PRELIMINARY HAZARD ANALYSIS REPORT

For

Vesuvius Australia
PO Box 92,
Bulli NSW 2069
Australia

REFRACTORY PROJECT
at
36 – 46 Gloucester Boulevarde,
Port Kembla NSW 2505

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EXECUTIVE SUMMARY

Scope

This study assesses the hazards and risks associated with the proposed Vesuvius Australia Refractory Project at 36-46 Gloucester Boulevarde, Port Kembla, NSW. A PHA of the refractory plant including a detailed assessment of the potential off-site risks is required as part of the land development process.

Overview

The proposal is to build a refractory manufacturing facility in an industrial area. The primary raw materials are clays and other minerals, but there are a small percentage of resins and other chemicals.

Risks and safeguards

This study has identified the risks associated with the use of those raw materials which are dangerous goods or otherwise present a potential hazard in terms of land use planning, and the use of various fuels which are dangerous goods.

All are adequately safeguarded against by the application of
- o Legislative requirements.
- o Standards and codes of practice.
- o Good industrial practices.

Details are provided below.

Recommendations

This study makes the following recommendations:
- o The design and operation of the proposal should proceed as planned, with the implementation of the safeguards detailed in this report.
- o Prior to construction of the building, the final design of the building, including bunded areas, tanker bay(s) and fire resistance levels adjacent to the combustible liquid tanks should be checked by a suitably qualified person to confirm compliance with the relevant safeguards.
- o A HAZOP study of the Hexion Cascophen AB403 resin storage and handling system design should be conducted, prior to construction/installation of that system.
- o The dangerous goods storage should be notified to WorkCover NSW and all dangerous goods requirements of the OH&S Act and Regulation should be met.
- o The detail of this study should be reviewed against the final design and any new requirements documented. Where significant changes have been made, a final hazard analysis should be conducted

Conclusions

The study concludes that the safeguards identified will provide adequate protection for both personnel and the environment.

From the analysis conducted the proposed facilities in operation will not pose a significant risk to surrounding land uses and are permissible. The recommendation to proceed (with the 5 requirements nominated) is made in conformity with the requirements of SEPP 33

1.Findings and Recommendations

1.1 Findings

The proposed facility and operations do not present significant the risks. This is achieved by means including separation, bunding liquid storage and providing contained tanker unloading.

From the analysis conducted, the proposed facilities in operation will not pose a significant risk to surrounding land uses and are permissible. The recommendation to proceed (with the five requirements nominated) is made in conformity with the requirements of SEPP 33

1.2 Recommendations

On the basis of this risk assessment, the proposal should proceed, with the following requirements:

- The design and operation of the proposal should proceed as planned, with the implementation of the safeguards detailed in this report.

- Prior to construction of the building, the final design of the building, including bunded areas and tanker bay(s) should be checked by a suitably qualified person to confirm compliance with the relevant safeguards.

- A HAZOP study of the Hexion Cascophen AB403 resin storage and handling system design should be conducted, prior to construction/installation of that system.

- The dangerous goods storage should be notified to WorkCover NSW and all dangerous goods requirements of the OH&S Act and Regulation should be met.

- The detail of this study should be reviewed against the final design and any new requirements documented. Where significant changes have been made, a final hazard analysis should be conducted

2 Site description

This section presents an overview of the site location and the operations proposed.

2.1 Location

2.1.1 The site

The site is located at 36-46 Gloucester Boulevarde, Port Kembla, NSW. The site is approximately 110m by 200m and slopes slightly down from the west to Gloucester Boulevarde.

2.1.2 Proposed development

The proposed development includes: an industrial building of 8,000m^2, with an included office component of 1900m^2 on the 1.8 hectare site. The building will be steel framed with concrete panel walls and sheet steel or other non-combustible roof.

The factory will make refractory products, primarily for use in the steel industry and the aluminium industry, which use them to line furnaces and the like. Vesuvius will be relocating production from an existing facility.

2.1.3 Surrounding land

The site is located in an industrial area which extends approximately half a kilometre in all directions except to the east where, across the road is an ocean beach.

The site is surrounded on all sides by existing industrial facilities. The closest residence is approximately 500 metres southwest of the site and there is a primary school approximately 500 metres south. These are shown in Appendix E

Stormwater drainage from the site flows into the Pacific Ocean

2.1.4 Site manning and security arrangements

The proposed development is expected to result in a total of about 80 employees, including 45 office personnel. The 35 factory workers will cover day shift from 6:00am to 2:00pm and afternoon shift from 2:00pm to 10:00pm (or occasionally 4:00 pm to midnight), Monday to Friday, with occasional Saturday work for maintenance or additional production

Out of hours, security arrangements will be via a contract security company and will include a minimum of weekend patrols (as at the existing facility). A separate review of security requirements will be undertaken

2.1.5 Site emergency planning

Because the aggregate quantity of dangerous goods on site exceeds the manifest quantity, an emergency plan will be prepared and submitted to the Risk Management Directorate of NSWFB for their comment.

2.2 Operations

2.2.1 General

The refractory manufacturing process consists essentially of three stages, preparation of the raw materials (see (a) below) followed by mixing (and drying where necessary) and packaging.

There are 4 different product ranges, each produced on a separate line as described in (b) to (e) below

a) Crushing/Screening/Ball Milling - raw materials (clay and other minerals) are processed to the ideal grain sizes to suit the end product.
b) Dry Powder Line - various raw materials are mixed to produce a final dry Powder product or premix for other product lines. Once mixed, dry powders are bagged.
c) Plastics Line – the premix has some acid added to produce a plastic (pliable) monolithic.
d) Comcast and Precast Line – the premix with water added is cast into a mould then dried before being heated to form a ceramic bond.
e) Tap Hole Clay - premix with a resin added is extruded and packed for delivery.

2.2.2 Dangerous Goods

The operation uses and/or stores the following dangerous goods. Items with a code number are raw materials, added in relatively small proportion to the clays and other minerals in the process.

Code	Name	Form	Package etc	UN No	Class etc
AB 400a	Hexamine	Solid	25 kg bags, max 2,000 kg	1328	4.1 PG III
AB 403	Hexion Cascophen AB403 resin (used in Taphole Clay)	Liquid	50,000 L heated tank	2810	6.1 PG III, C1
AB 405	Cascophen MWC5300	Liquid	IBC, max 2,000 L	1866	3 PG III
AB 421	Phosphoric acid	Liquid	IBCs, max 3,000 L	1805	8 PG III
AM 467	Sodium aluminate solution	Liquid	IBC, max 3,000 L	1819	8 PG II
AB425	Aluminium phosphate	Liquid	IBC, max 4,000 L	3264	8, PG III
	Natural gas (for ovens & dryers)	Gas	piped	1971	2.1
	LPG (for forklift fuel)	liquid	4,200 L tank	1075	2.1
	Diesel (for front end loader fuel)	liquid	7,000 L tank	-	C1

Note:
“C1” = combustible liquid C1, classified as dangerous goods for storage and handling
None of the finished products are dangerous goods

2.2.3 Storage of dangerous goods

Storage of solid materials

Hexamine

This flammable solid will be stored on pallets inside a steel container, located away from sources of heat and accumulations of combustible material. The existing container to be relocated to this development is pictured below.

Storage of liquid dangerous goods in tanks

Hexion Cascophen AB403 resin

This toxic and combustible liquid will be stored in a 50,000L tank located outside the main building.

Diesel

This combustible liquid will be stored in a 7,000L tank located outside the main building.

