21

Health and Safety

21. Health and Safety

21.1 Introduction

A preliminary and qualitative health and safety risk assessment for the smelter has been carried out on the proposed nature and scale of hazards associated with the facility (includes smelter, transport and handling systems). The risk assessment has been performed upon the assumption that further safety studies will be conducted during the detailed design and that appropriate Safety Management Systems and Risk Controls will be developed and implemented for the operating plant.

The risk assessment has been based upon the potential for credible hazardous events to occur at the facility while operating at full capacity and has included an assessment of both acute and chronic risks which have the potential to directly cause fatalities and/or result in significant community impact, serious environmental harm, or major property damage. The risk assessment has included a review of historical fatality and significant incident data from within the international primary aluminium industry and other related industries.

The impact of natural disasters including cyclones, seismic events and flooding has also been considered in the identification of the hazardous events.

The risk assessment has identified and defined a subgroup of hazardous events which are expected to make the greatest contribution to the facility's health and safety risks.

21.2 Methodology – Preliminary Health and Safety Risk Assessment

The methodology applied to the preliminary risk assessment is consistent with standard hazard and consequence analysis and risk assessment techniques outlined in:

- AS/NZS 4360:1999 Risk Management;
- Guidelines for Hazard Analysis (1992), Hazardous Industry Planning Advisory Paper No. 6 Department of Urban Affairs and Planning, NSW;
- Risk Criteria for Land Use Safety Planning (1997), Hazardous Industry Planning Advisory Paper No. 4 Department of Urban Affairs and Planning, NSW; and
- Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control (2001).

The hazard and consequence analysis and risk assessment was conducted by systematically reviewing proposed project design and operational information, considering relevant historical industry data (G McDonald 1994, Committee for the Prevention of Disasters 1997, International Association of Oil and Gas Producers 1996) and including contributions from persons with significant operations experience in the aluminium smelting industry. The assessment has primarily considered single events and has not included compounded consequences or impacts, from complex scenarios involving multiple energy release events occurring either simultaneously or in sequence.

Hazard and Consequence Analysis involved dividing the proposed facility into functional process areas as risk assessment nodes. Each node was critically reviewed to identify potential hazard (energy) sources and to develop a list of credible hazardous event scenarios. Each scenario was ranked according to the expected frequencies of incidents and consequences of interest. The consequences of interest for health and safety risks were fatalities and/or community impacts involving serious injury or greater (Appendix Y).

The hazardous events with the highest frequency ranking were considered to be the incidents with greatest contribution to the facility's health and safety risk. These event scenarios were investigated and analysed in greater detail to more accurately define their level of risk. A description of these major hazardous event scenarios and their risk assessment is provided, including opportunities for their control.

21.3 Hazard Identification and Consequence Analysis

The hazard identification and consequence analysis was conducted for each area of the facility and the list of all hazardous event scenarios identified and estimated risk ranking values, have been tabulated in Appendix Y.

The hazard identification process identified both physical and chemical hazards at the facility with the potential to cause fatality risks. The major hazardous materials to be stored, transported, handled and utilised within the facility have been summarised below (Table 21.1).

Table 21.1 Hazardous Materials Stored, Transported and Handled within Facility

Materials	Hazardous Properties
Dangerous Goods	
Spent Potlining	UN 3170. Dangerous Goods Class 4.3 "Aluminium Smelting By-Products"– in contact with water emit flammable (& toxic) gases. Dross (hot or wet) Listed as Goods Too Dangerous to be Transported. Toxic components may be leached from by-products in contact with water.
Spent Cathodes	
Aluminium Dross	
Coal Tar Pitch	UN 3257. Dangerous Goods Class 9 Miscellaneous "Elevated Temperature Liquid NOS at above 100°C and below its Flash point. Carcinogen Category 2 and skin (photo) sensitiser.
Petrol Fuel	UN 1203. Dangerous Goods Class 3 Flammable Liquid
Diesel Fuel	UN 1202 Dangerous Goods Class 3 Flammable Liquid
Natural Gas (as Methane)	UN 1971 Dangerous Goods Class 2.1 Flammable Gas, with no natural odour.
Hazardous/Toxic Substances	
Cryolite (Na_3AlF_6)	Inorganic Fluoride compounds – strong respiratory irritants through inhalation, mildly toxic by ingestion, and potential bone fluorosis from chronic overexposure.
Aluminium Fluoride (AlF_3)	
Calcium Fluoride (CaF_2)	
Pot Fume Emissions	Containing Inorganic Fluorides, Hydrogen Fluoride gas and Sulfur Dioxide gas – respiratory irritants
Green Anode and Anode Bake Plant Fume Emissions	Containing Coal Tar Pitch volatiles (PAH) and Sulfur Dioxide gas – Carcinogenic and skin (photo) sensitiser properties of PAH, and respiratory irritant (SO_2).

