Appendix 4

SEPP 33 Risk Screening and Preliminary Hazard Analysis

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A4.1 INTRODUCTION

Consideration has been given as to whether the Proposal should be considered a hazardous or potentially hazardous industry under *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33). This assessment was undertaken in accordance with the risk the procedures identified by:

- *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 – January 2011* (SEPP 33 Guidelines);
- *Risk Assessment – Hazardous Industry Planning Advisory Paper No 3* (HIPAP 3);
- *Risk Criteria for Land Use Safety Planning – Hazardous Industry Planning Advisory Paper No 4* (HIPAP 4);
- *Hazard Analysis – Hazardous Industry Planning Advisory Paper No 6* (HIPAP 6); and
- *Assessment Guideline – Multi-level Risk Assessment – May 2011* (Risk Assessment Guideline).

This assessment comprises three components as follows.

- A Risk Screening – to determine if the Proposed Modification is potentially hazardous.
- A Risk Classification and Prioritisation – to determine the level of risk assessment required for those aspects of the Proposed Modification determined to be potentially hazardous.
- A Risk Assessment – undertaken to the level of detail determined by the previous component.

A4.2 RISK SCREENING

This risk screening was undertaken in accordance with the method set out in Section 7 of the SEPP 33 Guidelines.

Table A4-1 identifies the reagents that would be used within the Project Site. The table also identifies the class and packing group for each reagent identified from the Material Safety Data Sheet for each and the relevant screening thresholds for storage of potentially hazardous industries. In addition, **Table A4-2** presents the relevant transportation-related thresholds for the identified reagents.

As indicated in **Tables A4-1** and **A4-2,** sulphuric acid, hydrochloric acid and LPG are the only products that meet the screening thresholds for storage. The following sub-sections provide an assessment of the risks associated with transportation and storage of this material within the Project Site.

Table A4-1
Hazardous Materials Storage with the Project Site

Material	Class/ Packing Group[1]	Description	Storage Quantity	Storage Location	Approx. Distance to Site boundary	Threshold Limit	Threshold Triggered
Sulphuric Acid (98% concentration)	8/ PGII	Liquid delivered in bulk	350t	Bunded tank, undercover area in processing plant area	>100m	25t	**Yes**
Hydrochloric Acid (33% concentration)	8/ PGII	Liquid delivered in bulk	35t	Bunded tank, undercover area in processing plant	>100m	25t	**Yes**
Magnafloc 338	ND	Powder delivered in 25kg bags	2t	Undercover reagent store in processing plant area	>100m	No Limit	No
Primene JM-T	8/ PGIII	Liquid delivered in 1t IBCs	2 000L	Undercover reagent store in processing plant area	>100m	50t	No
Shellsol D70	9/ PGIII	Liquid delivered in 1t IBCs	3 000L	Undercover flammable liquid store in processing plant area	>100m	No Limit	No
Oxalic Acid	ND	Powder delivered in 1t bulka bags	4t	Undercover reagent store in processing plant area	>100m	No Limit	No
Sodium Hydroxide (caustic soda)	8/ PGIII	Powder delivered in 1t bulka bags	4t	Undercover reagent store in processing plant area	>100m	50t	No
Sodium hydrosulphide (NaHS)	8/ PGII	Liquid delivered in 1t IBCs	7t	Undercover reagent store in processing plant area	>100m	25t	No
Hydrated lime	ND	Powder delivered in bulk	350t	Bulk silo in Processing Plant Area	>100m	No limit	No
Magnesium chloride	ND	Powder delivered in 1t bulka bags	55t	Undercover reagent store in processing plant area	>100m	No Limit	No
LPG	2.1/ -	Liquefied gas delivered in bulk	100m^3	Adjacent to processing plant	>100m	10t/ 16m^3	**Yes**

Note 1: ND = Non dangerous

Source: EMC Metals Australia Pty Ltd

A4.3 RISK CLASSIFICATION AND PRIORITISATION

A4.3.1 Overview of the Management of Potentially Hazardous materials

Section 2.5.13 presents a range of chemical and reagent management measures that would be implemented to manage such materials within the Processing Plant Area. The following provides the additional management measures that would be implemented to manage potentially hazardous materials.