Storage of liquid dangerous goods in IBCs

Cascophen MWC5300

This flammable liquid will be stored in IBCs in a dedicated flammable liquid bunded compound located outside the main building,

Corrosive liquids

Phosphoric acid and other Class 8 liquids will be stored in IBCs in a dedicated corrosive liquid bunded compound located outside the main building,

2.2.4 Hazardous Materials

The operation uses and stores the following hazardous materials, added in relatively small proportion to the clays and other minerals in the process. These materials present a weak dust explosion hazard

Code	Name	Package etc	Dust explosion?
AM 429	Dresinate "rosin soap"	25 kg, max 500 kg	Explosive dust St1
AM 452	Darvan sodium polyacrylate	25 kg, max 500 kg	"Readily combustible" assumed St1
AS 351	Aluminium grit	15 kg drums, max 200 kg	Explosive dust St1

Note:

"St1", "St2" and "St3" are classes indicating the degree of violence of a dust explosion, ranging from weak explosions (St1) to violent explosions (St3)

Some other chemicals are used in small quantities and some of these are classified as workplace hazardous substances, presenting a health exposure hazard to the user. While risk assessment is required under occupational health and safety legislation, these are not significant for land use planning risk assessment.

2.2.5 Storage of hazardous materials

Aluminium grit

The small (15kg) drums will be stored in an existing purpose built container to be relocated to this development, pictured below. Note incorrect dangerous goods sign shown, relating to a finer grade of material than proposed. This sign will be removed prior to relocation.

Rosin soap and polyacrylate

These other lower hazard materials will be stored on pallets in racking, away from sources of heat and accumulations of combustible material

2.3.2 Properties of Materials

The materials are all established chemicals used in industry generally and the refractory industry in particular and their properties are well known. The properties of greatest significance to land use relate to flammability/combustibility, toxicity and, to a lesser extent, corrosivity.

3 Hazard Identification

3.1 General

The storage and handling of the dangerous goods and hazardous materials listed above are well established in industry. The hazards associated with those materials and typical operations have been identified and addressed by various Australian Standards, Dangerous Goods Legislation and the like. However, it is necessary to identify hazards associated with the physical facility and its operation.

For this purpose, several types of operation have been identified as occurring in separate areas:

- Receipt and storage of raw materials and fuel
  - Bulk liquids (Hexion Cascophen AB403 resin and diesel)
  - Liquids in IBCs
  - Solids in packages
- Manual dispensing and use of certain raw materials
- Fixed, piped supply to end uses
  - Hexion Cascophen AB403 resin
  - Natural gas

3.2 Individual operations

These are detailed in the following tables

3.2.1 Receipt and storage of raw materials and fuel

Receipt and storage of bulk liquids

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Unloading road tanker	Flexible hose failure	Spillage	Regular inspection/maintenance of hose, as prescribed by ADG Code Containment of tanker bay
	Driver uncouples hose before closing valve on filling point	Spillage of contents of filling pipe	Tanks are top-filled, so maximum spillage limited to pipe contents, contained by bunding of tanker bay
	Drive away without disconnecting	Spillage of hose contents, plus other spillage depending on whether isolation valves closed	Tankers are fitted with interlock such that brakes are locked on until delivery hose is back in holder. Bund capacity is sufficient to contain foreseeable spills.
	Unloading in rainy weather	Bund full of rain, unable to accommodate spillage	Pump out rainwater prior to tanker discharge
	Receiving tank cannot accommodate tanker contents	Overflow of storage tank	Storage tank is bunded, able to take full tanker load. Driver has contents gauge at filling point Tanker not ordered unless capacity available.
Bulk Storage	Leak in tank or pipe below liquid level	Spillage	Regular inspection/maintenance of tanks and pipework Bunding sufficient to hold contents of all tanks
	Leak in bund	Spillage	Regular inspection and repair if necessary,
	Failure of level sensing and display	Possible overflow when filling tanks	Regular inspection/maintenance of tanks Storage tank is bunded, able to take full tanker load.

Receipt and storage of LPG

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Unloading road tanker	Flexible hose failure	Spillage and fire	Regular inspection/maintenance of hose, as prescribed by ADG Code, upstream excess flow valve to limit leak, location signs for no smoking etc to avoid ignition
	Drive away without disconnecting	Spillage of hose contents.	Tankers are fitted with interlock such that brakes are locked on until delivery hose is back in holder. Excess flow valve fitted.
	Receiving tank cannot accommodate tanker contents	Overflow of storage tank	Driver has contents gauge at filling point Tanker not ordered unless capacity available.
Bulk Storage	Leak in tank or pipe below liquid level	Spillage	Regular inspection/maintenance of tanks and pipework
	Failure of level sensing and display	Possible overflow when filling tanks	Regular inspection/maintenance of tanks .

Receipt and storage of IBCs of liquids

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Unloading trucks	IBC dropped	Spillage	Integrity of IBC, forklift driver training, site containment
	IBC speared by forklift	Spillage	forklift driver training, site containment
Storing IBCs	Not placed in bunded area	Leak not contained	Procedures, forklift driver training

Receipt and storage of packages (solids)

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Unloading trucks	Package dropped	Spillage	Integrity of package, forklift driver training
	package speared by forklift	Spillage	forklift driver training
Storing packages	Placed in wrong location	Hexamine not stored in area free of ignition sources etc and fire	Procedures, forklift driver training

3.2.2 Dispensing and use

Diesel

This is pumped from the storage tank into the fuel tank of the front end loader via a dispenser with “dead man” handle on the nozzle..

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Refuelling front end loader	Leaking hose	Small spill	Regular inspection/maintenance of hose. Spill containment to prevent stormwater contamination
	Overfilling front end loader tank	Small spill	“dead man” nozzle, Spill containment to prevent stormwater contamination

LPG

This is decanted from the main tank into cylinders for forklift use, while the cylinders are mounted on the forklift

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Filling cylinder	Hose failure	Leak and fire	Hose to AS 1596, upstream excess flow valve to limit leak, location signs for no smoking etc to avoid ignition
	Overfilling	Leak and fire	Contents gauge, driver training, instruction signs

Liquids in IBCs

The IBC is taken from the storage location by forklift and placed next to the appropriate mixer. There are small day tanks on the mixer platform that are filled from the IBC's brought in from the bunded storage area. These are filled by mono pump and the pipes are stored in the mixer bunded area. An audible alarm on the static tanks indicates when they are nearing full. Liquid is dispensed to the mixer on a metered basis

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Moving IBC	IBC dropped	Spillage	Integrity of IBC, forklift driver training, site containment
	IBC speared by forklift	Spillage	forklift driver training, site containment
Pumping	Day tank overfilled	Spillage	Quantity metered, high level alarm, relatively slow pump rate

Solid materials

<u>Aluminium grit</u>

The amount added is about 3kg per 1 tonne batch. The aluminium grit is weighed out and mixed with silicon metal (7kg) to disperse it and then it is added to the 1tonne batch prior to entering the mixer.

The aluminium grit is weighed out on the floor in front of the storage bin. Only sufficient batches are weighed out to fulfil the manufacturing requirements and the part empty drum is returned to the storage bin and then sealed. The additives are added to the 1MT batch at the small bag addition station just in front of the skip that loads the mixer. This is some distance (>100m) from the aluminium storage area. A procedure will be produced to cover this operation.

<u>Hexamine</u>

At the Hexamine storage box, by the side of the mixer, the amount is weighed off and elevated to the mixer platform and added to each batch of manufacture.

