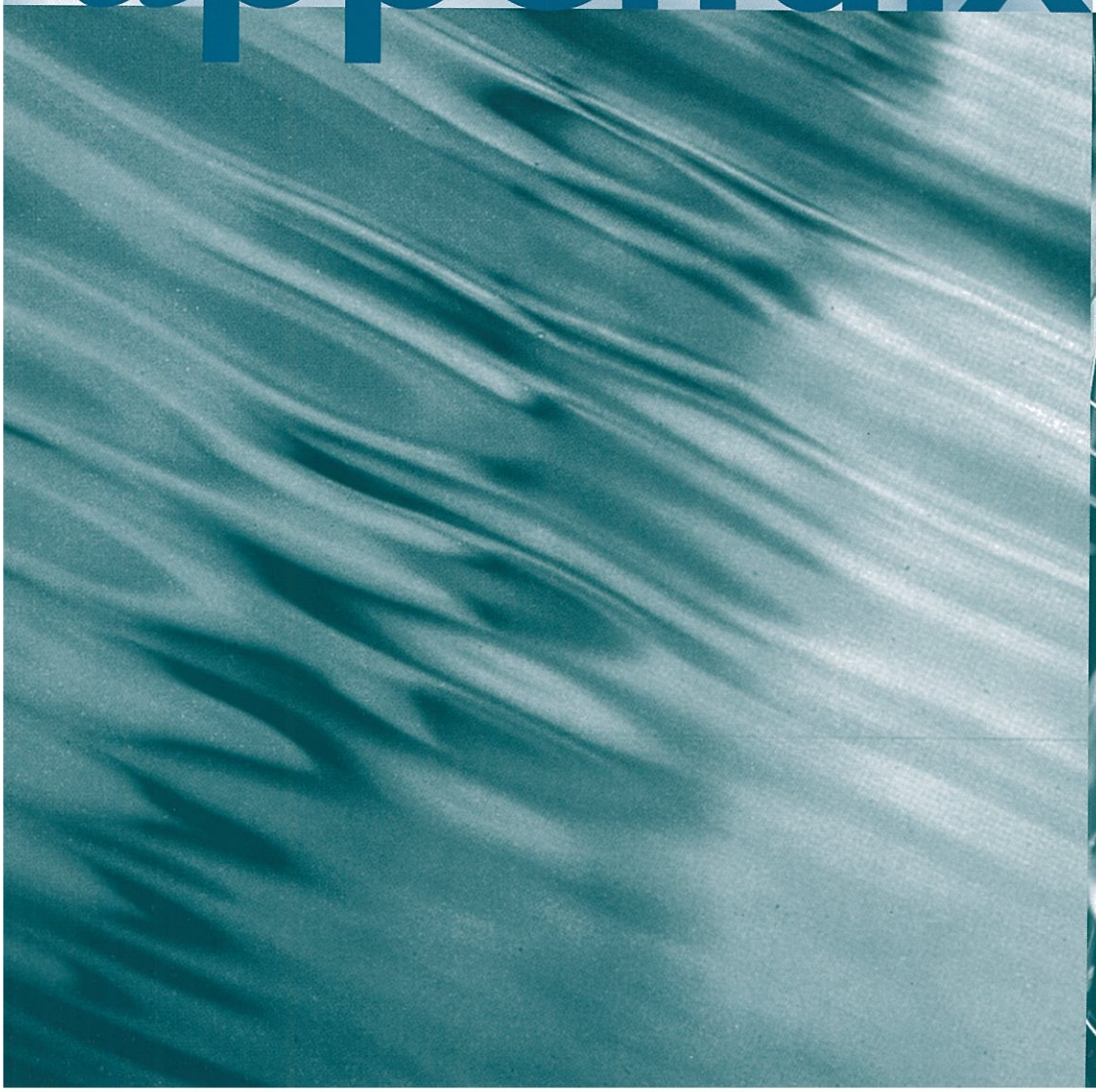
appendix

Appendix D

Premier Engineering Services' Fire Safety Study



Premier Engineering Services Pty Ltd
ABN 84 100 231 481

FIRE SAFETY STUDY

FOR CHEMSAL DEVELOPMENT

CHRISTIE ST, ST MARYS

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1. EXECUTIVE SUMMARY

1.1 Summary of Proposal

Chemsal specialises in the collection, treatment, recovery, recycling and disposal of all types of liquid and solid hazardous waste from industrial, laboratory, agricultural, pharmaceutical and medical sources. It operates in all Australian states and territories. In NSW, Chemsal currently operates at a site at 12 Bushell's Place, Wetherill Park. These premises handle chemical wastes of Class 3 (flammable), Class 6 (toxic), Class 8 (corrosive), Class 5 (oxidising) and Class 2 (gases).

Chemsal proposes to relocate to larger premises at 40 Christie St, St Mary's, where both the quantity of storage and the resource recovery services offered can be expanded. This relocation provides the opportunity to design a facility which maximises fire safety by a range of measures including:

- Separation of flammables from other materials, including other classes of dangerous goods, by means of distance, firewalls or a combination of both.
- Strict control of ignition sources in designated Hazardous Zones.
- Segregation of materials which might impede emergency response by virtue of their behaviour in a fire situation, by means of physical separation and bunding.
- Provision of appropriate fire fighting resources in accordance with the various Australian Standards relevant to each class of dangerous goods, and in accordance with the Building Code of Australia.
- Provision of fire water containment by means of bunding plus secondary containment by means of a Stormwater Isolation Valve

These design features will be augmented by operation procedures, emergency plans, maintenance and inspection procedures and training regimes.