21.4 Summary of All Hazardous Events and Consequences Identified

The preliminary risk assessment process identified 52 potential hazardous events as summarised below (Table 21.2).

Table 21.2 Summary of all Hazardous Events Identified with Potential to Result in Consequences of Interest

Ranking for Consequences of Interest and Expected Frequency in life of Facility	Health & Safety Risk (potential fatalities)
1 – Extremely High	0
2 – Very High	0
3 – High	7
4 – Moderate	11
5 – Low	19
6 – Very Low	15
TOTAL	52

Refer to Appendix Y Risk Screening Matrix for explanation of Ranking Frequencies and Consequences for each category.

21.5 Hazardous Events with Greatest Contribution to Facility Risk

The hazardous event scenarios likely to make the greatest contribution to the risk of potential fatalities are summarised below in Table 21.3 and 21.4. 'Onsite facility' refers to the operating site at Aldoga whereas 'offsite facility' refers to storage, transport and handling systems which are located away from the Aldoga operating site (eg storage silos at Fishermans Landing).

Table 21.3 Hazardous Events Contributing to On-site Facility Risk

Hazardous Event	Risk Rank	Consequences of Interest
Onsite vehicle impact on personnel	3	Potential for single fatalities, onsite impact only
Entrapment/struck by Machinery	3	Potential for single fatalities, onsite impact only
Molten Metal explosions	3	Potential for multiple fatalities, onsite impact only
Fall from heights	3	Potential for single fatalities, onsite impact only
Electrocution	3	Potential for single fatalities, onsite impact only
Storage stack collapse	3	Potential for single fatalities, onsite impact only
Chronic exposure	3	Potential for chronic disease fatalities with latency period beyond life of facility, onsite personnel impact only

For the purpose of this assessment, the offsite facilities were considered to be an integral part of the smelter's overall operation. An incident at these facilities does not automatically imply that there has been a community and/or environmental impact, unless damaging consequences extend beyond the operational boundary of the facility and personnel operating the facility, and include members of the public. However the offsite facilities were considered to be the most likely cause of community impact due to their limited boundary distances and closer proximity to the community as compared with the Aldoga site.

Worst case implies most credible worse case scenario and consequences.

Table 21.4 Hazardous Events Contributing to Off-Site Facility Risk

Hazardous Event	Risk Rank	Impact Distance (m)	Consequence of Interest or Worse Case Scenario
Aluminium dross off site transport incident	6	15m Est.	Worst case is explosion in container and potential missile damage.
Coal tar pitch transport incident	6	0m Est.	Worst case is fire and smoke impact only, radiant heat minimal, and unlikely potential or fatality
Truck (not cargo related) incident and general road traffic incidents	4	10m Est.	Worse case is vehicle impact with other vehicle or pedestrians causing multiple fatalities. Immediate vicinity of road only
Train (non hazardous cargo) incident	5	100m Est	Worse case is train impact with other vehicle or pedestrians causing multiple fatalities. Vicinity of rail line only
Engulfment when handling alumina/coke/pitch	4	0m Est	Worse case is multiple fatalities. No impact beyond equipment and silo
Fire in Pet coke silo at wharf	6	0m Est	Calcined coke not combustible. No event predicted.
Fire in coal tar pitch tank at wharf	5	100m Est	Worst case is prolonged fire and smoke impact only, radiant heat minimal, and unlikely potential or fatality

Est = estimated distance of hazard energy propagation from actual incident site and potential consequence impact

21.6 Hazardous Events with Greatest Contribution to Facility Risk

A brief description of each of the hazardous events outlined in Table 21.3 and 21.4 have been summarised below including, events with greatest contribution to the facilities health and safety risk (risk rank 3 or higher) and off-site events with potential for significant community impact.