Other (rosin soap and polyacrylate)
The Dresinate and Darvan are added in very small additions to each mix – 0.005%-0.1% per 1MT batch. There is a separate area for weighing these items off prior to manufacturing the main batch. Small, sealed plastic bags are accurately weighed off and marked with the details of the contents. A bag is then opened and added to each 1MT at the small ingredients weigh station just in front of the skip that feeds the TEKA

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Weighing out	Spill	Accumulation of layers of combustible material presenting local combustion hazard	Small quantities involved, procedures for immediate cleanup and general housekeeping
	Spill	Possible local dust cloud with potential for weak explosion	Exclusion of ignition sources, small quantities involved, procedures for immediate cleanup and general housekeeping

3.2.3 Fixed, piped supply to end uses

Hexion Cascophen AB403 resin

This resin, a toxic and combustible liquid, is stored in a water jacketed, heated 50,000 L tank. The resin is circulated through a pump and electric heater to maintain it at a temperature of about 50^{o}C to reduce its viscosity from about 6,000cP at 25^{o}C to that which can be easily pumped and added to the mixer. The pipework and mixer are separately heated with a gas fired packaged hot water boiler. This is maintained at 80 deg C. Both the electric heater and the gas boiler have high temperature cutouts.

It is noted that the supplier's MSDS specifies a flashpoint of 102^{o}C but does not indicate whether open or closed cup and does not specify the flammable/explosive range, so a conservative approach has been taken

The system is in a closed loop, with a heated water jacket, product is continuously recycled back to the storage tank. The temperature cutout on the main storage tank thermostat is set to 50^{o}C. The mixer is also heated by the water jacket and the liquid is metered into the mixer once all dry ingredients have been added.

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Storage tank heating and pipe heating	Failure of temperature controls	Increased resin temperature, lower viscosity, leak through bad joint etc	Large volume of resin would take a long time from control failure to overheat. Inspection and maintenance procedures
	Failure of temperature controls	Increased resin temperature, approaches flashpoint and vapour reaches ignition source leading to fire/explosion	Large volume of resin would take a long time from control failure to overheat. Inspection and maintenance procedures. Exclusion of ignition sources
Mixer	Overfilling	Spill	Quantity metered, relatively slow pump rate

Natural gas

A new system of "Tophat" ovens that can dry the normal product range is proposed. These ovens are commonly used in the foundry, heat treatment, refractory and allied industries and are also called “bell” ovens. The bell is capable of being lifted by a crane to place it on a different base. 2 ovens and 5 bases are proposed.

It is described as

> “The oven supplier will install a package burner on top of each tophat hood that feeds a hotbox to produce hot air that is passed around the internal chamber. The package burner has valves, controls and flame safety equipment. The main gas train will be situated off drier and against the main wall. This will contain the main gas regulator, main safety gas valve, pressure switches and shut off valve.
>
> The system will have a flexible coupling that attaches to the tophat hood and supplies each unit with gas. A flexible cable will supply electricity. Each tophat hood will have a control panel attached to a side that allows the operator to start and stop the system and monitor the firing curve and profile. It will also control an alarm system with siren and flashing light to inform the operator of any alarm raised by the system.
>
> To start the system the procedure requires a purge prior to starting the main burner. The burner for each bell is provided with a pilot burner as well as the main burner.

The installation will be fully compliant with AS 5601-2004 Gas installations

Function/area	Possible initiating events	Possible consequences	Prevention/protection measures
Main gas train	Pressure regulator failure	Overpressure, leaks	Inspection and maintenance procedures
	Mechanical damage	Leak and fire	Location away from vehicle movement, barriers if necessary
Flexible connection	Hose failure	Leak and fire	Compliant hose, inspection and maintenance procedures
	Poor connection to fixed pipe	Leak and fire	Operator training
Burner	Pilot failure	Buildup of gas before ignition, explosion	Flame failure detector, inspection and maintenance, operating procedures

3.3 Representative incident scenarios

Minor incidents, such as small spills contained and cleaned up on site are not considered further.

The remaining incident scenarios to consider are essentially under two categories:

- fire and explosion involving:
  - flammable gases (LPG, natural gas)
  - flammable or combustible liquids (resins, diesel)
  - flammable solids (hexamine)
  - solids with weak dust explosion potential
- release of liquids to the environment
  - flammable or combustible liquids (resins, diesel)
  - toxic liquids (Hexion Cascophen AB403 resin)
  - corrosive liquids (e.g. phosphoric acid)

4 Analysis

4.1 General

"The objective of hazard analysis is to develop a comprehensive understanding of the hazards and risks associated with an operation or facility and of the adequacy of safeguards." (HIPAP No 6). The principal output is the achievement of improved safety and the contribution to safety assurance, while another is the avoidance of avoidable risk and the identification of appropriate safeguards (HIPAP No 6).

The storage and handling of these industrial chemicals have been conducted quite widely and been the subject of specific legislative control for approximately 30 years in NSW. The currently prescribed controls are set out in the various Australian Standards and codes listed for each class of dangerous goods. These codes, coupled with the use of good practices, provide adequate safeguards for the ordinary hazards encountered in the storage and handling of these materials. However the risk from a fire needs to be addressed.

Qualitative assessment has been determined as appropriate – see Appendix D for details of this determination.

4.2 Hexion Cascophen AB403 resin

4.2.1 Receipt and storage of bulk Hexion Cascophen AB403 resin

The tanker will be parked in a dedicated bay. This will be designed to contain any spillage from hose leaks, coupling failures etc. The driver will be wearing personal protective equipment and will be able to stop the pump almost immediately. Any spill will be contained within the bunded area. The material is delivered warm (above 40^{o}C) to facilitate pumping and any spills will cool down becoming quite viscous (around 6,000 cP at 25^{o}C)

The tank will be located inside a bunded compound, capable of holding the entire contents, even in the event of a leak when nobody is in attendance. The tank and bunded compound will comply with both AS 4452:1997 "The storage and handling of toxic substances" and AS 1940:2004 "The storage and handling of flammable and combustible liquids" as the resin is classified as both toxic and combustible

The tank and bunded compound will be located close outside the building and the adjacent wall will comply with AS 1940 separation requirements, including fire resistance level (FRL) of 240/240/240 and shielding height requirements. Where required to comply with AS 4452 the wall beyond that required to meet AS 1940 will be rated for an FRL of 120/120/120

The delivery and storage containment will prevent any spills from escaping and the fire separation will prevent any fire spreading rapidly to other areas. Because the material is a combustible liquid kept below its flashpoint, the likelihood of a fire is very small. From land use planning, the toxicity is not an issue as spills will be fully contained and the potential for toxic emissions is related to products of combustion in the event of fire which has been assessed of as vey low.likelihood.

4.2.2 Usage of Hexion Cascophen AB403 resin

Since the usage is via fixed piping, the risks of leaks etc are very small and as the material cools it becomes quite viscous which further reduces the risk of spills spreading within the factory. When cooled, the material is not readily ignited. The use presents a very low risk.

4.3 Momentive Cascophen MWC5300

4.3.1 Receipt and storage of Momentive Cascophen MWC5300

IBCs will be unloaded from trucks and immediately placed in the dedicated bunded area. Any potential spillage will be contained within the bunded area. The IBCs will comply with ADG7 and will be stored and handled in accordance with AS 1940:2004 “The storage and handling of flammable and combustible liquids”

A separate bunded compound, capable of handling at least 1250 L will be provided.