1.2 Main Recommendations

The proposed use meets the statutory requirements for fire safety as set out in the in various Australian Standards being stored with regard to fire protection requirements.

Of the hazards and consequences considered, four scenarios are major issues for the Chemsal facility:

- Flammable package fire
- Flammable tank fire
- Loss of containment of flammable liquids
- Involvement of toxics and corrosives in a fire.

These scenarios are interdependent to some extent. The major issues to be considered can be summarised as follows:

- Ignition risk control.
- Containment of liquids, in particular flammables.

- Provision of sufficient resources to deal with a fire.
- Separation of "high risk" goods which represent extra hazards in a fire situation.

These issues are adequately addressed by the proposed design of the facility. A number of recommendations are made in Section 5 of this report, most of which relate to the transfer of existing technology and practices from Chemsal's existing facility to the proposed facility.

2. REPORT

2.1 Introduction

Chemsal proposes to store and despatch a range of products, primarily consisting of chemical wastes of Class 3 (flammables), Class 6 (toxics) (but not Class 6.2 – infectious substances) and Class 8 (corrosives), at this site. Smaller quantities of Class 2 (gases), Class 4 (flammable solids) and Class 5 (oxidising agents) and combustible liquids will also be handled.

The proposed site was formerly a timber yard. It is approximately one hectare in area, with a warehouse building occupying about 4000 square metres. Most of the remainder of the site is concrete hardstand. This makes it ideal for Chemsal's operations. The location is in a large industrial area, with appropriate separations from neighbouring business and with excellent access to emergency services. In fact, the St Marys Fire Station is located next door.

Full details of Chemsal's proposals are contained in the Environmental Assessment for this development prepared by Peter J Ramsay and Associates.

2.2 Scope of this Study

This study considers the existing site facilities, the proposed new facilities, and the alterations to existing facilities required by the new arrangements.

The "Hazardous Industry Planning Advisory Paper No. 2", Fire Safety Study Guidelines, has been used for guidance.

The majority of materials (by volume) to be stored on the site are classified as Flammable Liquids, and these constitute the greatest fire risk. The storage and handling of these materials is regulated in NSW by the Occupational Health and Safety Act and the Occupational Health and Safety (Dangerous Goods) Regulation 2005. The Regulation takes a risk management approach to Dangerous Goods management and cites a number of Australian Standards as Codes of Practice against which the risk assessments can be measured. The following Standards are relevant to Chemsal's facilities:

- AS/NZS1596:2002 The storage and handling of LP Gas
- AS1940-2004 The storage and handling of flammable and combustible liquids
- AS2714-1993 The storage and handling of hazardous chemical materials – Class 5.2 substances (organic peroxides)
- AS2507-1998 The storage and handling of agricultural and veterinary chemicals
- AS3780-1994 The storage and handling of corrosive substances
- AS4081-2001 The storage, handling and transport of liquid and liquefied polyfunctional isocyanates
- AS4326-1995 The storage and handling of oxidizing agents
- AS4332-2004 The storage and handling of gases in cylinders
- AS/NZS4452:1997 The storage and handling of toxic substances

The existing and proposed facilities are assessed in this study for compliance with these Standards in relation to fire safety.

Fire safety during construction is not considered as part of this study. OH&S has not been specifically considered, except as it relates to the matters in hand.

2.3 Site Facilities and Processes

The existing facilities consist of:

- Office area
- Warehouse building constructed with concrete slab walls on three sides, open on the fourth side (with awning), with a metal roof and concrete floor
- Hardstand yard area
- Car parking area

The proposed facilities will comprise the following:

An area dedicated of the storage and handling of flammable liquids, consisting of a decanting area, including a Hazpak unit, a roofed package store, and a small tank farm with tanker loading facilities. These will be located on the hardstand area at the southern end of the site.

The warehouse are will be divided into a number of discrete sections, separated by bunding where appropriate, for the storage of Class 6 and 8 materials, fluorescent lamp processing, metal and plastic shredding and security storage of pharmaceuticals.

Incoming materials will be received in packages or drums. The largest container size is an IBC (intermediate bulk container). Outgoing shipments will primarily consist of package despatches, but bulk recovered flammable liquids will be transported by road tanker.

General site location and layout are shown in Attachments 4.1 and 4.2 respectively.

2.4 Potential Fire Hazards

2.4.1 Flammable and Combustible Inventories

Proposed inventories consist of:

Flammable Liquids – Class 3 – maximum 100000 litres, typical 90000 litres.

This classification can be broken into three areas, namely the processing/decanting area, the package store and the tank farm.

The processing/decanting area is an area where flammable liquids will be recovered by use of a high pressure densification device, which will separate packaging from the contents. This unit will be used to recover paint, much of which will be "manufactured product" as defined in AS1940. These products represent a lesser degree of risk because

of their viscosity and high non-volatiles content. However, as the quantity and type of such manufactured products will vary from time to time, all will be treated as if they were ordinary Class 3 flammables for purposes of determining fire safety requirements. The inventory located in this area will be that required for the current batch being processed. For a throughput of 440 tonnes per annum, this equates to 1.7 tonnes per working day, equivalent to about two pallets. The liquid output of the process will be drummed or transferred to storage tanks.

The package store will be a bunded roofed store for palletised packages, primarily of size range 1 to 25 litres, with a small amount of larger drums (60 litre and 200 litre). On occasions, IBC's, typically with a capacity of 1000 litres, will be stored, but such storage is rare and intermittent. The capacity of this store will be about 50000 litres, with 30000 litres being typical inventory.

