provide a guide for the classification, design, installation and documentation of electrical equipment in hazardous areas and the maintenance requirements to ensure that the protection of the equipment is upheld.

2.0 SCOPE

Applies to all hazardous areas at Queensland Alumina

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3.0 RESPONSIBILITIES

Maintenance Superintendent

- Ensure that E/I Personnel working and maintaining electrical and instrumentation equipment in hazardous areas are trained and competent
- Ensure the Verification Dossier exists and is kept up to date

EI Supervisor

- Ensure that electrical / instrument equipment is maintained and inspected as per the hazardous area legislative requirements
- Maintain and verify the competencies of EI tradespeople to perform work in hazardous areas
- Review and update the verification dossier as required

EI Tradesperson

- Maintain their competency for the type of work to be undertaken in hazardous areas
- Work is carried out and inspected as per hazardous area requirements

Engineering & Asset Integrity Manager

- Ensure that correct classification and delineation of hazardous areas is completed by a qualified Hazardous Area Designer and that a safe system of protection is implemented for all fixed electrical equipment within the hazardous area.
- Any changes to Hazardous Areas due to new projects is risk assessed, documentation in the Verification Dossier is updated, and the project signed off by a Hazardous Area Designer

Operations Superintendent

- Equipment is made available for inspection, maintenance, repair as required by the SAP workorder or requested by the EI Supervisor
- Aware of the hazardous area legislative requirements for the hazardous area under their control
- Responsible for the verification dossier ownership

Area Manager

- Confirm that personnel (other than E/I) that are required to work in a hazardous area of their section are trained and competent
- Aware of the hazardous area legislative requirements for the hazardous area under their control

Hazardous Area Assessor / Auditor

- Must be accredited by the Department of Justice and Attorney-General (QLD)
- Responsible for the auditing of hazardous areas

Hazardous Area Designer

- Responsible for the classification and review of hazardous areas
- Responsible for the selection of electrical equipment and design of electrical installations within hazardous areas

4.0 REFERENCES

- Electricity Safety Act
- Electricity Safety Regulation

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- Workplace Health & Safety Act
- AS/NZS 1768 - Lightning Protection
- AS/NZS 3000 - Wiring Rules
- AS 1940 - The Storage and Handling of Flammable and Combustible Liquids
- AS/NZS 4761.1 - Competencies for working with electrical equipment for hazardous areas (EEHA) - : Competency Standards
- AS/NZS 60079 - Electrical apparatus for explosive gas atmospheres
- AS/NZS 61241 - Electrical apparatus for use in the presence of combustible dust
- AS3814 – Industrial and commercial gas-fired appliances
- AS5601.1 – Gas Installations
- AS1596 – The storage and handling of LP Gas
- P003.004 – Risk Evaluator
- P201.007 – Management of Change
- P202.013 – Authority to Operate
- P314.307 – Hot Work Permit System
- P314.314 - Permit to Work
- P314.260 - Isolation, Tag and Lockout Procedure
- P314.611 – Electrical Installations Testing
- P314.618 – Unterminated Electrical Cables
- QE50-091-02 (SAP No. 10884) – Electrical Equipment Identification Labels

5.0 DEFINITIONS

- Explosive Atmosphere:** Mixture with air under atmospheric conditions of flammable materials in the form of gas, vapour, mist, dust or fibres in which, after ignition, combustion spreads throughout the unconsumed mixture
- Explosion Protection:** Technique of protection which is applied to equipment or part of equipment to prevent the ignition of flammable vapours and gases in hazardous areas.
- Hazardous Area:** An area which an explosive atmosphere is present or may be expected to be present in quantities such as to require special precautions for:
- Any access or activity that presents an ignition source; or
 - The construction, installation and use of electrical equipment
- Verification Dossier:** An up to date master document as required by AS60079.14 Cl4.2 which lists all associated documents, including equipment certification, calculations, drawings of the hazardous area, records to enable the maintenance of equipment to maintain type of protection and copies of previous inspections.
- Ignition Source:** Source of energy, which may comprise of naked flames, sparks, hot surfaces / particles, sufficient to ignite an explosive atmosphere
- Intrinsic Safety:** Technique of protection used in which devices are restricted from releasing sufficient energy to ignite hazardous area gases by use of an intrinsically safe barrier which limits the energy to the device.
- Simple Device:** Any piece of equipment in which the energy level of the equipment on an energy curve is below the ignition level of the most volatile gases. This corresponds to a device which cannot store or generate more than 1.2V, 0.1A, 25mW or 20µJ
- Source of release:** Point or location from which a flammable material may be released into the atmosphere, so that an explosive atmosphere could be formed.
- Zones:** Hazardous Areas are classified into zones based upon the frequency of the occurrence and the duration of the explosive atmosphere
- EPL:** Equipment Protection Level. Level of protection assigned to equipment based on its likelihood of becoming a source of ignition and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres.