Table A4-2
Hazardous Material Transportation

Material	Class/ Packing Group[1]	Average No. of Loads	Threshold Limit	Approximate Load Size	Threshold Triggered
		Loads per Year			
Sulphuric Acid (98% concentration)	8/ PGII	385	>500	40t	No
Hydrochloric Acid (33% concentration)	8/ PGII	26	>500	40t	No
Magnafloc 338	ND	26	-	2t	No
Primene JM-T	8/ PGIII	4	>500	$1m^3$	No
Shellsol D70	9/ PGIII	26	>1 000	$3m^3$	No
Oxalic Acid	ND	26	-	4t	No
Sodium Hydroxide (caustic soda)	8/ PGIII	26	>500	4t	No
Sodium hydrosulphide (NaHS)	8/ PGII	26	>500	4t	No
Hydrated lime	ND	26	-	10t	No
Magnesium chloride	ND	26	-	14t	No
LPG	2.1/ -	70	>500	40t	No
Note: ND = Non dangerous					
Source: EMC Metals Australia Pty Ltd					

Hydrochloric and Sulphuric Acid

- Ensure that hydrochloric and sulphuric acid is delivered by a suitably licenced and experienced transportation contractor using well maintained equipment in accordance with the *Dangerous Good Code.*
- Ensure that hydrochloric and sulphuric acid is transferred to the on-site storage tanks using fit for purpose equipment by personnel that have been trained in the handling of those materials.
- Ensure that hydrochloric and sulphuric acid are stored and handled in accordance with the following.
  - The MSDS for each product.
  - Australian Standard *AS3780 The storage and handling of corrosive substances.*
- Ensure that hydrochloric and sulphuric acid is only stored within suitably constructed storage tanks in separately bunded areas that are not adjacent or in close proximity to incompatible chemicals.
- Ensure that all personnel within the Project Site have been trained in responding to spills and emergencies related to hydrochloric and sulphuric acid and that appropriate spill and emergency management equipment is available at all times.

- Prepare an implement a *Hydrocarbon, Chemical and Reagent Management Plan*, including emergency management procedures for hydrochloric and sulphuric acid.
- Ensure that local emergency services are aware of the location and volume of hydrochloric and sulphuric acid within the Project Site and management of these substances in the event of an emergency.
- Ensure that MSDS for hydrochloric and sulphuric acid are available at all times.

LPG

- Ensure that LPG is delivered using suitably constructed containers and vehicles in accordance with the Australian Dangerous Goods Code.
- Ensure that LPG is stored and managed in accordance with *AS/NZS 1596 The storage and handling of LP Gas.*
- Ensure that suitable isolation valves emergency shutoffs are installed and maintained.
- Prepare an implement a *Hydrocarbon, Chemical and Reagent Management Plan*, including emergency management procedures for LPG.
- Ensure that local emergency services are aware of the location and volume LPG within the Project Site and management in the event of an emergency.
- Ensure that MSDS for LPG is available at all times.

A4.3.2 Approach to the Preliminary Hazard Analysis

Appendix 5 of the SEPP 33 Guideline identifies that the Preliminary Hazard Analysis should be undertaken using a multi-level approach to risk assessment. This approach is summarised in **Figure A4-1**. In summary, for those projects determined to be potentially hazardous, three levels of assessment exist as follows.

- Level 1 – Qualitative Analysis where:
  - screening and risk classification and prioritisation indicate there are no major offsite consequences and societal risk is negligible;
  - the necessary technical and management safeguards are well understood and readily implemented; and
  - there are no sensitive surrounding land uses.
- Level 2 – Semi-quantitative Analysis where screening, hazard identification and/or risk classification and prioritisation has identified one or more risk contributors with consequences beyond the site boundaries but with a low frequency of occurrence.
- Level 3 – Quantitative risk analysis where the above requirements cannot be achieved.