21.6.1 Onsite Vehicle Impact on Personnel

There will be a significant number of vehicles moving on the site including light personnel vehicles and load carrying vehicles (fork trucks, crucible carriers and trucks). These vehicles move loads within the site and also transport loads to/from the site. Consequently some vehicles will be specialised for onsite use only, some will be licensed for offsite use, and others used in both capacities. There are four distinct vehicle pathways which may bring vehicles into coincidence with people, other vehicles and plant on the site:

- designated roadways;
- designated loading areas;
- operating areas which are shared between vehicles and pedestrians; and
- within the perimeter of the vehicle (ie driver impacted by vehicle) .

In addition there will be specialised vehicles with limited visibility and manoeuvrability, utilised within the smelter.

Based on historical data from the primary aluminium industry the risk of fatality occurring within the life of the facility is generally estimated to be approximately 3×10^{-1} (or 1 per 100 years). The risk can be controlled by designating road ways and vehicle routes which are separated (in time and space) from personnel access ways and work areas.

21.6.2 Entrapment/Struck By (Machine)

A significant number of fixed and mobile plant onsite will be used to mechanically lift, transfer and transport large loads of raw materials, products and by-products. These machines are of sufficient size and utilise sufficient mechanical energy to entrap/impact people and cause sufficient crushing/impact damage to lead to a fatality.

The incidents may occur in various modes including:

- Coincidence between pedestrians and suspended or moving loads eg suspended metal crucible during tapping, anode block transfer during anode forming and baking, ingot bundles during loading; and

- Person entering into areas between large moving components of fixed and/or mobile plant eg automatic anode handling equipment.

Based on historical data from the primary aluminium industry the risk of fatality occurring within the life of the facility is generally estimated to be approximately 3×10^{-1} (or 1 per 100 years). The risk can be controlled by designing out areas of entrapment and impact, separating load handling/suspended loads from personnel, installing and maintaining physical guarding and implementing procedural systems of isolation, lockout and tag out.

21.6.3 Metal Explosions

Molten aluminium metal explosions can occur as the result of activities including charging/melting furnaces, casting into molds, transferring molten metal, spillage/overflow, introduction of tools/objects and/or addition of foreign materials to the metal (eg glass, cans). These incidents primarily occur where there are quantities of molten aluminium metal (and may include molten iron) including cells, crucibles, cast/storage furnaces and casting molds.

The consequences of metal explosions, which are dependent upon a range of factors, may include:

- single or multiple fatalities as a result of contact with molten metal or impact from projectiles;
- minor to significant property damage as a result of impact from projectiles or pressure waves; or
- disruption to process.

The cause of metal explosions is typically due to contact between molten metal aluminium and water, or molten metal aluminium and reactive chemicals (eg metal oxides and nitrates). These explosive conditions can be realised in situations where water/reactive chemicals are introduced to a vessel containing metal or when metal is introduced to a vessel containing water.

Based on historical data from the primary aluminium industry the risk of fatality occurring within the life of the facility is generally estimated to be approximately 3×10^{-1} (or 1 per 100 years). The risk can be controlled by designing systems which prevent the introduction of water or reactive chemicals into molten metal, the transfer of molten metal onto wetted surfaces, and/or the inadvertent contamination of tools and vessels with water and reactive chemicals.

21.6.4 Fall From Heights

There are a significant number of buildings, operating structures and maintenance lifting equipment which will potentially expose people to work at heights. Most work areas will include purpose designed access ways with fall restraints/protection, however there will be significant items of plant and opportunities for people to access areas beyond these restraints (eg ladders, mobile equipment, unplanned maintenance tasks etc).

The consequences of falling are single fatality, no property damage and no environmental damage.

Based on historical data from the primary aluminium industry the risk of fatality occurring within the life of the facility is generally estimated to be approximately 3×10^{-1} (or 1 per 100 years). The risk may be controlled by designing and installing adequate access ways to areas where operational and maintenance tasks are required. Where access ways are not practical then the installation of fall protection systems and wearing of fall arrest harnesses will be implemented for work at heights.