The tank farm will consist of a separately bunded array of four vertical tanks of capacity 10000 litres each.

Combustible Liquids – maximum 25000 litres, typical 15000 litres.
These are defined in AS1940-2004 (The storage and handling of flammable and combustible liquids) as any liquid other than a flammable liquid that has a flashpoint, and that has a fire-point less than its boiling point. For the purposes of this Standard, combustible liquids are divided into two classes as follows:

Class C1—a combustible liquid that has a flashpoint of 150°C or less.
Class C2—a combustible liquid that has a flashpoint exceeding 150°C.

The combustible liquids stored at Chemsal are typically used engine oils, of Class C2. It should be noted that C2 combustibles are not defined as dangerous goods in the NSW OHS (Dangerous Goods) Regulation 2005. Combustibles will be decanted and stored in the warehouse area.

Gases - Class 2 – maximum 250 empty cylinders, typical 60 cylinders.
Class 2 materials stored are mostly empty refillable LPG cylinders, with small numbers of welding or medical gas cylinders (also empty). The cylinders will be stored outside the warehouse in the yard area in pallet cages. The storage complies with the Minor Storage provisions of AS/NZS1596 (The storage and handling of LP Gas),

Oxidising Agents - Class 5.1 – maximum 500 kg, typical 100 kg.

A very small amount of oxidising agent is stored in metal cabinets in the yard area. All are of Class 5.1. Only minor quantities of organic peroxides of Class 5.2 are stored.

The storage complies with the Minor Storage provisions of AS4326-1995 (The storage and handling of oxidizing agents). The primary hazard from oxidising agents arises from their potential to enhance combustion when in contact with other materials. This issue is addressed by their outside storage location, remote from other goods.

Toxics - Class 6 – maximum 30000 kg/litres, typical 20000 kg/litres.

Toxics are stored in a dedicated bunded area, separated from other class of dangerous goods. In general, these products are not easily ignitable, but an impinging fire can lead to loss of containment, toxic fumes and environmental damage. These issues are addressed by separation, containment and provision of fire protection including cooling water.

In order to reduce the risk to emergency responders in the event of a fire, the following extra precautions will be taken:

> Liquid organochlorines, which produce toxic thermal decomposition materials in a fire situation, and often have a Class 3 sub-risk (flammable) will be limited to a maximum of 1700 kg, which will be kept in two approved cabinets, located outside the warehouse.
>
> Toxic materials of Packing Group I will be limited to one item only: chloropicrin. This will be stored in metal cabinet remote from fire hazards.

Corrosives - Class 8 – acidic 15000 litres/kg
basic 15000 litres/kg

Corrosives are not usually readily combustible, but the impact of a fire can be similar to that for toxics.

Other Combustibles

These include packaging and pallets. The major accumulation of such combustibles will be a storage for wooden pallets. This has been allocated a dedicated area in the warehouse, well away from the flammables area, so there is very little chance that it would contribute to the fuel load in the event of a flammables fire.

2.4.2 Proposed Inventories

Type of Material / Product	Proposed Average at any one time	Proposed Maximum at any one time
Flammable Liquids	50000 litres	100000 litres
Class 4 solids	Minor	Minor
Combustibles (C2)	15,000 litres	25000 litres
Corrosives	10000 kg/l	30000 kg/l
Toxics	15000 kg/l	30000 kg/l
Gas cylinders	60 cylinders	250 cylinders
Oxidising agents	100 kg	500 kg
TOTAL	90100 kg/l	185500 kg/l

2.4.3 Hazard Assessment

A range of hazard events has been considered. The consequences and required protection are included in Attachment 4.3. While there are many possible combinations of hazards and circumstances, there are two issues which stand out as requiring special attention regarding fire safety, both in terms of prevention and response:
Firstly, there is considerable inventory of flammable goods which represents a substantial fire load in itself, hence the emphasis, as will be seen, on separation of this component by both distance and firewalls, control of ignition sources, together with appropriate fire response resources and fire water containment.
Secondly, the nature of Chemsal's activities mean that various other materials, most of which do not contribute significantly to the likelihood of a fire, but do contribute to the consequences of a fire, are stored in significant quantity. These include materials which have a significant influence on emergency response, mostly by virtue of production of toxic thermal decomposition residuals. These are treated in some detail, but again the main control measures are separation, so that one risk does not superimpose on another, plus appropriate fire prevention and response measures. Where a particular risk is identified, for example, the storage of halogenated hydrocarbons of Class 3 and Class 6 sub-risk, particular controls (in this example, remotely located cabinets, in compliance with the relevant Australian Standards) are recommended.

Of the hazards and consequences considered, four scenarios are major issues for the Chemsal facility:

- Flammable package fire
- Flammable tank fire

- Loss of containment of flammable liquids
- Involvement of toxics and corrosives in a fire

In terms of fire response, the first two issues can be considered together, ie a worst case scenario in which the whole of the flammables storage area is engulfed in flames. The issues in this case are containment of the fire within the fire separated area, to avoid any impact on other storage areas, and the provision of sufficient fire-fighting resources to extinguish the fire.

In the case of loss of containment of flammables, the critical issue (assuming that volumetric capacity is available) is the is elimination of ignition sources. This is dealt with in Attachment 4.5.

The principal consequence of the involvement of toxics, and to a lesser extent, corrosives, in a fire is the production of toxic fumes. The primary prevention measure is separation of such substances from fire events by both physical distance, and the provision of fire walls where appropriate.