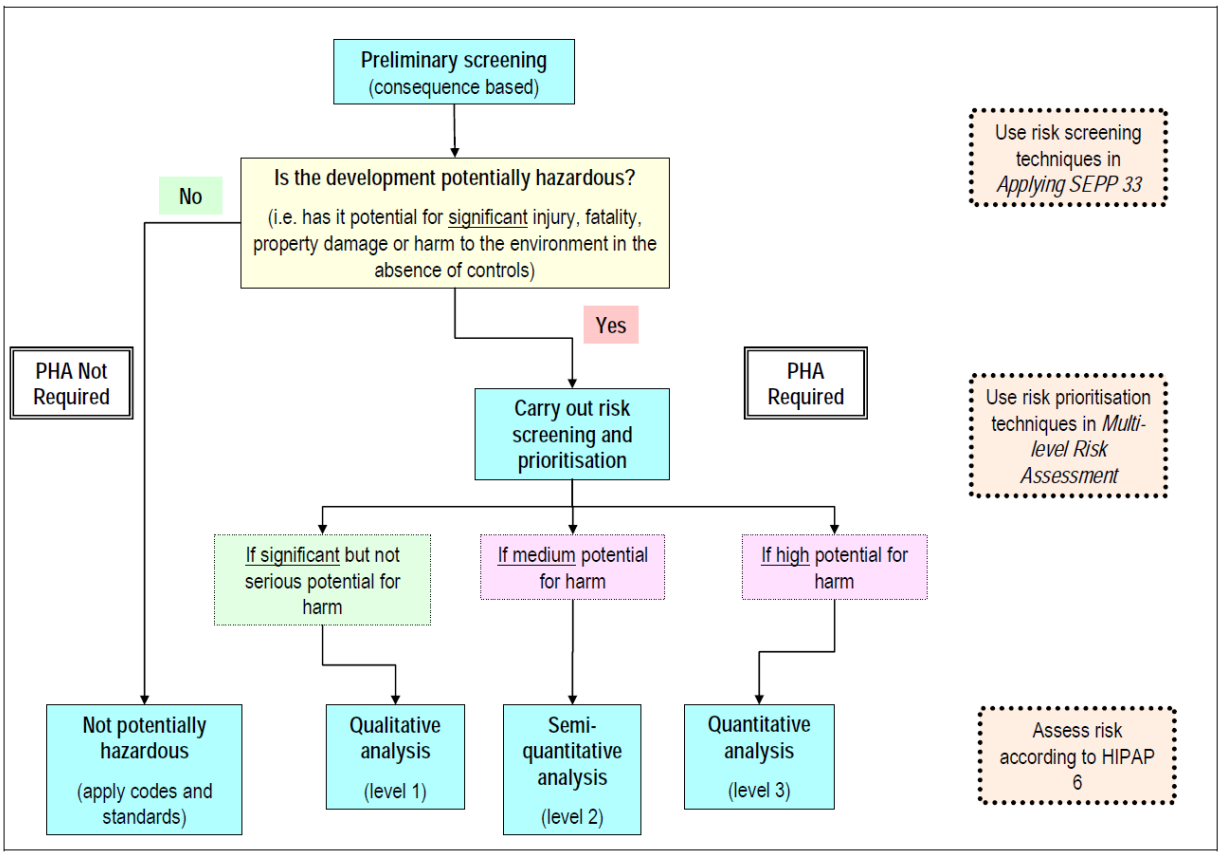


Figure A4-1
MULTI LEVEL RISK ASSESSMENT PROCESS

Source: SEPP 33 Guideline – Figure 11

In determining the level of assessment required, the risk classification and prioritisation methodology identified in Appendix 1 – Section A1.2 of the Risk Assessment Guideline is to be used.

A4.3.3 Non-transportation Risk Classification and Prioritisation Assessment

A4.3.3.1 Introduction

This risk classification and prioritisation assessment for the storage of hydrochloric and sulphuric acid and LPG has been undertaken in accordance with the procedure identified in Appendix 1 – Section A1.2 of the Risk Assessment Guideline. The following subheadings correspond with the steps identified in the guideline.

A4.3.3.2 Scope of the Study

The study area includes the Project Site and immediate surrounds. To avoid duplication, figures and plans presented in the *Environmental Impact Statement* are not reproduced in this Appendix. The following present the figures and plans relied on in this assessment.

- Locality Plan and Regional Setting – **Figure 1.1** of the *Environmental Impact Statement*.
- Proposed Project Site Layout, including the location of the reagent storage area – **Figures 2.1** and **2.4** of the *Environmental Impact Statement*.
- Regional Topography and Drainage – **Figure 4.1** of the *Environmental Impact Statement.*
- Project Site Topography and Drainage – **Figure 4.2** of the *Environmental Impact Statement*.
- Surrounding Landownership and Residences – **Figure 4.5** of the *Environmental Impact Statement.* The closest residences to the Processing Plant Area are Residence R1 and R6 located approximately 3.5km to the west-northwest and north of the Processing Plant Area respectively.
- Land zoning – **Figure 1.2** of the *Environmental Impact Statement*

As identified in Section 4.1.5.2 of the *Environmental Impact Statement*, land uses surrounding the Project Site include the following (**Figure 4.6**).

- Agriculture – principally grazing and cropping, with areas of rural residential/homestead land use also present.
- Nature conservation with limited grazing.
- Transport – namely the Barrier Highway, Gilgai Road and the Nyngan-Cobar Railway.

A4.3.3.3 Classification of the Type of Activities and Inventories

As identified in Section A4-2 and **Tables A4-1** and **A4-2**, the only activities that meet the thresholds for preparation of a Preliminary Hazard Analysis include storage of the following with the reagent storage area within the Processing Plant Area.

- Hydrochloric acid.
- Sulphuric acid.
- LPG.