As the IBCs comply with ADG7, the likelihood of failure if dropped from a forklift is extremely small. The other possibility is accidentally spearing a container with the tine of a forklift truck. Since forklift truck drivers are subject to training and assessment, the likelihood of this occurring is quite small.

The potential spill involved by spearing is only a part of the contents, i.e. less than 1000 L and all of that will be contained on site, due to the proposed containment for the unloading area.

The forklift used to handle the IBCs will either comply with the design and construction requirements for use in a hazardous area or alternatively will comply with the requirements for use specified in Appendix D of AS1940 for use of forklifts with packaged flammable liquids, thus controlling the risk of ignition.

4.3.2 Usage of Cascophen MWC5300

The pumping from the IBC has a low risk of spillage of a small quantity. As ignition sources will be controlled, the likelihood of fire from any spill igniting is very low. As a small spill on fire could be quickly knocked down by use of extinguishers, the risk of a fire extending beyond the immediate area is very low.

4.4 Diesel

4.4.1 Receipt and storage of diesel

The tanker will be parked in a dedicated bay, shared with the Hexion Cascophen AB403 tanker. This will be designed to contain any spillage from hose leaks, coupling failures etc. Any spill will be contained within the bunded area.

The tank will be located inside a bunded compound, capable of holding the entire contents, even in the event of a leak when nobody is in attendance. The tank and bunded compound will comply with AS 1940:2004 “The storage and handling of flammable and combustible liquids”

The tank and bunded compound will be located close outside the building next to the bund for the Hexion Cascophen AB403 and the adjacent wall will comply with AS 1940 separation requirements, including fire resistance level (FRL) of 240/240/240 and shielding height requirements.

The delivery and storage containment will prevent any spills from escaping and the fire separation will prevent any fire spreading rapidly to other areas. Because the material is a combustible liquid kept below its flashpoint, the likelihood of a fire is very low.

4.4.2 Use of diesel

The only use is in the fuel tank of a low loader, presenting no significant risk

4.5 Hexamine

4.5.1 Receipt and storage of hexamine

This flammable solid will be stored on pallets inside a steel container, located away from sources of heat and accumulations of combustible material. The maximum quantity is 2000 kg, noted as well below the manifest quantity (10,000 kg) specified for dangerous goods of that nature. The risk of ignition is low and the quantity, if involved in a general factory fire, would not present a significant heat load. Further details are in Appendix F

4.5.2 Usage of hexamine

Usage of hexamine is in relatively small quantities and does not present a significant hazard.

4.5.3 Detailed analysis

A detailed analysis of the hazards and risks associated with hexamine is included as Appendix F

4.6 Corrosive liquids

4.6.1 Receipt and storage of corrosive liquids

Corrosive liquids will be received and handled in IBCs in a similar way to Momentive Cascophen MWC5300 (see 4.3 above). The IBCs will comply with ADG7 and will be stored and handled in accordance with AS 3780:1994 “The storage and handling of corrosive substances” Spill containment for at least 1,000 L as required by the Standard will be provided.

The delivery and storage containment will prevent any spills from escaping to the environment.

4.6.2 Usage of corrosive liquids

The pumping from the IBC has a low risk of spillage of a small quantity, but this presents no risk as it will be contained within the factory

4.7 Hazardous materials

Note this refers only to materials with a potential dust explosion hazard

These materials as indicated above are stored in dedicated areas and only handled in small quantities. They present a risk that, in the event of a dust cloud being formed, it may ignite to produce a weak explosion and a risk that accumulated layers may also ignite. The prime risk control measure is housekeeping in accordance with Clause 4.7.2 “Housekeeping” in AS/NZS 4754:2004 “Code of practice for handling combustible dusts”

As the handling is in small quantities and localised, the likelihood of a secondary explosion due to widespread accumulated dust is negligible, and the risk is not significant in terms of land use planning.

4.8 LPG

4.8.1 Receipt and storage of LPG

This will be fully in accordance with AS 1596 and only trained personnel will be involved. The 4,200 L tank is less than the manifest quantity (5,000 L) specified for flammable gases and is located as required by the Standard.

4.8.2 Usage of LPG

The only usage is for filling fuel cylinders on forklifts. This does not present a significant risk.

4.9 Natural gas.

Natural gas is piped in for use with the “tophat” ovens. All piping and burner controls will be in compliance with AS 5601:2004 “Gas installations” with well established pressure control, burner management etc, such that no significant risk is presented.

5 Conclusions and recommendations

The proposed new manufacturing facility and associated operations present no significant risk.

In general, the risks are controlled by the application of the relevant Australian Standards.

On the basis of this risk control, the proposal should proceed, with the following requirements:

- The design and operation of the proposal should proceed as planned, with the implementation of the safeguards detailed in this report.

- Prior to construction of the building, the final design of the building, including bunded areas, tanker bay(s) and fire resistance levels adjacent to the combustible liquid tanks should be checked by a suitably qualified person to confirm compliance with the relevant safeguards.

- A HAZOP study of the Hexion Cascophen AB403 resin storage and handling system design should be conducted, prior to construction/installation of that system.

- The dangerous goods storage should be notified to WorkCover NSW and all dangerous goods requirements of the OH&S Act and Regulation should be met.

- The detail of this study should be reviewed against the final design and any new requirements documented. Where significant changes have been made, a final hazard analysis should be conducted

SEPP 33 requires that "potentially hazardous" developments be subject to a PHA. If the PHA demonstrates that the risk is not significant, "the development is permissible and can proceed to detailed assessment" ("Applying SEPP 33", Fig 1).

From the analysis conducted the proposed facility in operation, will not pose a significant risk to surrounding land uses and is permissible. The recommendation to proceed (with the five requirements nominated) is made in conformity with the requirements of SEPP 33

APPENDICES

A. **References**

B. **Glossary**

C. **MSDSs etc**

D. **Basis of assessment**

E. **Drawings etc**

A. References

Australian Standards

- AS 1596:2002. The storage and handling of LP gas
- AS 1940:2004. The storage and handling of flammable and combustible liquids
- AS 3780:1994. The storage and handling of corrosive substances
- AS 4452:1997. The storage and handling of toxic substances
- AS 4754: 2004. Code of practice for handling combustible dusts
- AS 5601: 2004. Gas installations

WorkCover NSW

- Storage and Handling of Dangerous Goods; Code of Practice 2005 (specifically sections 10.9 and 10.10 dealing with flammable solids)

Other standards and codes

- ADG Code (Australian Dangerous Goods Code) 6th and 7th editions

NSW Dept of Planning

- “Guidelines for Hazard Analysis” Hazardous Industry Planning Advisory Paper No. 6, 1996 (HIPAP No 6)
- “Applying SEPP 33; hazardous and offensive development application guidelines”

Legislation

- NSW Occupational Health and Safety Act 2000
- NSW Occupational Health and Safety Regulation 2001
- State Environmental Planning Policy No 33, Hazardous and Offensive Development

MSDSs – see Appendix C

B. Glossary

ADG Code (Australian Dangerous Goods Code). The code applying to transport of dangerous goods, but also used for defining and classifying dangerous goods for storage and handling purposes, usually with a suffix indicating the edition, e.g. **ADG7**.

AS. Australian Standard (**AS/NZS.** Joint Australian and New Zealand Standard)

Class. See 'DG Class'

Combustible liquid. A liquid with a closed cup flashpoint above 60^{o}C. C1 liquids have flashpoints up to 150^{o}C and C2 liquids beyond that. C1 liquids are defined dangerous goods for storage and handling.