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6.0 ACTIONS

6.1 Classification of Hazardous Areas

The Hazardous Area Designer is responsible for the classification of hazardous areas. Classification of hazardous areas must be undertaken by a competent person as per section 6.13 and certified by an external auditor.

6.1.1 Classification for Liquids, Gas and Vapors

Classification of the combustible liquids, gas and vapour hazardous areas shall be done in accordance to AS/NZS 60079.10.1.

Records of hazardous area classification shall be documented in the verification dossier.

6.1.2 Classification for Combustible Dust

Classification of the combustible dust hazardous areas shall be done in accordance to AS/NZS 60079.10.2.

Records of hazardous area classification shall be documented in both the verification dossier and hazardous area design reports.

6.1.3 Gas Industry Codes

Equipment certified as complying with the AS3814, AS5601 and AS/NZS1596 may be classified as non-hazardous areas as per exemptions outlined in AS60079.10.1 ZA.6.2

However, the following associated equipment must be classified as per Hazardous Area AS60079.10.1 ZA.6.2 requirements -

- Pressure Relief Devices
- Vent Discharge Points
- Pit and Enclosures that are inadequately ventilated
- Cylinders with a capacity exceeding 30m³
- Cylinder Filling Hoses

6.2 Identification and Signage

All hazardous areas shall be marked by clearly visible signs.

The area must be signed appropriately (AS 1319). Signage must:

- Clearly identify the nature/ type of hazard i.e. the presence of a flammable liquid, gas or vapour; the presence of combustible dust in suspension or in layers; or a combination of explosive gas and dust atmospheres
- Identify requirements/precautions to be adhered to by persons in the Hazardous Area i.e. equipment which is not permitted, required PPE, etc.

These signs shall give clear instructions and control measures to prevent the presence of ignition sources in the area. Their detail may include the following as specific to the area:

- Lighters and matches
- Spark / flame producing equipment (eg. welders, grinders)
- Portable electrical / electronic equipment (eg. power tools, radios, cameras, mobile phones)
- Forklifts
- Any other item, equipment or activity that may constitute an ignition source

Additional precautions for gas zones may also include:

- Drop boxes installed at the entrances to such areas for non-hazardous rated radios / mobile phones / etc.
- Fenced off areas to prevent un-authorized access

Where areas are fenced off, it is the Area Asset Co-ordinators responsibility to ensure access into these areas is controlled and secured.

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6.3 Documentation

The initial preparation of the Verification Dossier documentation may be delegated by the Area Asset Co-Coordinator to a hazardous area expert. It shall be the Maintenance Superintendent responsibility to ensure that the relevant information is produced and current.

The ongoing upkeep of the document will remain the Maintenance Superintendent responsibility. The Maintenance Superintendent may choose to delegate responsibility to the section EI Supervisor for the updating of maintenance and inspection records within the Verification Dossier.

For the purposes of the Verification Dossier, all documentation related to the hazardous area shall be stored electronically in the highest SAP function location level related to the hazardous area.

A hard copy Verification Dossier of all the electronic information shall also be kept and updated in the EI Section where the hazardous area exists. The locations of the Hardcopy Verification Dossiers are:

- Coal Handling Area: Utilities E/I Maintenance Supervisors office
- Gas Gate Station: Whiteside E/I Maintenance Supervisors office
- Thermal Oxidizer compound: Redside E/I Maintenance Supervisor's office

Hazardous area zones shall be detailed on layout drawings including elevations and sections. These drawings shall be kept current under the SAP function location for the hazardous area as part of the Verification Dossier.

Equipment characteristics and certification shall also be recorded under the SAP function location for the hazardous area equipment. These records should have sufficient information to enable the protected equipment to be maintained in accordance with its type of protection (for example – QAL spares, certificates, technical information and manufacturer's instructions)

System documentation and calculations for intrinsically safe systems will be stored in the SAP function location of the intrinsic device.