Table A4-3 presents an overview of the location, form, quantity and storage/use conditions for each of the above.

Table A4-3
Overview of Storage Conditions

Location	Form	Maximum Anticipated Quantity	Storage Conditions and Controls
Storage of Sulphuric Acid			
Reagent Storage Area	Solution	800t	• Concentration – 98%. • Delivered using suitably constructed containers and vehicles in accordance with the Australian Dangerous Goods Code. • Transferred using fit for purpose equipment by trained personnel. • Stored in purpose built storage tank(s) in a separate bunded area in accordance with *AS3780 The storage and handling of corrosive substances.* • Prepare and implement a *Hydrocarbon, Chemical and Reagent Management Plan*, including emergency management procedures. • Ensure that all personnel within the Project Site have been trained in responding to spills and emergencies related to these materials and that appropriate spill and emergency management equipment is available at all times. • Access restricted to authorised personnel only. • Liaise with local emergency services in relation to the storage of the materials. • Ensure that MSDS are available at all times. • Undertake daily inspections.
Storage of Hydrochloric Acid			
Reagent Storage Area	Solution	50t	• Concentration – 33%. • Delivered using suitably constructed containers and vehicles in accordance with the Australian Dangerous Goods Code. • Transferred using fit for purpose equipment by trained personnel. • Stored in purpose built storage tank(s) in a separate bunded area in accordance with *AS3780 The storage and handling of corrosive substances.* • Prepare and implement a *Hydrocarbon, Chemical and Reagent Management Plan*, including emergency management procedures. • Ensure that all personnel within the Project Site have been trained in responding to spills and emergencies related to these materials and that appropriate spill and emergency management equipment is available at all times. • Access restricted to authorised personnel only. • Liaise with local emergency services in relation to the storage of the materials. • Ensure that MSDS are available at all times. • Undertake daily inspections.

Table A4-3 (Cont'd)
Overview of Storage Conditions

Location	Form	Maximum Anticipated Quantity	Storage Conditions and Controls
Storage of LPG			
Reagent Storage Area	Liquefied gas	100m^3	• Delivered using suitably constructed containers and vehicles in accordance with the Australian Dangerous Goods Code. • Transferred using fit for purpose equipment by trained personnel. • Stored and handled in accordance with *AS/NZS 1596 The storage and handling of LP Gas.* • Ensure that suitable isolation valves emergency shutoffs are installed and maintained. • Prepare an implement a *Hydrocarbon, Chemical and Reagent Management Plan*, including emergency management procedures. • Access restricted to authorised personnel only. • Liaise with local emergency services in relation to the storage of the materials. • Ensure that MSDS are available at all times • Undertake daily inspections.
Source: EMC Metals Australia Pty Ltd			

A4.3.3.4 Estimation of Consequences

Introduction

The *Risk Assessment Guidelines* provides an assessment methodology based on the document *Manual for the classification of risks due to major accidents in process and related industries* published by the International Atomic Energy Agency in 1996 (IAEA, 1996). Based on that methodology, Section A1.2.4 of the *Risk Assessment Guidelines* identifies the following formula for estimating the consequence of an accident involving a hazardous substance.

$$Ca,s = A \times d \times f_A \times fm.$$

Where Ca,s = *the external consequences.*

A = *affected area.*

d = *population density within the affected area.*

fA = *correction factor for the distribution of population in the affected area.*

fm = *correction factor for mitigation effects.*

It is noted that the *Risk Assessment Guidelines* for a Preliminary Hazard Analysis relate to the potential for human fatalities associated with a catastrophic failure of the containment systems within the Project Site. It is acknowledged that non-lethal consequences may also occur and that significant environmental damage would also result from such a failure. While such outcomes are relevantly a matter for consideration in the *Environmental Impact Statement*, they do not form a component of the assessment required to determine if the Proposed Modification is a hazardous project.

It is also acknowledged that partial failures of the containment systems may occur, including, for example, failure of transfer pipes. Such partial failures are also not a component of the assessment identified by the *Risk Assessment Guidelines* unless they are likely to result in human fatalities surrounding the Project Site.

Affected Area

IAEA Table IV(a) of the *Risk Assessment Guidelines* presents a classification of substances by effect categories. Based on that classification the effect distance and area are identified in IAEA Table V. **Table A4-4** identifies the effect distance and area of effect.