Dangerous Goods. Goods or material classified as dangerous for storage and transport by the ADG Code or legislation. Generally speaking they present an immediate danger to persons or property. Note that not all Dangerous Goods are Hazardous Substances and many Hazardous Substances are not Dangerous Goods

DG Class (Dangerous Goods Class). The Class assigned by the ADG Code (e.g. Class 3)

Division. A dangerous goods classification within a Class (e.g. Division 4.1)

Flashpoint. The result of a specified test method, indicating ease of ignition.

FRL (fire resistance level). A measure of the fire resistance of a material or structure. It consists of three numbers (e.g. 120/120/90), representing the period of resistance in minutes for structural adequacy, integrity and insulation.

Hazardous material. For the purposes of this report, a material other than a dangerous good which presents a hazard of potential significance to land use planning. Typically this includes C2 combustible liquids, readily combustible materials and powders presenting a dust explosion hazard.

Hazardous Substance. Material presenting a hazard, including long term hazards, to the health or safety of persons (see relevant legislation for more details). MSDS conforming to Australian requirements will indicate if the material is classified as hazardous under the criteria set by WorkSafe Australia. Note that not all Dangerous Goods are Hazardous Substances and many Hazardous Substances are not Dangerous Goods

HAZOP (Hazard and Operability) Study. A formal safety review conducted by a team reviewing in detail a design, usually in the form of a firm P&ID (Process and Instrumentation Diagram) and outline operating instructions

HIPAP. Hazardous Industry Planning Advisory Paper, published by Dept of Planning or Dept of Urban Affairs and Planning, or Dept of Infrastructure, Planning and Natural Resources, now Dept of Planning

IBC. An “intermediate bulk container”, typically of around 1000 L capacity designed to be handled with a forklift truck

L Litre(s)

Manifest quantity. The quantity of dangerous goods above which legislation requires notification to WorkCover, submission of emergency plans to NSWFB and other controls.

MSDS (Material Safety Data Sheet) also **SDS.** A document describing the identity, chemical and physical properties, health hazards, precautions for use, safe handling and other information. The document should be less than 5 years old and meet other criteria of SafeWork Australia (previously ASCC or NOHSC

NSW Occupational Health and Safety Act 2000 and **NSW Occupational Health and Safety Regulation 2001.** The legislation applying to storage and handling of Dangerous Goods (as well as other health and safety requirements)

OHS. Occupational health and safety

Packing Group. A classification of the primary hazard within a dangerous goods Class or Division, with PG I representing the greatest degree of hazard and PG III the least

SEPP. State Environmental Planning Policy, a NSW legislative instrument.

UN Number. The four-digit substance identification serial number assigned to dangerous goods by the United Nations Committee of Experts on the Transport of Dangerous Goods and listed for each substance or article in the ADG Code.

C. MSDSs

A list of those consulted is provided below. In accordance with HIPAP No 6 guidelines, only MSDS for “unusual materials” need to be included in this appendix.

Those listed are proprietary resins etc. As all are commonly traded chemicals, references only are provided.

List of MSDSs consulted:

- Hexion Cascophen AB403 resin
  Hexion Cascophen AB403, supplier Hexion Specialty Chemicals Pty Ltd, reference Chemwatch 11948, dated 4 Dec 2008

- Momentive Cascophen MWC5300
  Momentive Cascophen MWC5300, supplier Momentive Specialty Chemicals Pty Ltd
  reference CHEMWATCH 15-6765 , Version 2, dated 9-Apr-2010

- Rosin soap
  Dresinate ™ TX Rosin Soap, supplier Eastman Chemical Company, reference AU/EURO/EN/15000006683/Version 4.1, dated 08/10/2007

- Sodium polyacrylate
  Darvan ® 811D, supplier A.S.Harrison & Co Pty Ltd, reference 14433, dated 2/4/2007

D Basis of Hazard Assessment

The quantity of dangerous goods proposed to be stored exceeds the "Applying SEPP 33" screening threshold. and on this basis the proposed facility is "potentially hazardous" as defined by SEPP 33. It is not "potentially offensive" as no environmental licence is required

In determining the level of assessment required, consideration was given to the proposed separate operations:

- Receipt and storage of raw materials and fuel
- Dispensing and use of materials
- Piped supply to end uses

Simply exceeding the threshold does not automatically warrant quantitative risk assessment. Both HIPAP 6 and "Multi-Level Risk Assessment" ("MRLA") indicate criteria for determining the applicable method or "level" of assessment. "Applying SEPP 33" ("AS33") under question 4.2 indicates some criteria whereby a qualitative assessment is appropriate and these are essentially applicable in this case.

"MRLA" provides a risk classification and prioritisation method (the IAEA method) for a variety of dangerous goods such as flammable liquids and gases, but not including the classes stored in this case. Alternative means were sought to make such a classification. All three references indicate that only a minority of PHAs would require Level 3 and suggest various criteria for a qualitative PHA being appropriate

"AS33" indicates in Question 4.2 that a qualitative PHA may be sufficient in circumstances "where the materials are relatively non-hazardous (for example, corrosive substances and some classes of flammables)". "MRLA" indicates in Fig 4 a hierarchy of analysis, corresponding to consequences from minor to significant:

- No further analysis (apply codes and standards)
- Level 1 – Qualitative analysis
- Level 2 – Partially quantitative analysis
- Level 3 – Quantitative risk analysis

In the absence of a suitable prioritisation method in "MRLA", consideration was given to the following issues

- Quantity and type of dangerous goods
- Type and complexity of the storage and handling operations
- Ease of implementation of technical and management safeguards
- Surrounding land use (being relatively non-sensitive).

It is appropriate to look at the scope and extent of any relevant Australian Standard in the initial prioritisation to determine the level of assessment. The types of dangerous goods are, as described in Section 3.1, those of "a well established industry where the hazards associated with those materials and typical operations have been identified and addressed by various Australian Standards, Dangerous Goods Legislation and the like. However it is necessary to identify hazards associated with the physical facility and its operation."

Relevant standards apply

- AS 1596:2002. The storage and handling of LP gas
- AS 1940:2004. The storage and handling of flammable and combustible liquids
- AS 3780:1994. The storage and handling of corrosive substances
- AS 4452:1997. The storage and handling of toxic substances
- AS 4754: 2004. Code of practice for handling combustible dusts
- AS 5601: 2004. Gas installations

In each case, the scope of the standard includes storage of the quantities proposed. In each case, the operations proposed to be performed are within the scope of the standard and are specifically addressed in the standards.

HIPAP 4 defines criteria for qualitative risk assessment as, in summary:

- All "avoidable" risks should be avoided
- Risks should be reduced wherever possible
- The consequences of any high probability hazardous events should be contained within the boundaries
- If there is an existing high risk, additional hazardous developments should not be allowed if they add significantly to that risk.
- In addition, there are two criteria relating to proximity to sensitive environmental areas.

These criteria have been met, and in particular, proposed risks have been reduced and no "high probability" hazardous events were identified.