21.6.5 Electrocution

People come into contact with electrically energised plant in the form of:

- electrical facilities (switch gear, substations, transmission, rectifier/transformers etc);
- energised Plant (Reduction lines: including cells, bus bars etc); and
- electrical Equipment (including industrial welders, induction furnaces and portable tools and appliances etc).

Contact with electricity may result in current passing through the body and fatality (electrocution).

Based on historical data from the primary aluminium industry the risk of fatality occurring within the life of the facility is generally estimated to be approximately 3 x 10^{-1} (or 1 per 100 years). The design, installation, maintenance and operating of electrical systems are well regulated. The risk of electrocution can be controlled by following regulatory requirements and guidelines.

21.6.6 Storage Stack Collapse

Significant quantities of raw materials, products and by-products will be stored and stacked as discrete items. The stacked items may fall and impact on people and/or items of operating plant. The impact from falling items may cause fatalities and or disruption to components of the operation.

The items to be stored and stacked include:

- raw materials – Packaged Goods (bagged and palletised), Unpackaged Goods (Anode blocks, Cathode Blocks, Cathode Bars, Refractory blocks);
- products – Packaged Product (strapped bundled ingots); and
- by-products – Packaged (bagged Dross Fines), Unpackaged (spent anodes, spent cathodes).

Based on historical data from the primary aluminium industry, the risk of fatality occurring within the life of the facility is generally estimated to be approximately 3 x 10^{-1} (or 1 per 100 years). The risk of objects and loads falling from stacks can be controlled by designing inherently stable structures and stacking configurations, providing adequate stacking and lifting equipment and separating stacks from vehicle traffic and/or personnel.

21.6.7 Chronic Exposures

There are two significant chronic exposure risks known within the aluminium smelting industry:

- Occupational asthma associated with inhalation exposure to emissions from the aluminium reduction processes and some related operations. The primary agents are believed to be a combination of gaseous and particulate fluorides, sulphur dioxide and general bath related particulate. During the life of the facility, there is likely to be an increase in the incidence of occupational asthma and/or related respiratory effects observed (among smelter workers). The risk of community impact from respiratory irritation or asthma induced from emissions is likely to be negligible; and
- The International Agency for Research on Cancer has classified the primary aluminium industry as a Group 1 Carcinogen, as a result of epidemiological data which has suggested there to be an elevated incidence of cancer among industry workers (predominantly from the older Soderberg smelter design). One of the likely causes of at least some of the cancer incidence is expected to be from exposure to coal tar pitch volatiles (CTPV) leading to respiratory and/or bladder cancer. The CTPV represents both an inhalation and skin absorption risk. Exposures to these compounds will be significantly lower in the pre-bake smelter for this proposed facility compared with the Soderberg smelters reported in the literature. However the same compounds occur and the incidence of cancers are expected to be proportional to the exposures to these compounds.

The risk of chronic exposure will be controlled by installing effective fume extraction systems on specific items of plant. Exposure risk will be further reduced by minimising the duration of exposure and the wearing of respiratory protection during maintenance activities and high exposure tasks which bring people into direct contact with priority contaminants.

The exposure to personnel will be monitored periodically to assess and evaluate the effectiveness of control measures and personnel should be provided with pre-employment and ongoing health surveillance.

21.6.8 Offsite Truck and General Road Traffic incident

There are two significant transport risks which were identified as a result of the preliminary risk assessment. These are:

- truck carrying raw materials from Auckland Point Wharf on public road through Gladstone to the site. There will be a significant number of truck movements along this route. The pathway of the truck may coincide/collide with people (pedestrians or bystanders), other vehicles and roadside structures (commercial, residential, public buildings). In conjunction with the above collisions and/or independently, the truck's load may be discharged and initiate the same modes of collision; and

- truck carrying raw materials from Fisherman's Landing Wharf on public road through the industrial area to the site. This route will experience the same collision modes as described above.

The consequences of these events may be single or multiple fatalities, vehicle damage and minor property damage, and unlikely environmental.