Table A4-4
Overview of Storage Conditions

Type	Classification	Comment
Storage of Sulphuric Acid		
Effect Category	EIII	High Toxicity. Storage within Tank Pit. Quantity 200t to 1 000t.
Effect Distance	200m to 500m	
Effect Area	8ha	
Storage of Hydrochloric Acid		
Effect Category	CIII	High Toxicity. Storage within Tank Pit. Quantity 50t to 200t.
Effect Distance	50m to 100m	
Effect Area	0.3ha	
Storage of LPG		
Effect Category	"small enough to be ignored"	Liquefied by pressure – Low toxicity. Quantity 50t to 200t.
Effect Distance	-	
Effect Area	-	
Note: Terminology and classification consistent with IAEA Table IV(a) and IAEA Table V of the *Risk Assessment Guidelines*		

Population Distribution and Correction Factor

The *Risk Assessment Guidelines* require that the population distribution within the affected area identified above should be determined or estimated based information presented in IAEA (1996). There are no residences within the 500m of the Processing Plant Area and, given the agricultural setting of the Project Site, the potential for non-Proposal personnel to be within 500m of the Processing Plant Area in the event of an emergency is negligible. As a result, the population density, for the purposes of this assessment, is zero.

As the Effect Area category is III, the population distribution factor identified in IAEA Table VII is 1.

Mitigation Correction Factor

IAEA Table VIII identifies that a population density mitigation factor of 0.05 should be applied to toxic liquid substances.

Calculation of External Consequences

Using the formula identified previously, **Table A4-5** identifies the external consequence of catastrophic failure of the containment systems associated with the storage of sulphuric and hydrochloric acid.

Table A4-5
Overview of Storage Conditions

Activity	Affected Area (ha)	Population Density	Population Correction Factor	Mitigation Correction Factor	Estimated Number of Fatalities
Storage of Sulphuric Acid	8	0	1	0.05	Nil
Storage of Hydrochloric Acid	0.3	0	1	0.05	Nil
Storage of LPG	-	-	-	-	-

A4.3.3.5 Estimation of Probability

The *Risk Assessment Guidelines* provides a probability estimation methodology based on IAEA (1996). Section A1.2.5 of the Guidelines identifies the following formula for estimating the probability of an accident involving a hazardous substance.

$$Ni,s = N^*i,s + nl + nf + no + np$$

Where Ni,s = *Probability number*

N^*i,s = *average probability number for the class of facility*

nl = *the frequency of loading/unloading operations*

nf = *safety systems associated with flammable substances (where applicable)*

no = *organisational and management safety*

np = *wind direction towards the populated area*

The relationship between the probability number and the frequency value P is given by the formula:

$$N = | log10\ P |$$

Storage of Sulphuric Acid

The following apply to the storage of sulphuric acid within the reagent storage area. References in parenthesis indicate the Table in IAEA (1996) from which the identified value has been drawn.

- N*i,s = toxic liquid or 5 (IAEA Table IX).
- nl = 385 times per year or -1.5 (IAEA Table X(a)).
- nf = not relevant as sulphuric acid solution is non-flammable.
- no = average industry practice or 0 (IAEA Table XII).
- np = Effect Area category is III and the area of affect is not populated (see Section 3.3.4.4, however, for the purposes of this assessment assume 5%). As a result, the wind direction correction factor is 1.5.

As a result, the probability number for storage of sulphuric acid is as follows.

$$Ni,s = 5 – 1.5 + 0 + 0 + 1.5 = 5$$

As a result, based on the conversions provided in IAEA Table XIV, the probability of an accident associated with the storage of sulphuric acid is 1×10^{-5} events per year which is the equivalent of one event every 10 000 years.

Storage of Hydrochloric Acid

The following apply to the storage of hydrochloric acid within the carbon-in-leach plant.

- N*i,s = toxic liquid or 5 (IAEA Table IX).
- nl = 26 times per year or 0 (IAEA Table X(a)).
- nf = not relevant as hydrochloric acid solution is non-flammable.
- no = average industry practice or 0 (IAEA Table XII).
- np = Effect Area category is III and the area of affect is not populated (see Section 3.3.4.4, however, for the purposes of this assessment assume 5%). As a result, the wind direction correction factor is 1.5.