Additional documentation requirements in the case of dust shall include:

- Material characteristics of the combustible dust including minimum ignition temperature of the dust cloud, minimum ignition temperature of the dust layer, minimum ignition energy of the combustible dust cloud and electrical resistivity

Inspection and maintenance records of hazardous area equipment shall be recorded electronically against the associated work order raised in SAP either via measuring point documents or the associated inspection checklist document as per section 6.7. A hardcopy of the inspection checklist document shall also be kept in the Verification Dossier.

6.4 Access Control

Work in hazardous areas shall be managed using the QAL Procedures –

- P314.314 - Permit to Work
- P314.260 - Isolation, Tag and Lockout Procedure
- P314.307 - Hot Work Permit System

Work above a hazardous area shall be managed as though the work was being conducted in the hazardous area. In classified gas zones the following additional controls may be implemented whilst performing work –

- Isolation of potential sources of flammable gas or vapour within 15m of the work area.
- Initial and continuous gas testing to confirm the hazardous areas gases are below their lower explosive limits

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- Use of non-sparking tools and / or intrinsically safe equipment
- Use of hazardous area approved test/maintenance equipment

In classified dust zones the following additional controls may be implemented whilst performing work -

- Isolation of equipment which may create flyings (sparks and other ignition sources) or introduce dust clouds
- Clean and wet down of the work area and surrounds
- Use of non-sparking tools and equipment

6.5 Hot Work

A Hot Work permit as per QAL Procedure P314.307 will be required for all work within or above a Hazardous Area.

6.6 Electrical / Instrumentation Equipment in Hazardous Areas

6.6.1 Installation

Only essential electrical / instrument equipment shall be installed in hazardous areas. The designer of the electrical / instrument equipment must ensure that a safe system of protection is implemented for all fixed electrical equipment within the hazardous area as per AS60079.14.

All new electrical / instrument equipment installations or modifications to equipment in hazardous areas shall have a hazardous area design report completed.

Intrinsically safe devices shall have an entity calculation as per AS60079.14 as well as AS60079.1 and AS60079.25 for intrinsically safe in explosive gas atmosphere or AS61241.11 for combustible dust to ensure energy to the device is limited. Entity calculations shall be included in the verification dossier.

Electrical / instrument equipment for use in hazardous areas must be certified under the ANZ Ex or IEC Ex schemes (or the phased out Aus-Ex scheme for older equipment). ATEX certified equipment requires a conformance assessment document to ensure it offers the same level of safety as the other schemes.

Conformance certificates must be supplied by the manufacturer for fixed electrical equipment and attached to the verification dossier in SAP.

Conformance certificates are not required for simple devices, although the preferred method of protection is to make them intrinsically safe through the use of a barrier or galvanic isolator.

Where trunking, ducts, conduits, pipes or trenches are used to accommodate cables, precautions shall be taken to prevent the passage of flammable gases, vapours or liquids. This may be achieved by seals, sand filling or adequate venting.

Any electrical / instrumentation installation work shall be carried out by a competent person as outlined in section 6.12

6.6.2 Hazardous Area Commissioning of New Installations

Before power can be connected or reconnected to a new installation, the installation must be inspected by an accredited hazardous area auditor. The accredited hazardous area auditor is required to confirm that it has been tested to ensure it is electrically safe as required by the Queensland Electrical Safety Regulation 2002 Clause 153.

6.6.3 Modifications / Upgrades to Existing Equipment / Installations in Hazardous Areas

Where existing electrical equipment that is operating or has operated in an area that has been classified as a hazardous area where no such hazardous zone previously existed, an Authority To Operate (ATO) as per QAL Procedure P202.013 and risk assessment shall be performed to determine the level of risk for that equipment to operate until the equipment can be changed to comply with the required Hazardous Area standards.

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Where an ATO cannot be approved in instances the risk is unacceptable, the equipment shall be isolated until the installation can be upgraded to the required hazardous area zone standards.

Electrical equipment that is upgraded as part of a maintenance activity from previously non-hazardous area to hazardous area compliant equipment may be re-energised if the following conditions apply –

- a) The installation has been completed by a competent and trained person as per section 6.12; and
- b) An electrical inspection as per QAL Procedure P314.611 Electrical Installations Testing has been completed by a competent and trained person as per section 6.12 and recorded in the Verification Dossier; and
- c) A hazardous area check sheet has been completed by a competent and trained person as per section 6.12 and recorded in the Verification Dossier; and
- d) A Management of Change is completed to reflect the changes required for SAP preventative maintenance activities, SAP measuring point data, SAP Bill of Materials, any related drawings, and date for a hazardous area assessor to review the installation no later than a period within 4 months; and
- e) The risk of re-energisation is classified as 'LOW' as per the QAL Risk Evaluator in the Management of Change (QAL Procedure P201.007)

Any modification or change to electrical equipment that is not like for like in a hazardous area shall follow QAL Management of Change Procedure P201.007 and recorded in the Verification Dossier.