The level of fatality risk is expected to increase in proportion with the resultant increase in traffic compared with existing. The analysis and calculation of a reasonable estimate of fatality risk from this scenario would require detailed information on current road use, traffic rates and road conditions. It is recommended that this be conducted as a separate study in consultation with the state road authorities and has not been conducted as part of this preliminary assessment.

The control of this risk may include consideration of reducing road traffic by transporting employees by bus, by diverting raw materials transport from road to rail, diverting public traffic to alternative routes within the Gladstone sectors and consideration of upgrade to road conditions (where appropriate).

21.6.9 Offsite Aluminium Dross

Aluminium dross is capable of reacting with water and emitting toxic and flammable gases (eg ammonia and hydrogen).

Dross is classified under the Australian Dangerous Goods Code as a Dangerous Goods (Class 4.3 Dangerous when wet) under 'Aluminium Smelting By-Products'. When this material is wet or hot it is included among those materials listed as 'Goods Too Dangerous to be Transported'.

Dross will be trucked offsite by public road to external operators for metal recovery. At this stage, no nominated metal recovery companies have been engaged and the final destination is unknown. The incident of interest is primarily the transport of wet dross with a consequence of an explosion or fire offsite on a public roadway.

Based on load threatening accident data, an ignition frequency of 1 in 100 events and an estimated distance travelled by the dross transport truck per year, an estimated individual fatality risk of $5x10^{-11}$per year has been calculated. This calculation assumes an impact radius of 100m from the site of release. A similar risk could generally be assumed for the transport of spent cathodes.

The resultant risk calculated is significantly lower than the level of acceptable risk recommended by the HIPAP Criteria (NSW Department of Urban Affairs and Planning 1997) for 'intensification of hazardous activities in an existing complex' or for 'no intensification of residential development' of 1×10^{-6}.

This risk can be controlled by following the regulations for the Transport of Dangerous Goods as they apply to Aluminium By-Products (Dross etc), ensuring the dross is not inadvertently wetted prior/during loading into the truck (eg rain/leakage), dross is not loaded into a wet or contaminated truck and the truck container is adequately weather proof and ventilated.

21.7 Risk Assessment Summary

The preliminary risk assessment has been completed for the proposed smelter and associated facilities including:

- There were no significant community impacts or environmental damage consequences identified for the operation of the facility and potential hazardous events. However there were some hazardous events including molten metal explosions which would cause significant on-site (facility) property damage.

- There were no hazardous events identified which would project damaging energies outside of the onsite facility (smelter) boundary. Hence detailed quantitative risk analysis and contour mapping was not performed.

- There were a number of likely events identified for the offsite facilities which may have an impact on the community but these were estimated to occur at extremely low incident frequencies and/or not to significant levels of consequence. These included the potential for an offsite truck incident involving Dangerous Goods (eg dross), potential fires in offsite storage facilities for Dangerous Goods (eg coal tar pitch) and general increase in offsite road traffic risk from smelter traffic.

- There were a number of hazardous events identified which would potentially contribute to the onsite fatality risk. The hazardous events likely to have the greatest contribution to onsite fatality risk have been summarised and a brief description of these scenarios have been provided with an estimate of their level of risk for the life of the facility based on historical industry data and possible control strategies.

- The hazardous event scenarios and risks in general at this facility can be adequately managed to acceptable levels by performing the recommended safety studies as part of detailed design, applying recommended control strategies and implementing a Safety Management System.

21.8 Mitigation Measures

21.8.1 Safety Management Systems

As discussed generally, AAS will develop and implement a comprehensive and well documented Safety Management System, to ensure the ongoing safety of the operation of the facilities and the storage, transport and handling of its hazardous materials. The Safety Management System will be consistent with the legislative requirements and national standards and guidelines for:

Workplace Health and Safety, including:

- *Workplace Health and Safety Act 1995* and workplace *Health and Safety Regulation 1997*.

Dangerous Goods Safety Management, including:

- Dangerous Goods Safety Management Act 2001 and Dangerous Goods Safety Act 2002; and
- National Occupational Health and Safety Commission (NOHSC) Control of Major Hazard Facilities, Control of Storage and Handling of Dangerous Goods and Control of Workplace Hazardous Substances (NOHSC 1994, 1996 and 2001).