As a result, the probability number for storage of sulphuric ac is as follows.

$$Ni,s = 5 + 0 + 0 + 0 + 1.5 = 6.5$$

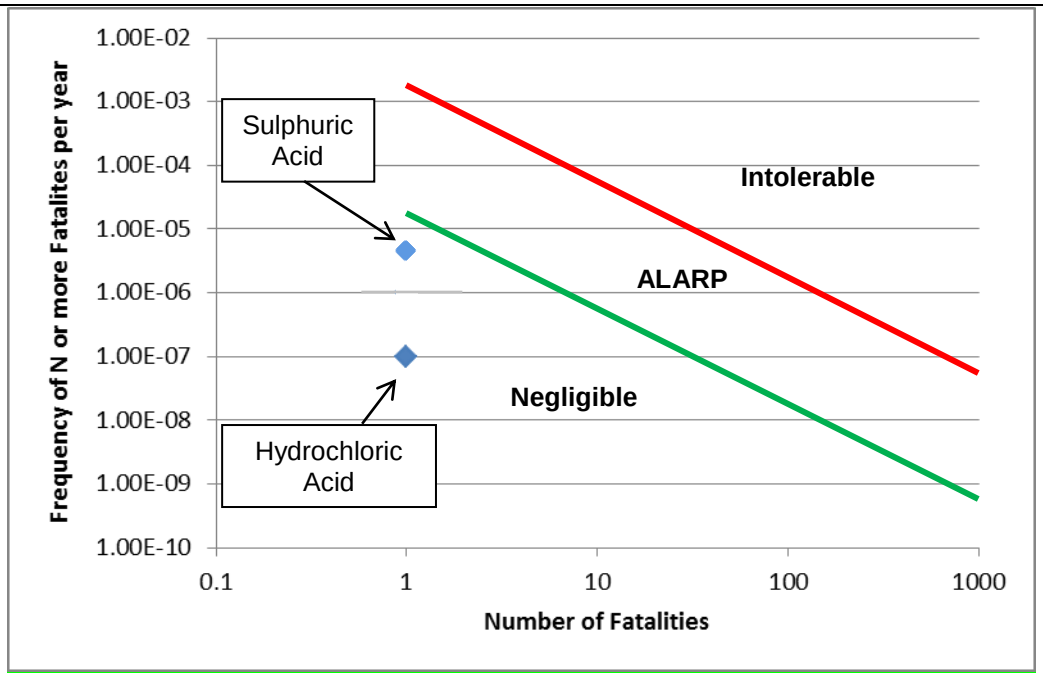
As a result, based on the conversions provided in IAEA Table XIV, the probability of an accident associated with the storage of hydrochloric acid is 1×10^{-7} events per year which is the equivalent of one event every million years.

A4.3.3.6 Estimation of Societal Risk

The estimated consequence and probability of a catastrophic failure of the containment systems for the storage of sulphuric and hydrochloric acid are presented in the preceding subsections. The *Risk Assessment Guidelines* identify in Section A1.2.5 that the calculated frequency and consequences should be plotted and compared with the classifications presented on Figure 6 of the Guidelines. **Figure A4-2** presents the results of the consequence and probability analysis for the storage of sulphuric and hydrochloric acid. It is noted that as the axis of the graph are logarithmic, the anticipated number of fatalities per event have been rounded from zero to one.

A4.3.3.7 Determination of Assessment Level

Section 3.1.2 of the *Risk Assessment Guidelines* identify that a Level 1 – Qualitative Risk Analysis should be undertaken for all activities for which the initial screening thresholds have been exceeded. In the present case, the storage of sulphuric and hydrochloric acid have exceeded the screening thresholds. The storage of LPG also exceeded the screening threshold, however, as identified in **Table A4-4**, the effect category for storage of LPG was determined to be "small enough to be ignored".



Note 1: ALARP = as low as reasonably practicable

Figure A4-2
MULTI LEVEL RISK ASSESSMENT PROCESS

The Guidelines identify that the following four conditions need to be satisfied to justify a Level 1 – Qualitative Risk Analysis. Commentary in relation to the applicability of each of the conditions to the Project is also provided.

- All points on the indicative societal risk curve produced from the risk classification and prioritisation should be below the negligible line.

  As shown on **Figure A4-2**, each of the identified activities fall below the negligible line.

- There should be no events with consequences extending significantly beyond the site boundary at a frequency of greater than 1×10^{-7}.

  None of the activities have a frequency greater than 1×10^{-7}.

- The process or operation should be well understood and covered by established and recognised standards and codes of practice.

  Storage of sulphuric and hydrochloric acid is a well understood process and there are recognised standards and practices that would be implemented, including Australian Standard *AS3780 The storage and handling of corrosive substances.*

- If there are any off-site consequences these will not impact on any sensitive adjoining land use.

  There are no sensitive adjoin land uses.

In light of the above, the Proponent contends that a Level 1 – Qualitative Risk Assessment is appropriate.