As can been seen, these scenarios are interdependent to some extent. The major issues to be considered can be summarised as follows:

- Ignition risk control.
- Containment of liquids, in particular flammables.
- Provision of sufficient resources to deal with a fire.
- Separation of "high risk" goods which represent extra hazards in a fire situation.

Summary of Major Considerations:

a) Ignition Risk:

The main contributor to fuel load in the event of a fire is the volume of flammable liquids, and therefore great emphasis has been placed on security of product containment, and exclusion of ignition sources. The assessment of ignition risks, and the control measures put on place are contained in Attachment 4.1.5.

In the case of combustible liquids, ignition does not occur unless the flash points mentioned above are reached. Such temperatures can be reached in maintenance situations such as welding or grinding (not required in normal or even breakdown circumstances, due to the simplicity of Chemsal's operations) or by extraneous sources such as arson. These risks are well managed on site by the application of Hot Work Permit systems, no smoking rules and good security.

b) Loss of Containment (Flammables):

Even if a fire occurs, escalation will not be sudden or uncontrollable unless there is significant loss of containment. The common scenarios where this would occur are covered in Attachment 4.1.3. In particular, the possibility of propagation of fire, due to containment loss, to areas where other classes of dangerous goods are stored, has been

considered. Flammable liquids are contained within bunds complying with AS1940 requirements, for packages and tanks.

In the case of liquid dangerous goods of other classes, spill containment is provided by way of bunding as specified in the relevant Australian Standards.

c) Fire Fighting Resources:

Because the different classes of dangerous goods have been provided with discrete and separate storage and containments areas, each area can be assessed individually to determine fire resources. The relevant Australian Standards for each class provide specifications for suitable resources and these have been provided. In addition, the site is to be provided with a fire detection system and automatic call-out of the Fire Brigade.

Details of the resources are provided in Section 2.5 below.

d) Separation of "high risk" dangerous goods from fire scenarios.

As well as the separations required by the various Standards, further separation of the materials constituting the greatest risk will be provided. In particular, the small amounts of chloropicrin (the only material of Packing Group I to be stored) will be contained in a dedicated metal cabinet located in the Class 6 storage area, and Class 6 materials with a Class 3 sub-risk will be stored in approved Flammable Liquids Cabinets (to AS1940), outside the warehouse building, so that any emergency event in the warehouse will not impact on them, and any event involving the cabinets will not impact on the warehouse depots.

In addition, a toxic gas detector will be provided. This will be relocated from Chemsal's Wetherill Park premises where it has bee installed as recommended by Moore Consulting and Management correspondence Chemsal Pty Ltd – Proposed Chemical Waste Facility – Wetherill Park, 8/9/2005.

2.5 Fire Risk Resources

2.5.1 Design of Protection Systems

The following Australian Standards apply to these First Response Resources:

- AS/NZS1221 Fire Hose Reels
- AS2441 Installation of Fire Hose Reels
- AS/NZS1841 Portable Fire Extinguishers
- AS2444 Portable Fire Extinguishers – Selection and Location
- AS/NZS1851 Maintenance of Fire Protection Equipment
- AS2419 Fire Hydrant Installations

The Christie St site was previously used as a timber yard, so is well equipped with fire fighting equipment. The existing equipment will be supplemented by extra fire

extinguishers of the types and sizes required by the relevant Australian Standards for the particular classes of dangerous goods on which they are to be used. These are detailed in Section 2.5.2 below.

Fire water supply details are available in Attachment 4.1.4. The "worst case" fire incident identified in Attachment 4.1.3 is a pool fire in the flammables storage area. Assuming this fire spread over the total area of the Class 3 storage area including both the package store and the tank storage area (ie the "worst-case" scenario) the total area of such a pool fire would be 215 m^2. In accordance with AS1940-2004 clause 11.12.1 (c) (i) and note 2, the inferred minimum flow rate is 12.5 X 215/(10 X 60) = 4.48 litres per second.. The available pressure at the site, with this flow rate, is 34 meters head, which is well in excess of the minimum design pressure of the on-site foam branch, 300 kPa.

In addition to fire fighting resources, smoke and fire detection equipment, with automatic dial out to the Fire Brigade, in accordance with AS1670.1, monitored by an Authorised Third Party Provider, in accordance with the requirements of AS1670.3, will be provided.

2.5.2 First Response Resources

These consist primarily of the fire extinguishers, hose reels and foam induction facilities outlined in the sections above. They are designed to present a formidable first response resource to site personnel, bearing in mind the nature of the main fire risks. Their purpose is to prevent ignition of uncontained product by foam blanketing and to extinguish small fires before they can become established. In the worst case, they will provide a measure of fire retardation until the Fire Services can attend.

Staffing of the facility consists of fourteen personnel initially, rising eventually to thirty, all of whom receive twice-yearly fire extinguisher and fire response training. Training records are maintained in Chemsal's personnel management records.

It should also be noted that three members of the current staff are members of the Rural Fire Service.

Fire fighting resource requirements are set out in the various Australian Standards relating to the storage and handling of the different classes of dangerous goods. The Chemsal facility has been designed so that the various classes are separated as required in those Standards, so that each storage can be treated as a stand-alone facility. The requirements for each class are as follows:

Class 2 Gases in Cylinders

Most cylinders are small LPG cylinders, to which AS1596 applies. This Standard has no specific requirements regarding fire fighting equipment for Minor Storage. Another Standard, AS4332, can be applied, and this Standard requires, for storages with a water capacity equivalent of 1000-2000 litres, either a hose reel or a powder extinguisher and a water hose connection. The facilities available on the proposed site easily exceed these requirements. In any case, the selection of fire fighting equipment is based on the needs of the surroundings rather than on the cylinder store itself.