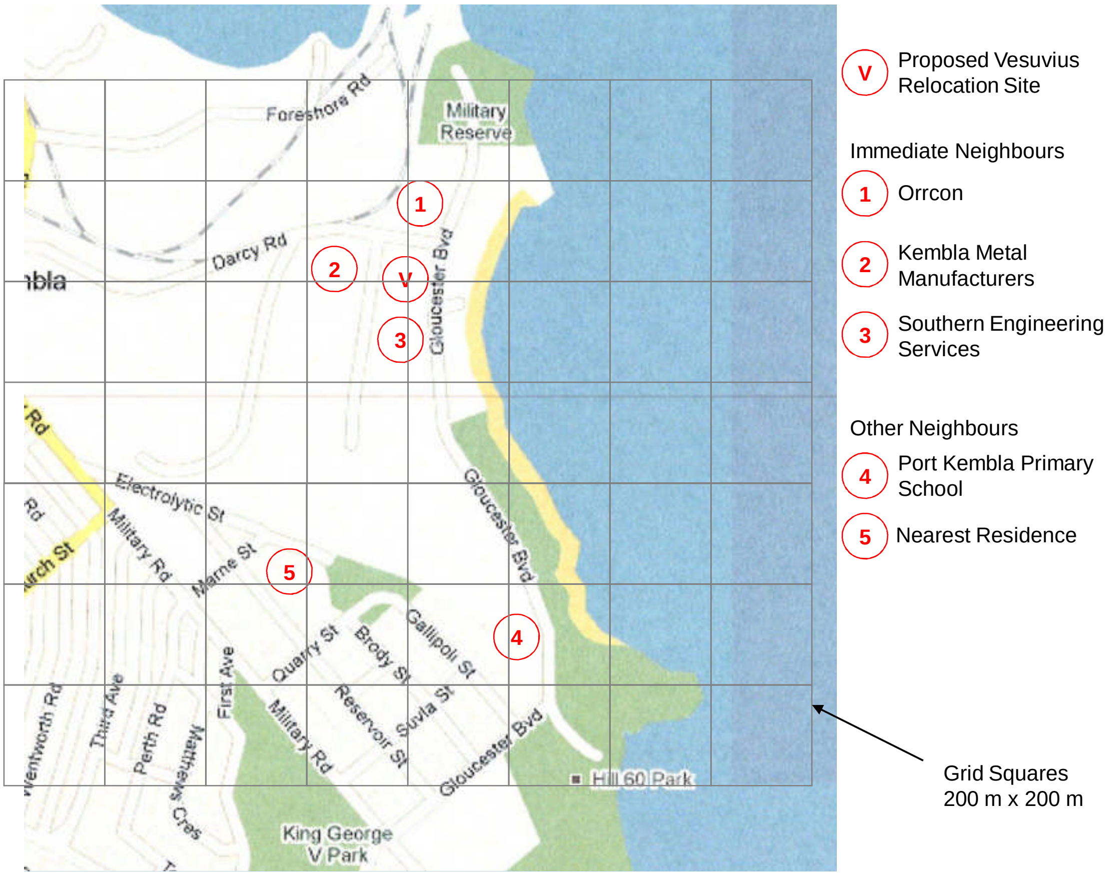
As a verification of the validity of using a Level 1 assessment, one of the criteria for using a qualitative PHA is that the safeguards identified in the analysis are all "self-evident and readily implemented". The hazards identified by analysis of the specific proposal and operations and the safeguards (in Tables 3.2.1 to 3.2.3) are all "self-evident and readily implemented". They are also similar in principle to safeguards identified in the standards.

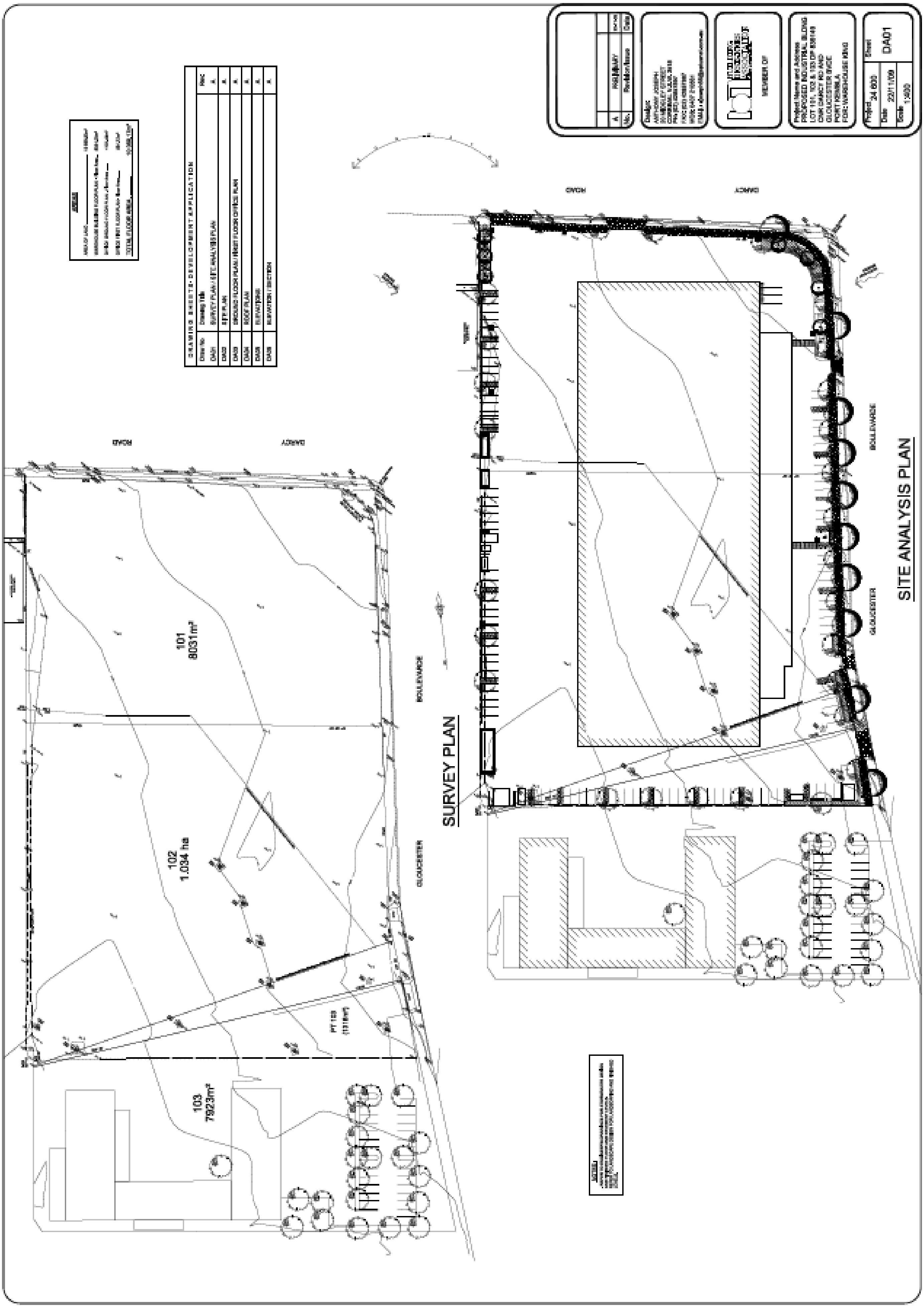
Having regard to all the above, a Level 1 (qualitative) assessment is appropriate.