A4.3.4 Qualitative Risk Assessment

A4.3.4.1 Preparation of the Qualitative Risk Assessment

This subsection presents the qualitative risk assessment prepared for the proposed storage of sulphuric and hydrochloric acid. The assessment was prepared by Mitchell Bland (BSc(hons), MEconGeol, LLB(hons), Principal Environmental Consultant with RWC and has been reviewed by:

- Mr John Thompson (B.E.Mining, FAusIMM) – Vice President – Project Development – EMC Metals Australia Pty Ltd..
- Dr Geoff Duckworth (B.Eng. (Chem)), B.Eng.Sci., PhD) – Senior Consultant – Process, Lycopodium Minerals Pty Ltd.

A4.3.4.2 Assessment Methodology

To ensure consistency, the qualitative risk assessment was undertaken using the methodology described in Section 5.1 of the *Environmental Impact Statement*. The outcomes of the risk analysis incorporate the adoption of standard, industry-wide controls and mitigation measures, together with the implementation of specific control measures identified in Section A4.3.2 of this Appendix.

Risk is measured in terms of consequence (severity) and the likelihood (probability) of the event happening. The allocation of a consequence rating was based on the definitions contained in **Table A4-6**. Similarly, the likelihood or probability of an impact occurring was allocated based on the definitions contained in **Table A4-7**. Finally, the overall risk is then determined by considering the relative consequence and likelihood of an event occurring as defined by **Table A4-8**. To ensure consistency, the definitions contained in **Tables 5.1** to **5.3** are consistent with those used by the Applicant for its internal risk assessment processes.

The four levels of risk identified in **Table A4-8** are managed by the Applicant as follows.

- Low – can be managed by routine procedures and is unlikely to require specific application of resources.
- Moderate – can be managed to minimise the potential for environmental harm by the implementation of specific monitoring programs and response procedures. Responsibility for the implementation of monitoring and management activities must be specified.
- High – requires the development of specific management or action plans identifying specific monitoring, trigger levels for contingency management and specification as to the roles and responsibilities of personnel to implement contingency management. Senior management attention is required to ensure appropriate resources are available to manage this risk.
- Extreme – presents a risk which may not be able to be satisfactorily managed by the development and implementation of management plans. Director attention is needed to identify alternative methods of operation to reduce the risk to a level where it can be satisfactorily managed.

Table A4-6
Qualitative Consequence Rating

Insignificant	Minor	Moderate	Major	Critical
Health and Safety				
• First aid treatment or injury only; • Low level soreness or small amount of pain.	• Medical Treatment Injury; • Restricted Work Injury; • Presented to hospital (no overnight stay).	• Single Lost Time Injury; • Short term hospitalisation (< 7 days); • Reversible impairment to human health.	• Multiple Lost Time Injuries; • Extended hospital treatment (> 7 days); • Permanent disability < 30%; • Serious long-term health issue.	• Permanent disability > 30%; • One or more fatalities.
Environment				
• No or very low environmental impact; • Impact confined to a small area.	• Low environmental Impact; • Rapid clean-up by internal staff or contractors; • Impact contained to area already impacted by operations.	• Moderate environmental impact; • Clean-up by internal staff or contractors; • Impact confined within lease boundary.	• Major environmental impact; • Considerable clean-up effort required by internal staff and external contractors; • Impact may extend across lease boundary.	• Severe environmental impact; • Likely species destruction and long recovery period; • Extensive clean-up using external resources; • Impact on a regional scale.
Community/External Relations				
• Isolated complaint received; • No media coverage; • No damage to reputation or relationships with stakeholders.	• Multiple or sporadic complaints received; • No media coverage; • Short-term damage with relationship with one or more stakeholders but no damage to reputation.	• Repeated or serious rate of complaints; • Local media interest and coverage; • Reversible damage with stakeholders and to reputation.	• Ongoing complaints from local groups, NGO's or regulators; • Regional/national media interests; • Protests by external stakeholders; • Local or regional damage to reputation.	• High level concern from community, regulators, stakeholders and /or stakeholders; • Adverse national or international media coverage; • International damage to reputation.
Legal				
• Questionable or minor non-conformance with operating condition; • No fine or prosecution; • Unlikely to attract regularity interest; • Easy to resolve.	• Non-compliance with operating conditions; • Could attach low level administrative response from regulator; • No court appearance required.	• Breach of local or national law with potential prosecution by regulator; • Continuing occurrence of minor breach.	• Major breach of local or national law; • Prosecution or penalties by regulator likely; • Short term treat to operations continuing; • Civil action initiated.	• Significant breach of national or international law with potential jail sentence; • Operations suspended or cease (short term or long term); • Licenses withdrawn or revoked; • Class action initiated.
Operational / Cost				
• Minor impact, easily corrected with no loss of production; • <$5,000.	• Minor damage to equipment or infrastructure with minimal loss of production (< 1 day); • $5,000 - $50,000.	• Damage to equipment or infrastructure causes production to cease < 1 week; • $50,000 - $100,000.	• Damage to equipment or infrastructure causes production to cease < 1 month; • $100,000 - $500,000.	• Damage to equipment or infrastructure causes production to cease > 1 month; • > $500,000.