Class 3 Flammable Liquids

The package store requirements are set out in Table 11.3 of AS1940. For the proposed store, ie a roofed store of >10 to <100 m3, the requirements are powder extinguishers at each doorway, plus further extinguishers positioned to achieve a 15m maximum travel distance, hose reel and foam making equipment capable of reaching all parts of the store. In fact, in the case of Chemsal's package store, the extinguishers positioned at the doorways will meet the travel distance criterion.
The processing/decanting area will typically contain one or two pallets of materials, so the requirements here are one powder and one foam extinguisher. These are provided and can be augmented by hose reels and foam equipment.
The tank farm requirements, as set out in Table 11.4 of AS1940, are one powder extinguisher plus a hose reel with foam. These are provided.

Existing facilities at the site comprise two unequipped hydrants, one near the front entrance, and one adjacent to the flammables package store, plus hose reels on the front wall of the warehouse building.

Class 4 Flammable solids/spontaneously combustible/dangerous when wet

There is no Australian Standard relating specifically to these materials, so the appropriate fire response has to be determined according to the properties of each material. In most cases, the issues involve appropriate storage arrangements, rather than fire fighting resources. Where resources are required, the site facilities are more than adequate to deal adequately with any emergency, particularly given the very small amounts stored.

Class 5 Oxidising substances and organic peroxides

The Standards covering these materials are AS4326 and AS2714. AS2714 has no specific requirements, and AS4326 requires provision of a hose reel capable of reaching all parts of the store.

Class 6 Toxics and Class 8 Corrosives

The Standards for these materials (AS/NZS4452 and AS3980) do not have any specific requirements. They do however point out that in determining the fire protection measures, consideration should be given to adjoining materials. In the case of this proposal, this has been done by ensuring that other storages are not only appropriately separated, but are provided with the fire resources specified in the various Standards. Some Class 6 materials have a Class 3 sub-risk, and these are provided with the fire protection required in AS1940 for flammable liquids cabinets.

2.5.3 Deployment of Resources

The location of resources is shown on the Attachment 4.6.

Chemsal maintains a thorough personnel training scheme, which includes emergency management and the use of first response resources.

2.5.4 Maintenance

Chemsal have written maintenance procedures which cover, inter alia, maintenance of equipment as required, in particular, fire protection systems to AS1851-2005.

2.6 Containment of Fire Water

AS1940 requires bunding of package stores, with particular reference to bund capacity in relation to fire-water containment. The requirement for the proposed storage would then be calculated as follows:

100% of the largest package (say 1000 litres IBC).....1000 litres

plus 25% capacity up to 10000 litres.....2500 litres

plus 10% capacity beyond 10000 litres (ie 40000 litres).....4000 litres

plus 20 minutes output of manual fire suppression system.....12000 litres

(This figure is based on "worst case" use of a hydrant with an output of 10 litres per second. In practice, initial response would be with fire extinguishers and hose reels with much lower output.)

Total bund capacity required.....18500 litres.

The proposed bund capacity provided is by means of a 150mm concrete bund wall containing an area of 11.55m by 13.75m, giving a capacity of 23850 litres.

The capacity required for tank bunding is the volume of the largest tank, in this case 10000 litres, plus 20 minutes fire water, giving a total bund volume requirement of 22000 litres. This equates to a bund depth of about 400mm for a bunded area of 13.75 m X 4.1 m.

The bunding requirements for the other storage areas are as follows:

Class 8 liquids.....3750 litres required.....16900 litres provided

Class 6 liquids.....3750 litres required.....11570 litres provided

It should be noted that the bunds associated with the various classes are separated by distances specified in the standard. The intervening area is also bunded, so there is an extra degree of secondary bunding inside the warehouse, which would increase the volume which could be contained in the event that a primary bund overflowed due to fire-water. This extra capacity is not considered in the above calculations.

Furthermore, the yard at the side of the warehouse is bunded, offering approximately 140000 litres of secondary containment, provided that a drain valve is installed and provided with a closing mechanism. There are a number of commercially available systems available, including actuated butterfly valve with the actuation to close the valve

being triggered by a hydrocarbon sensor located upstream of the valve. Alternatively, an inflatable plug can be installed in the drain, with inflation triggered by a solenoid valve on a compressed air cylinder connected to the plug. In either case, the system can be activated manually, so that the stormwater system can be isolated immediately. Operating procedures and appropriate signage will be installed.

3 Recommendations

The proposed facility meets the statutory requirements for fire safety as set out in the various Australian Standards for the different classes of materials to be stored at the facility.

Therefore the recommendations of this study are limited to the following:

3.1 The toxic gas detector should be relocated from Wetherill Park to the new facility.

3.2 Class 6 substances with a Class 3 sub-risk should be stored in flammable liquids cabinets (manufactured to AS1940), located outside the warehouse building.

3.3 The empty LPG cylinders should be relocated away from other dangerous goods stores and the storage area should be protected by bollards or similar impact protection.

3.4 Chloropicrin will be stored in a dedicated metal cabinet in the Class 6 storage area, and inventory will be limited to 10 litres maximum.

3.5 A yard Stormwater Isolation Valve, or equivalent, is to be installed and labelled as such and signposted with operating instructions and containment capacity.