Occupational Health and Safety Management System, including:

- Australian Standards AS/NZ 4801:2001 and AS/NZ 4804:2001.

Safety Case – Safety Management Systems, including:

- Hazardous Industry Planning Advisory Paper No. 9 (NSW Department of Urban Affairs and Planning 1995);
- Major Hazard Facilities Regulations Guidance Notes No. 3 and 17 (Workcover Victoria 2001).

AAS is committed to the safe operation of the smelter and will implement the Safety Management System as a systematic approach to managing health and safety risks. The Safety Management System will include the following key components.

- Management Leadership and Commitment;
- Health and Safety Policy and Objectives;
- Organisational Structure, Roles, Responsibilities and Accountabilities;
- Facility Description of Plant Operation and Significant Risks;
- Risk Assessment and Management Processes;
- Operational Controls for significant hazards and risks;
- Safe Operating Procedures for plant;
- Standards for plant design, operation and legislative compliance;
- Process for managing change and continuous improvement;
- Performance monitoring, auditing and reporting;
- Training and Competencies;
- Provision for consultation/communication with workforce, community and authorities;

- Emergency preparedness, planning, resources and facilities;
- Administration of the Safety Management System, document control, integrity and currency; and
- Management review and continuous improvement of Safety Management System.

The Safety Management System will be established from further safety studies of hazard and risk analysis and the development of risk control strategies, for those items of significant risk which were identified in the Preliminary Risk Assessment.

These safety studies will include:

- review of statutory and regulatory requirements, licences and approvals, and in particular the application and classification of the smelter as a Dangerous Goods Facility;

- extension of this preliminary risk assessment, to include serious and permanent injury as the consequence of interest and to identify strategies to minimise these risks. For example occupational asthma from exposure to airborne emissions and musculo-skeletal injuries from manual handling;

- detailed risk analysis, hazard studies (eg HAZOPS), and control strategies to be conducted for:
  - Confined explosions for onsite incident, involving natural gas, spent potlining, or dross and recommending building design and/or explosion protection systems where appropriate;
  - Molten metal explosions and their prevention;
  - Electrical incidents, including potential bridging and earthing scenarios in reduction lines and the effects of loss of power on critical electrical systems of risk control;
  - Onsite vehicle collision and/or impact with people;
  - Mechanical entrapment of people in energised plant and opportunities for isolation, separation and guarding;
  - Integrity of structures and logistics for remote load storage and stacking away from people; and
  - Minimisation of chronic exposure to hazardous airborne contaminants, including optimisation of forced ventilation/extraction and fume collection systems, consideration of their potential failure modes and selection of appropriate personal protection.

- offsite increase in vehicle traffic and impact on road conditions;

- impact of external operations and hazards on the smelter for the transport, storage and handling of Dangerous Goods; including the location of storage with respect to neighbouring industrial activities and storage facilities for Dangerous Goods;

- fire study of the smelter;

- capacity of external (local) emergency service resources to respond and provide adequate support to onsite emergency response team, at major onsite incident and at major offsite (storage and transport) incident;

- simultaneous operation of plant and construction activities from commencement to full production;
- plant commissioning; and
- plant decommissioning.

21.8.2 Risk Reduction Opportunities

The following opportunities will be considered as a potential means of reducing identified risks during the detailed design phase:

- Buildings and plant structures designed for cyclone and seismic events (where appropriate), to prevent structural collapse and integrity of weather (water) proofing for storage of dangerous goods (specifically Class 4.3);
- Reduce inventory of Class 4.3 dangerous goods storage on site (eg spent potlining and dross). Consider processing of spent potlining material to reduce Dangerous Goods Classification and hazardous properties;
- Provision for redundant water capacity to supply fire protection systems and critical process water;
- Isolate people from load carrying/mechanical handling systems, vehicle traffic and storage and stacking locations;
- Installation of fit-for-purpose access ways and fall protection systems to facilitate safe access to fixed and mobile plant;
- Introduce detection odour into natural gas prior delivery to site;
- Provision and integrity of process tanks, waste holding tanks and bunded areas as per Australian Standards;
- Segregation of incomplete products and ingredients;
- Containment of hazardous materials;
- Collection, treatment and disposal facilities and procedures for spillage of hazardous materials and wastes;
- Potline buildings designed with natural ventilation capacity to protect operators in the event of a failure of the forced extraction/ventilation system;
- Security of facility to prevent unauthorised access to plant, introduction of prohibited items, and control of onsite traffic; and
- Development of emergency response management systems commensurate with site specific hazards and risks (fire, explosion, rescue and first aid).