Source: EMC Metals Australia Pty Ltd

Table A4-7
Qualitative Likelihood Rating

Rating	Description in terms of full operating life of the site	Description in terms of frequency
Almost Certain	Consequences expected to occur in most circumstances	Daily or continuous
Likely	Consequences will probably occur in most circumstances	Weekly or monthly
Possible	Consequences could occur at some time	Annually
Unlikely	Consequence will probably NOT occur in most circumstances	Within the life of the operation
Rare	Consequence may occur in exceptional circumstances	>100 years
Source: EMC Metals Australia Pty Ltd		

Table A4-8
Risk Rating Matrix

Likelihood	Consequences / Severity				
	Insignificant	**Minor**	**Moderate**	**Major**	**Critical**
Almost Certain	HIGH 15	HIGH 10	EXTREME 6	EXTREME 3	EXTREME 1
Likely	MODERATE 19	HIGH 14	HIGH 9	EXTREME 5	EXTREME 2
Possible	LOW 22	MODERATE 18	HIGH 13	EXTREME 8	EXTREME 4
Unlikely	LOW 24	LOW 21	MODERATE 17	HIGH 12	EXTREME 7
Rare	LOW 25	LOW 23	MODERATE 20	HIGH 16	HIGH 11
Source: EMC Metals Australia Pty Ltd					

A4.3.4.3 Qualitative Risk Assessment Results

Table A4-9 presents the results of the Qualitative Risk Analysis. In summary, all identified incidents with the potential to result in adverse environmental or community safety impacts were determined to have a residual risk rating of Low or Moderate, with one potential incident, namely a road traffic accident resulting in discharge of product, retaining a residual risk rating of High. This ranking is the result of the fact that any road traffic accident has the potential to result in serious injury. As a result, while the likelihood classification is the minimum possible, namely "Rare" the consequence category is "Major," resulting in a residual risk raking of High (16). This ranking, however, is as low as reasonably practicable (ALARP), with further controls unlikely to further reduce the impact of a potential incident.

Table A4-9
Analysis of Standard and Residual Environmental Risk

Risk Source	Consequence / Hazard	Proposed Control Measures	Residual Risk with Proposed Control Measures
Transportation of sulphuric and hydrochloric acid	• Road traffic accident resulting in discharge of product • Malfunction of containment system (valve or structural failure, human error) resulting in discharge of product • Human injury resulting from contact with product. • Environmental harm resulting from discharge of product.	• Ensure that hydrochloric and sulphuric acid is delivered by a suitably licenced and experienced transportation contractor using well maintained equipment in accordance with the Dangerous Good Code.	H(16) ALARP
Transportation of sulphuric and hydrochloric acid from delivery vehicle to storage tank	• Leakage of product during transfer. • Human injury resulting from contact with product	• Ensure that hydrochloric and sulphuric acid is transferred to the on-site storage tanks using fit for purpose equipment by personnel that have been trained in the handling of those materials.	M(20) ALARP
Failure of storage tank(s) as a result of poor	• Discharge of product • Human injury resulting from contact with product. • Property loss/damage resulting from contact with product. • Environmental harm resulting from discharge of product.	• Ensure that hydrochloric and sulphuric acid are stored and handled in accordance with the following. – The MSDS for each product. – Australian Standard *AS3780 The storage and handling of corrosive substances.* • Ensure that hydrochloric and sulphuric acid is only stored within suitably constructed storage tanks in separately bunded areas that are not adjacent or in close proximity to incompatible chemicals. • Ensure that all personnel within the Project Site have been trained in responding to spills and emergencies related to hydrochloric and sulphuric acid and that appropriate spill and emergency management equipment is available at all times. • Prepare an implement a *Hydrocarbon, Chemical and Reagent Management Plan*, including emergency management procedures for hydrochloric and sulphuric acid.	L(23)
Unrelated emergency/event on site impacts on reagent storage area	• Discharge of product • Human injury resulting from contact with product. • Property loss/damage resulting from contact with product. • Environmental harm resulting from discharge of product.	• Prepare an implement a Hydrocarbon, Chemical and Reagent Management Plan, including emergency management procedures for hydrochloric and sulphuric acid. • Ensure that local emergency services are aware of the location and volume of hydrochloric and sulphuric acid within the Project Site and management of these substances in the event of an emergency.	L(23)