3.6 The warehouse should be provided with a heat and smoke alarm system, with fire panel providing automatic Fire Brigade Call-out.

4 Attachments

4.1 Site Location

4.2 Site Layout

4.3 Fire Hazard Identification

4.4 Fire Flow Pressure Certificate – Sydney Water

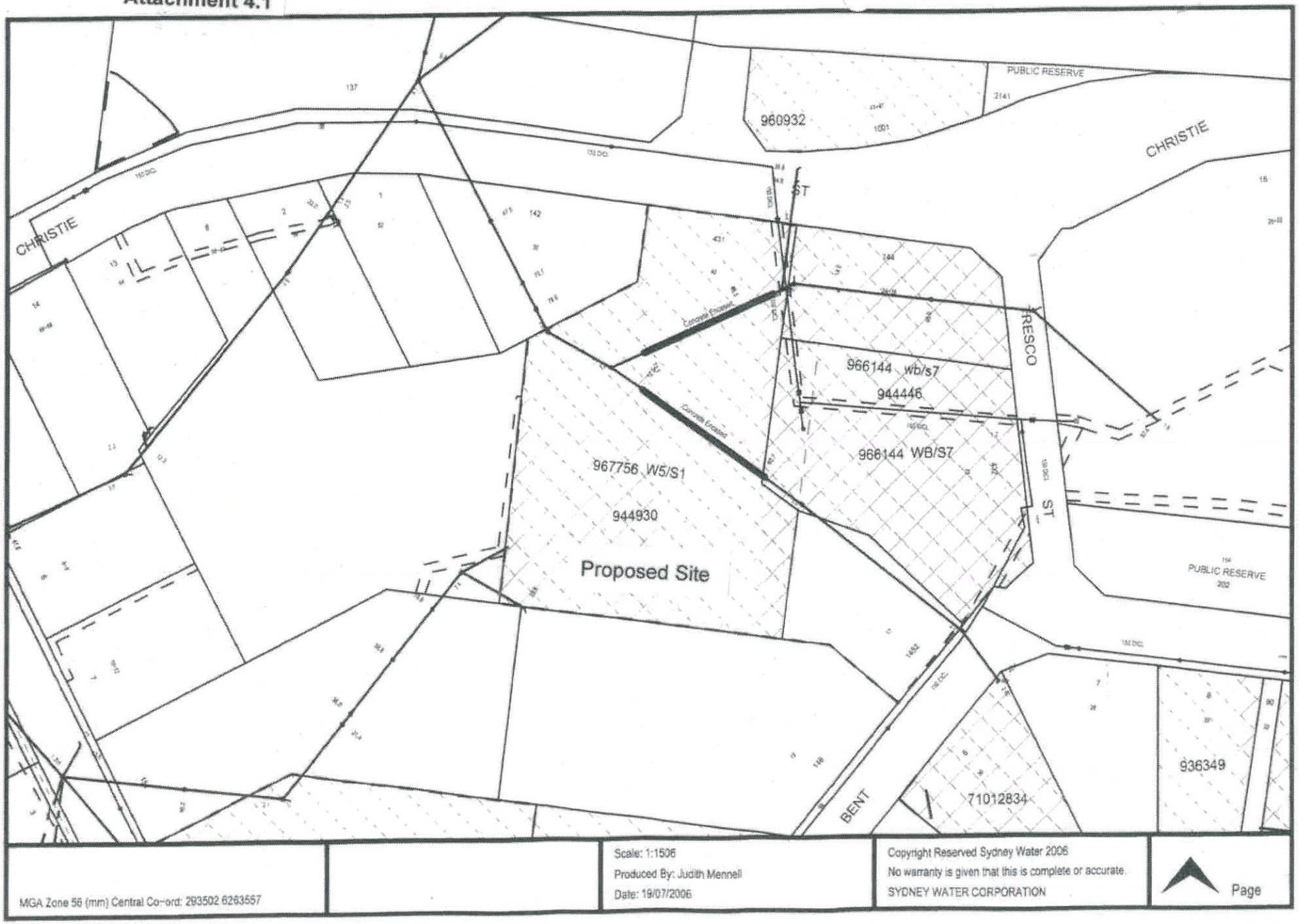
4.5 Risk Assessment – Ignition Sources

4.6 Fire Fighting Resources

5 REFERENCES

1. Hazardous Industry Planning Advisory Paper No. 2, Fire Safety Study Guidelines, Department of Planning.
2. Building Code of Australia.
3. AS/NZS1596:2002 The storage and handling of LP Gas.
4. AS1940-2004The storage and handling of flammable and combustible liquids.
5. AS3780-1994 The storage and handling of corrosive substances.
6. AS4326-1995 The storage and handling of oxidizing agents.
7. AS/NZS4452:1997 The storage and handling of toxic substances.
8. The Australian Dangerous Goods Code.
9. Preliminary Hazard Analysis, Waste Chemical and Treatment Facility, Chemsal Pty Ltd, June 2006, Moore Consulting and Engineering.
10. Background Document for a Major Project, Proposed Resource Recovery Facility, May 2006, Peter J Ramsay and Associates.