21.8.3 Risk Control Systems

The plant buildings and structures will be designed, constructed and maintained in accordance with relevant statutory requirements and standards.

The plant systems for the transport storage and handling of hazardous materials will be designed, constructed and operated in accordance with relevant statutory requirements and standards. In particular, the structures used for the storage, handling and transport of spent potlining and dross (class 4.3) will be designed in such a way to prevent the inward leakage of water from all credible events, be adequately ventilated to prevent the accumulation of flammable mixtures in air, include explosion (pressure relief) protection systems, and be located away from potential sources of ignition and general work areas.

Forced extraction ventilation and fume treatment will be designed and applied to the Green Mill, Anode Baking Plant, Coal Tar Pitch handling systems and individual pots in the potlines, to reduce process emissions and exposure risks to personnel.

Physical machine guarding will be designed and installed on plant items to prevent access and the risk of entrapment. The plant components will be designed to facilitate procedural systems of isolation, lockout and tagging.

Specific emergency response plans will be developed and implemented for natural disasters including cyclones, flooding and seismic events (where appropriate).

21.8.4 Emergency Response Systems

AAS will establish an Emergency Management System for the operating facility which will be consistent with legislative requirements, national standards and guidelines for:

- Dangerous Goods Safety Management Act and Regulations;
- Emergency Preparedness and Planning Guidelines; and
- Fire Protection Systems – Operation and Maintenance (Australian Standards).

The objective of the Emergency Management System will be to reduce the frequency and severity of consequences from emergency incidents and will include the following components:

- Description of reasonably foreseeable emergencies: processes, hazards, quantities and properties of hazardous materials and potential hazmat incidents;
- Operational procedures including:
  - Containment and suppression;
  - Rescue and first aid;
  - Communication and Command structure;
  - Relationship with public emergency response services;
  - Termination of emergency response; and
  - Statutory Requirements including approvals, notifications and reporting.
- Maintenance of Fire Protection Systems;
- Training and Competencies;
- Public Relations and management of community impacts;
- System Administration and Documentation; and
- Management Review.

Onsite emergency response personnel will be trained for fire suppression and containment, rescue and first aid. The emergency personnel will be fully trained to competency standards which are consistent with the Australian Fire Authority Council – Public Safety Competencies. The training will be provided by a training organisation which is nationally accredited to provide the specific competency based training.

AAS will provide fully functional on-site emergency response facilities to respond to reasonably foreseeable emergencies, including fire, explosion, rescue and first aid treatment. The on-site facilities will include:

- Plant and Building Fire Protection Systems;
- Fire Truck;
- Ambulance; and
- First Aid and Medical Centre.

The smelter will have installed Fire Protection Systems including automatic fixed systems and portable systems which are designed fit-for-purpose for site specific fire hazards and maintained according to Australian Standards.

Specific fire protection systems will include:

- Fire alarm systems consisting of manually operated local alarm stations and bells located in strategic locations and a central alarm control panel;

- Hose reels and dry chemical extinguishers on all levels of the Carbon Plant, where fire risk exists;

- Automatic sprinkler system installed in the coal tar pitch/paste mixing area;

- Explosion proof electrical systems within the coal tar pitch areas and heat transfer media system. Static electricity protection systems for all systems in coal tar pitch handling;

- Automatic firing control system for natural gas at the Anode Baking Furnaces. Gas metering and let-down station with manual shut- valves and quick-disconnect couplings, and gas drops at each burner frame; and

- Process control rooms protected by halon (or equivalent) extinguishing media.

Specific protection systems will be installed at the electrical installations including:

- Specialised network of electrical grounding incorporating each process building, plant area substations, and high voltage switching/rectifier areas, with ground fault monitoring;

- Personnel electrical protection to be provided for all circuits and connected equipment;

- Emergency power generation for emergency lighting, communication systems, medical facility and computers; and

- Fire deluge at switch yards and plant area substations.