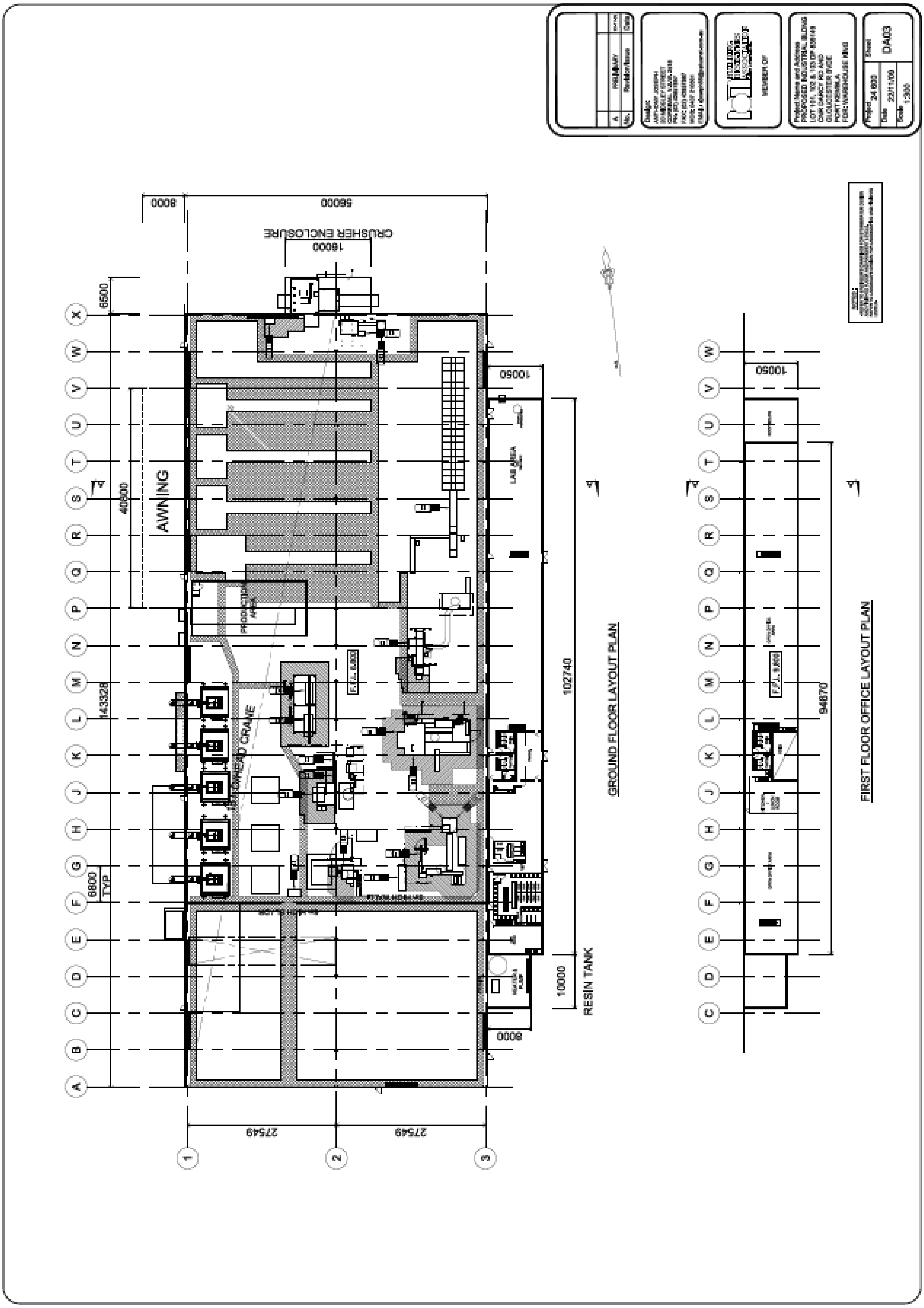
E. Drawings etc

(a) Location diagram of site (below)

(b) Neighbouring properties:




SURVEY PLAN
SITE ANALYSIS PLAN
101
8031m²
102
1.034 ha
103
7923m²
GLOUCESTER
BOULEVARDE
DARCY
ROAD
DA01



GROUND FLOOR LAYOUT PLAN
FIRST FLOOR OFFICE LAYOUT PLAN
AWNING
CRUSHER ENCLOSURE
OVERHEAD CRANE
RESIN TANK
DA03

F. Properties of hexamine

MSDS statement
The MSDS for Hexamine states that "Excessive heat will cause decomposition, releasing formaldehyde and ammonia". Land use planning aspects of a hexamine fire are discussed in detail below.

Hexamine on ignition and exposure to heat
There is a difference between decomposion of hexamine when exposed to heat and the combustion of hexamine when ignited. These differences are addressed in detail below and considered in relevant scenarios.

<u>Hexamine fire with excess oxygen</u>
Hexamine is relatively easily ignited by direct flame (as witness its use as a fuel for camping stoves). When ignited with plenty of air available to provide oxygen, combustion is essentially direct to final products:

- Hexamine – also called hexamethylenetetramine (HMT) or metheneamine – is a heterocyclic organic compound widely used in organic synthesis. The combustion reaction of hexamine can be represented as

  $$(CH_2)_6N_4 + 10O_2 \rightarrow 4\ CO + 2CO_2 + 2NO = 2NO_2 + 6H_2O$$

  Amalajyothi, K. and Berchmans, L.J. "Novel synthesis of cerium hexaboride by hexamine route" International Journal of Self-Propagating High-Temperature Synthesis, Volume 17, Number 4 / December, 2008, Allerton press Inc.

- Products of Combustion: These products are carbon oxides (CO, CO2), nitrogen oxides (NO, NO2...).

  Science Lab.com Metheneamine MSDS, last updated 11/06/2008
  http://www.sciencelab.com/xMSDS-Methenamine-9924639

- Decomposition Products: carbon dioxide, carbon monoxide, nitrogen oxides, water

  Swift and Company Limited Hexamine MSDS, revision issued 28 April 2004
  Copy provided by client , March 2009

The above is supported by decades of use by civilian and military personnel using hexamine as fuel in camp stoves. Hexamine stoves were first used in any significant way by Germany in World War II (the esbit kocher – see Bull, S.R. "Encyclopedia of military technology and innovation" Greenwood 2004). These stoves were used by British and Australian and other NATO forces in WW II, Korea, Malaya, Vietnam and are still in use today. They have been popular with civilian campers and are readily available.

HEXAMINE CAMPING STOVE WITH FUEL TABLETS

Product Code: HS0010
Price: $5.95
AUD inc GST
currency converter

The standard hexamine stove remains a favourite of soldier, cadet and outdoors enthusiast. Compact, rugged and an efficient means of cooking.
http://www.wellingtonsurplus.com.au/showProduct/HS0010

Industrial scale hexamine fires are further addressed below.

Recent specific fire advice is:

- Fire Hazards
  If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).
  - Hexamine is a COMBUSTIBLE SOLID.
  - Finely dispersed Hexamine particulate or powdered dust is an explosion hazard.
  - Use dry chemical, water spray, sand, earth or foam as extinguishing agents.
  - POISONOUS GASES ARE PRODUCED IN FIRE, including Nitrogen Oxides.
  - Use water spray to keep fire-exposed containers cool.