6.6.4 Electrical Work / Testing within a Hazardous Zone

All Electrical/Instrumentation installations shall require a Hot Work Permit as per QAL Procedure P314.307 for any live work (including testing for 'dead' unless the isolation has already been tested at the substation / MCC) within a hazardous zoned area.

Any electrical enclosure that is not intrinsically safe, shall not be opened without first isolating the equipment and sufficient time has been given for any surface temperature or stored energy to dissipate to a level which will not cause ignition.

A risk assessment must be completed before any electrical testing can be performed in a hazardous area. The risk assessment will include a Contact Hazard Assessment as outlined in QAL Procedure P314.619 Working on or Near Live Low Voltage Electrical Equipment as well as further controls outlined in section 6.4

6.6.5 Labeling

All explosion protected electrical equipment installed in hazardous areas must have markings that comply with the requirements of section 4 of AS 2380.1 1989 or section 29 of AS/NZS 60079.0.

Each explosion protected electrical device must have a unique identification/tag number assigned and displayed as per QAL Standard QE50-091-02 (SAP No. 10884) – Electrical Equipment Identification Labels.

6.7 Maintenance

Hazardous area installations must be inspected periodically as per Section 6.8 to ensure that they comply with the hazardous area standards. It is the responsibility of the designer to ensure that the grade and frequency period of inspection for new equipment is detailed in hazardous area design reports.

It is the responsibility of the EI Supervisor of the area to ensure that scheduled SAP work orders for Visual, Close and Detailed inspections are completed to periodically inspect each functional location and source of release. The inspection frequency should be as detailed in the hazardous area design report for that hazardous area.

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It is the responsibility of the Area Asset Co-Coordinator (AAC) to make equipment available for repair if any fault is detected as a result of the inspections. The AAC shall also ensure the area is tidy and free from potential ignition sources or other fire hazards.

Hazardous area inspection check sheets shall be used to complete inspections as per the hazardous area dossier requirements. Hazardous area inspection check sheets for Ex type equipment are located on Site Document Access -> Forms -> Engineering and Maintenance Services -> Electrical. Completed check sheets shall be recorded in the hardcopy Verification Dossier for future auditing. Any non-conformance issues shall have a notification raised as part of the SAP inspection work order.

Replacement of faulty hazardous area electrical equipment shall be on a like for like basis so that the original protection is not voided.

Any change required shall follow the required QAL Change Management process and involve a Hazardous Area Designer to verify the equipment is fit for operation within the required hazardous area as per zone requirements

6.8 Inspections

To predict accurately an appropriate periodic inspection interval is a complex issue. The grade of inspection and the interval between periodic inspections shall be determined taking account of the type of equipment, manufacturer's guidance, if any, the factors governing its, the area classification and/or the EPL requirements and the results of previous inspections. Where inspection grades and intervals have been established for similar equipment, plants and environments, this experience shall be used in determining the inspection strategy.

The interval between periodic inspections shall not exceed four years without conducting and documenting a risk assessment as per AS60079.17 based on the equipment type, location and service. Any risk assessment varying scheduled inspection frequencies shall be recorded in Verification Dossier in SAP and hard copy folder.

In general, the following frequency intervals apply for QAL Hazardous Areas.

6.8.1 Initial Inspection

Before a new hazardous area installation is brought into service, it shall be given a detailed inspection and all non-conformances recorded and rectified.

6.8.2 Visual Inspection

Visual inspections can be performed with the equipment energized. The visual inspection period shall be no greater than 12 months.

6.8.3 Close Inspection

Close inspections can be performed with the equipment energized. The close inspection period shall be no greater than 24 months.

6.8.4 Detailed Inspection

Detailed inspection requires the equipment to be offline. The detailed inspection period shall be no greater than 4 years.

6.9 Additional Housekeeping Controls for Combustible Dust Zones

Combustible Dust areas are zoned based on the presence and accumulation of dust that builds in an area. As such zones can be dependent on the housekeeping in an area. The protection level required for electrical / instrumentation equipment within combustible dust zones is dependent on the amount of housekeeping within the area.