Attachment 4.1



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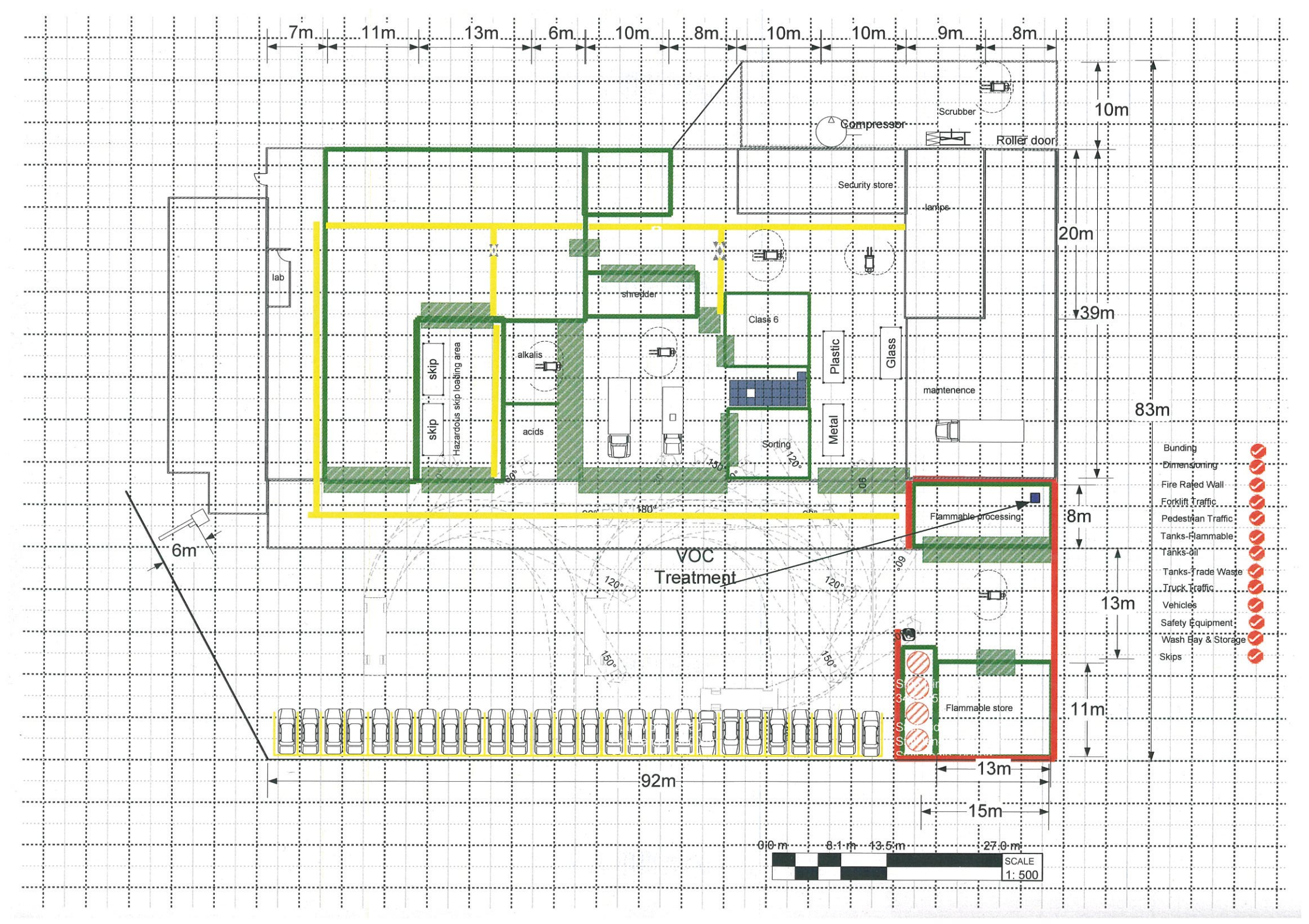
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Attachment 4.3

CHEMSAL PROPOSAL - FIRE HAZARD IDENTIFICATION

EVENT	CAUSE	CONSEQUENCE	PREVENTION
Flammable Tank Fire	Tanker transfer operations		RT1 trucks only
	Introduced ignition sources	Ignition of vapour cloud	No access allowed for spark-ignition engines Authorised personnel only
	Leak outside bund (eg from transfer hose)	Liquid or vapour reaches	
Flammable Package Fire Refer also Attachment 4.5	Hot Work	Fire, vapours, fumes, smoke Containers may rupture violently	Hot Work not normally performed Hot Work Permit System exists Fire resources to AS1940 Evacuation alarm
	Static	Not likely as flammables are not decanted	N/A
	Cigarette	Fire possible if in contact with un-contained combustibles	No smoking site Housekeeping
	Impact spark	Unlikely - but refer Hot Work	Hot Work Permit System
	Hot product	Flammable vapours	No heating media in store
	Faulty electrics	Fire if vapour in explosive limits	Maintenance program No electrics in flammables store
	Fork Lift	Fire if vapour in explosive limits	Forklift is "flameproof"
	Arson	Fire	High security site. CCTV's installed.
	Lighting strike	Fire	Packages stored under a roof.

EVENT	CAUSE	CONSEQUENCE	PREVENTION
Loss of Containment flammables	Impact	Spill	Trained forklift drivers Spill kits installed Recovery capsules (over-packs) available
	Failure of package	Spill or leak	Bunding Overpacks available High storage is against wall "Chemsal Stillages" used
	Vandalism	Spill or leak	High security site. CCTV's.
	Burning flammables on fire water	Contact with other dangerous goods	Flammables area is bunded Other areas are bunded separately
	Fire Water	Pollution if contaminated water reaches stormwater outlet untreated	Each depot is separately bunded Warehouse is bunded Yard has shut-off valve to drain and large containment capacity
	Natural disaster	Wind storm or earthquake causing spill	All storage is in roofed and bunded area
Truck on fire (10000L Class 3 max)	Spill plus introduced ignition source	Escalation to store	Physical separation by bunding. Bunding and distance to stores of other classes
Flammables Recovery Area "Hazpak"	Loss of containment	Flammable vapours	Spill limited to work in progress only
	External fire	Escalation to Hazpak	Same fire protection as Class 3 tanks and package stores.
	Mechanical malfunction	Fire due to friction or overheating	Refer Plant Risk Assessment for Hazpak 3000 provided by Old Park Engineering Services Limited.