  New Jersey Department of Health & Senior Services Right to Know Program Hexamine Hazardous Substance Fact Sheet, revised February 2009.
  http://nj.gov/health/eoh/rtkweb/documents/fs/0996.pdf

  The above is consistent with essentially complete combustion to oxides of carbon and nitrogen in fire scenarios

- Hexamethylenetetramine - **Fire Hazards**: *Flash Point (deg. F)*: 482 CC; *Flammable Limits in Air (%):* Not pertinent; *Fire Extinguishing Agents:* Water, foam, carbon dioxide, or dry chemical; *Fire Extinguishing Agents Not To Be Used:* Not pertinent; *Special Hazards of Combustion Products*: Formaldehyde gas and ammonia may be given off when exposed to heat; *Behavior in Fire*: Not pertinent; *Ignition Temperature (deg. F):* > 700; *Electrical Hazard*: Not pertinent; *Burning Rate*: Not pertinent. **Chemical Reactivity**: *Reactivity with Water*: No reaction; *Reactivity with Common Materials:* No reactions; *Stability During Transport*: Stable; *Neutralizing .Agents for Acids and Caustics*: Not pertinent; *Polymerization*: Not pertinent; *Inhibitor of Polymerization*: Not pertinent.

Davletshina, T.A. and Cheremisinoff, N.P. "Fire, Explosion and Chemical Reactivity Data for Industrial Chemicals" Noyes Publications 1998.

The above draws the clear distinction between exposure to heat and behaviour in fire which is described as "not pertinent". Section 4.1 of the reference defines this as;

> "Not pertinent" refers to the fact that the particular property is not important in making a hazard or risk assessment"

Hexamine decomposition or fire with limited oxygen

Hexamine will decompose on heating and, in a fire in the absence of sufficient oxygen, may produce ammonia and formaldehyde:

> **Fire Hazard**
> Special Hazards of Combustion Products: Formaldehyde gas and ammonia may be given off when hot.
>
> Chemical Book Hexamethylenetetramine Product Description
> http://www.chemicalbook.com/ChemicalProductProperty_EN_CB8852597.htm

Applicable scenarios

The issue is to determine the realistic scenario(s) for the proposed development. Hexamine, as indicated in the PHA is to be stored in a steel storage cabinet and only small amounts at a time are dispensed for use.

In the event of a small amount of hexamine outside the storage (e.g. as dispensed for use) being somehow ignited, being outside the storage, it would burn with plenty of air (due to the size of the building) and could be readily extinguished by the dispensing operator. This would not result in any off site effects.

In the event of a major fire elsewhere in the building providing sufficient heat to cause decomposition of the hexamine inside the storage cabinet, formaldehyde and ammonia may be given off. Various different outcomes are possible. Some or all of the gases may undergo combustion in the main fire, resulting in conversion to oxides of carbon and nitrogen and/or the gases may be sucked into the rising plume of combustion gases from the main fire and dispersed. Having regard to the contents of the building being largely minerals and mechanical equipment, the likelihood of a fire large enough to cause sufficient heating of the hexamine storage is quite low.

However, if such a fire did occur the offsite consequences related to the presence of hexamine would not be significant. This is supported by consideration of reports of large quantities of hexamine involved in fires and the proposed quantities being relatively small.

Incident reports of hexamine involved in fires

There are very few incident reports available by internet search. In a 20 year period to 2009, two reports incidents involving fire have been located. In each case a significant quantity of hexamine was involved. There were two other reports of incidents involving hexamine not relevant to ordinary fires. One, involving an experimental reaction of hexamine with other chemicals in a commercial-size reactor in May 2009, resulted in an explosion. The other one, involving the reaction of hexamine with nitric acid in an explosives manufacturing facility, resulted in a small fire extinguished by an operator using a hose.

One fire incident occurred in Pinjarra WA on 4 Feb 1987 when fire in a storage shed spread to storages of 25 tonnes of ammonium nitrate and 30 tonnes of hexamine which were involved in a fire which "was brought under control by Fire Brigade personnel after burning for two hours. Pollution to the environment was minimized by containing the fire water within sand walls" (from "Summary of accident reports 1987; Explosives, flammable liquids, dangerous goods" Explosives and Dangerous Goods Division, Department of Mines WA). Pinjarra is not a remote area; it is a town located about 20 km inland from the coastal city of Mandurah.

The other fire incident involved the hexamine production section of the Wright Chemical Corporation plant in Acme, Columbus County on 9 Jul 1990. A newspaper report quoted the attending fire chief indicating some sort of electrical short leading to a dust fire which spread to crystals of hexamine being separated from aqueous slurry (Wilmington Morning Star Tuesday July 10, 1990, page 1C). No quantity of hexamine involved was reported, but the plant is a substantial producer, as indicated by a 2003 report of 200,000 lb/day production of formaldehyde, most of which "is for captive production of hexamine and specialty resins" (Perstop Formox AB Sweden "Informally Speaking" Autumn/Winter 2003
http://www.perstorpformox.com/upload/2_2003.pdf)

Comparison of quantities
These reports of substantial quantities of hexamine involved in fires do not indicate any toxic fume issues affecting either fire fighters or the environment. This is consistent with the material set out above

The maximum quantity of hexamine on the premises is limited to 2000kg, although the quantity usually on the premises would be somewhere between 500kg and 1500kg due to the pattern of use and ordering. The storage container (see photo in Section 2.2.3 of PHA) can hold two pallets, each of 1,000 kg. When stock reaches around 1,000 kg (i.e. there is only one pallet), another pallet is ordered and when it arrives the stock level would have dropped well below 1,000 kg due to usage between order and delivery.

The maximum stock of hexamine, at 2 tonnes, is only 40% of the SEPP 33 screening threshold of 5 tonnes (Table 3 in "Applying SEPP 33") and, as indicated in Section 4.5.1 of the PHA, is "well below the manifest quantity (10,000 kg) specified for dangerous goods of that nature" in the regulations applicable to dangerous goods (NSW OH&S Regulation 2001).

Conclusion
In considering all of the above, it is concluded that the risks to surrounding land uses posed by the involvement of hexamine in a fire are not significant.

Potential for dust generation and subsequent fire or explosion
The quantities handled are small (related to dispensing small amounts) and the prime risk control measure is housekeeping in accordance with Clause 4.7.2

“Housekeeping” in AS/NZS 4754:2004 “Code of practice for handling combustible dusts”

The relevant sections of this clause include:

> Good housekeeping reduces the opportunity for ignition of dust and reduces the fuel load in the event of a fire or dust explosion. As housekeeping is fundamental to the level of risk, any housekeeping controls need to be strictly regulated and controlled. Relevant aspects to be considered are—
>
> (b) the work area should be maintained as clean, orderly and sanitary as working conditions allow;
>
> (d) dust should not be permitted to accumulate, including stockpiles of waste which may self-ignite, e.g. organics, unless specific procedures are in place;
>
> (e) particular attention should be paid to the removal of dust from heated surfaces, e.g. pipes, radiators and electrical apparatus
>
> (f) spills should be removed at once and disposed of in a safe location;
>
> (g) housekeeping practices should be designed to minimize the risk of dust explosions by—
>
> > (i) ensuring that materials used do not introduce ignition sources (i.e. the use of non-sparking and antistatic tools and appropriate personal protective equipment);
> >
> > (ii) using methods of cleaning which minimize the creation of dust clouds (e.g. vacuum cleaning as opposed to sweeping and blowing using compressed air, other gases or water jets);
>
> (h) brooms, brushes, dustpans and other items used for cleaning should be made of nonsparking antistatic material;

In addition, other clauses in AS/NZS 4754:2004 are relevant, including clauses

> 4.2 Training/awareness
> 4.3 Personal protective equipment (PPE)
> 4.6 Safety operating procedures.

These requirements are to be included in operating procedures.

In considering all of the above, it is concluded that the risks to surrounding land uses posed by the risk of fire or explosion from hexamine dust are not significant.