The operation of the site emergency response systems and fire protection systems will be consistent and compatible with the systems and standards which are applied by the public emergency response authorities (such as the Australian Inter-Agency Incident Management System), to ensure that they may be optimally applied by external services in the event of a major emergency incident.

21.8.5 Legislation Standards and Codes of Practice

AAS will operate the smelter in accordance with their duty of care and statutory obligations for health and safety.

The main items of legislation with specific requirements for Health and Safety for the operation of the facility include:

- *Workplace Health and Safety Act 1995*;
- *Workplace Health and Safety Regulations 1995*;
- *Workplace Health and Safety (Miscellaneous) Regulations 1995*;
- *Advisory Standards – WHS (Advisory Standards) Notice 1998*;
- *Industry Code of Practice – WHS (Industry Code of Practice) Notice 1999*;
- *Dangerous Goods Safety Management Act 2001*;
- *Dangerous Goods Safety Management Act 2002*; and
- *WorkCover Queensland Act 1996*.

Workplace Health and Safety

The purpose of the *Workplace Health and Safety Act 1995* (WHS Act) is to ensure the health and safety of persons in their workplace and to protect others (members of the public) from occupational risks which may result from the carrying out of work in a workplace. The WHS Act outlines the specific obligations of Employers (and other persons) to ensure the health and safety of persons at the workplace. These obligations must be discharged by implementing the prescribed ways of preventing or minimising exposure to risk, as are defined in the Workplace Health and Safety Regulations. The Employer obligations may also be discharged by following other recognised standards for controlling risks, as are defined in the Advisory Standards and/or guidelines provided within Industry Codes of Practice. The Foundry Industry Code of Practice 1999 is one of the Industry Codes which is relevant to smelting operations.

In the absence of prescribed ways, Advisory Standards and Industry Codes of Practice, the National Standards and Guidelines (National Health and Safety Commission) and/or Australian Standards may be considered as acceptable methods of controlling risks and discharging their obligations.

There are common philosophies implied between and Employers obligations under the WHS Act and the Employers Duty of Care obligations at Common Law.

Dangerous Goods Safety Management

The *Dangerous Goods Safety Management Act 2001* (DGSM) applies specifically to hazardous materials (particularly Dangerous Goods and combustible liquids). The purpose of this legislation is to minimise the risks associated with the operation of Major Hazard Facilities and Large Dangerous Goods Facilities and to ensure the safety of occupiers and employees. Similarly with the Workplace Health and Safety Legislation there are obligations placed on the occupier of the facility (and other persons).

One key requirement of this legislation will be an application to the Queensland Government Department of Emergency Services for classification of the smelter as a Large Dangerous Goods or Major Hazard Facility. This classification is based upon the threshold quantities of Dangerous Goods inventories stored on the site and this classification will determine the specific obligations under the DGSM Act.

The hazardous materials at the smelter that will contribute to the greatest significance for this classification system are those with Dangerous Goods Class 4.3 (Dangerous when wet) including aluminium dross and spent potlining. These materials are included in the category "Aluminium Smelting By-Products". It should be noted that aluminium dross (wet or hot) is also listed as "Goods Too Dangerous to be Transported". The classification will require further information on the rate of evolution of toxic and flammable gases from the materials when wet, and the assignment of an appropriate Packaging Group. It is anticipated that the material will meet Packaging Group III and the facility will not meet the criteria for a Major Hazard Facility.

Additional items of legislation relevant to Health and Safety and the facilities safe operation include:

- *Electricity Act 1994*;
- *Electrical Safety Bill 2002 (Act 42/02)*;
- *Gas Act 1965*;
- *Gas Regulation 1989*;
- *State Counter-Disaster Organisation Act 1975*; and
- *State Counter-Disaster Organisation Regulation 1975*.

21.9 Conclusions

The preliminary risk assessment for the smelter and offsite facilities identified that the highest risk assessment identified that the highest risks were associated with handling of dangerous goods, exposure to coal tar pitch, onsite vehicle accidents and molten metal explosions.

Consideration of these potential incidents and implementation of the mitigation measures during design, operation and decommissioning of the smelter will minimise the potential and impact of these incidents.