The 3 levels of housekeeping for a hazardous area can be described as –

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- Good – Dust layers are kept to negligible thickness, or are non-existent, irrespective of the grade of release. In this case the risk of the occurrence of explosive dust clouds from layers and the risk of fire due to layers has been removed.
- Fair - Dust layers are not negligible but are short lived (less than one shift). Depending on the thermal stability of the dust, and the surface temperature of the equipment, the dust may be removed before any fire can start.
- Poor - Dust layers are not negligible and persist for more than one shift. The fire risk may be significant, and this should be controlled by selecting equipment accordingly.

Housekeeping practices should be designed to minimise the risk of dust explosion by –

- Materials used during housekeeping do not introduce ignition sources
- Using methods that minimise the creation of dust clouds
- Using non-sparking anti-static materials

Housekeeping of combustible dust layers is fundamental to the level of risk and any housekeeping controls must be strictly regulated by the Area Asset Coordinator. It is the Area Asset Coordinator's responsibility to maintain the dust layers to the agreed designed limits. Housekeeping shall occur as per Operations housekeeping routine schedule on the routine boards in the section.

Housekeeping audits shall be performed and recorded by the Operations Superintendent at monthly intervals for the appropriate hazardous zone requirements. The audits must be completed to detail the state of dust levels for the hazardous area (i.e. Good, Fair, or Poor).

Work orders shall be raised under the highest SAP function location for any housekeeping work required as a direct result of an inadequate audit result.

Housekeeping audits must be performed at least twice a week in combustible dust hazardous area zones to ensure adequate housekeeping practices are maintained.

Any work within combustible zones must not occur unless adequate housekeeping has been performed to minimise the risk of creating dust clouds.

6.10 Redundant / Unterminated Cables

Redundant cables shall not be left cut / unterminated within a hazardous zone area.

All redundant cables shall be removed from hazardous areas, unless they are deemed impractical to be removed as per QAL Procedure P314.618 – Unterminated Electrical Cables. Any redundant cables deemed impractical to remove must have a Change Management completed and the cable details recorded as per QAL Procedure – P314.618 Unterminated Electrical Cables as well as documented in the Verification Dossier.

Any cable that is redundant or is yet to be installed must be terminated in such a way that it meets the zone requirements for the area it is located in – including all spare unused cores.

6.11 Lightning Protection and Earthing

Lightning protection must be installed for all hazardous area facilities. The lightning protection design shall meet the requirements of AS/NZS 1768

All metallic structures within a hazardous area must be electro-statically earthed to prevent sparking. Earthing integrity inspections within hazardous area installations shall be carried out during the visual inspection as per section 6.8. Repairs to defective earthing shall be carried out immediately upon discovery.

6.12 Smoking

Smoking is not permitted inside any hazardous area.

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6.13 Training and Competency

All persons who are expected to, or who may be likely to enter a hazardous area for any reason, must receive appropriate training / instruction in relation to safety precautions. Safety precaution training is to be part of an areas induction where a hazardous zoned area exists and must also include the need to ensure that no potential ignition sources are taken into a hazardous area.

Operations Superintendents, Maintenance Superintendents and Area Asset Co-Coordiators shall be trained and aware of their legislative requirements with regards to hazardous areas under their control.

All personnel required carrying out design, construction, maintenance, operation, testing or inspection of hazardous area installations are to be deemed competent with the requirements of AS4761.

The inspection and maintenance of installations shall be carried out only by persons whose training has included instruction on the various types of protection and installation practices, relevant rules and regulations and on the general principles of area classification. The competency of the person shall be relevant to the type of work to be undertaken.

E/I Personnel shall complete Hazardous Area Training TE45 before conducting any installation or maintenance activities on electrical equipment within hazardous area zones and are to be deemed competent with the requirements of AS4761. Hazardous Area Refresher TE45A training shall occur every 4 years.

QAL Training Department shall maintain current records on SAP of personnel competent to either enter hazardous areas or work on hazardous area installations.

6.14 Person Having Ownership of the Installation

It is a requirement to identify the person(s) having ownership of the installation in the verification dossier. The person having ownership of the different hazardous areas on site are:

- Coal Handling Area: Raw Materials Area Asset Coordinator
- Gas Gate Station: Calcination Area Asset Coordinator
- Thermal Oxidizer compound: Digestion Area Asset Coordinator

7.0 ATTACHMENTS

Nil

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