EVENT	CAUSE	CONSEQUENCE	PREVENTION
Corrosives burning (Note: Most are not combustible)	Adjacent fire	Release of corrosives Toxic smoke and fumes Ecotoxic waste	Separation of depots Separate bunding Fire fighting equipment available Hose reels for package cooling Acids stored separately from alkalis Evacuation alarm
Toxics burning	Adjacent fire	Release of toxics Toxic smoke and fumes Ecotoxic waste	Separation of depots Separate bunding Fire fighting equipment available Hose reels for package cooling Evacuation alarm Toxic vapour alarm.
	Adjacent fire near organochlorines	Toxic smoke and fumes	Containment in a chemical cabinet Separation from fire sources
LPG cylinders	Adjacent fire	Explosion	Relocate away from likely fire sources as per AS1596
	Impact	Gas leak	Locate away from truck turning areas & instal bollards
	Leak	Fire if ignition sources present	Locate cylinders so that there are no ignition sources within 1.5m
	Fire	Intensification of fire if impinges on oxidising agents	Locate cylinders 5m from Oxidising agents
Oxidising agents	Adjacent fire	Possible intensification of fire	Separation - oxidising agents are stored outside the warehouse Separation as per AS4326
	Impact	Loss of containment	Cabinets are located away from truck turning area
	Package failure	Leak	Storage in cabinets Spill kits available

EVENT	CAUSE	CONSEQUENCE	PREVENTION
Office Fire	Electrical or malicious damage	Escalation to chemical store	Distance from Class 3 area Equipment kept in good condition First response (extinguishers) available and staff trained Site security Nearest storage is combustibles only Automated fire alarm system installed.
Envirowipe Area	Electrical malfunction	Fire with escalation to other areas	No combustible accumulation in this area.
Fluoro tube processing	Impinging fire	Mercury vapours	Physical separation from flammables and combustibles - by distance 19m and FRL wall
Security Storage	Impinging fire	Decomposing pharmaceuticals	Unlikely to support combustion.
Oil container Shredding	Electrical malfunction	Fire with escalation to other areas	No combustible accumulation in this area.

Attachment 4.4

Sydney WATER

Date: 25 July, 2006

Postal Address:
51 Hermitage Road
WEST RYDE NSW 2114
DX 2517W

Pressure Inquiry No: **1891**
Contact Person: P. Wiggan
Contact No: 02 9800 6463
Fax No: 02 9800 6479

Premier Engineering Service
9 Falls Street
Leichhardt N.S.W. 2040
Attention: **Bill Callan**

Your Pressure Inquiry Dated : **19/07/06**
Property Address: **40 Christie Street, St Marys 2760**

The expected maximum and minimum pressures available in the water main given below relate to modelled existing demand conditions, either with or without extra flows for emergency firefighting, and are not to be construed as availability for normal domestic supply for any proposed development.

ASSUMED CONNECTION DETAILS

Street Name	**Christie Street**	Side of Street	**North**
Nearest Cross Street	**Tresco Street**	Distance & Direction from Nearest Cross Street	**99** m **West**

Approximate Ground Level (AHD): **29** **metres**
Nominal Size of Water Main (DN): **150** **mm**

EXPECTED WATER MAIN PRESSURES AT CONNECTION POINT

	NORMAL SUPPLY CONDITIONS	
1.	**Maximum Pressure**	**113** metre head
	Minimum Pressure	**32** metre head

	WITH PROPERTY FIRE PREVENTION SYSTEM DEMANDS	Flow (L/s)	Minimum Pressure (m head)
	Fire Hose Reel Installations (Normally two hose reels simultaneously)	**0.66**	**32**
2 & 3.	**Fire Hydrant/Sprinkler Installations** (Minimum pressures are based on the design pressure expected to be maintained for 95% of the time)	N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A
	Maximum Permissible Flow	N/A	N/A
4 & 5.	**Fire Installations based on peak demand.** (Minimum pressures are based on the design pressure expected to be maintained with flows combined with peak demand in the water main.)	N/A N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A N/A
	Maximum Permissible Flow	N/A	N/A

(Please refer to reverse side for NOTES)

P. Wiggan
Team Leader
Asset Planning

Attachment 4.5

RISK ASSESSMENT - IGNITION SOURCES

Premier Risk Manager V2.1 PREMIER

DRAFT

CHEMSAL Pty Ltd

CHEMSAL Hazard Identification, Risk Assessment & Control Record

Location	**Christie St**	Plant Item / Operational Area:	**All chemical storage areas**	No:	CH Ign
Area	**All operational areas**	Task Details:	**Identify and control potential sources of ignition**		
Prepared By:				Date	4/05/2006
Review Date:		Reviewed By:		Date:	

NO.	ACTIVITY/CIRCUMSTANCE	POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT	INHERENT RISK			CONTROL MEASURE	RESIDUAL RISK		
			L	C	R		L	C	R
1	**1.Flames and high temperatures**	Ignition of flammable vapours Ignition of combustibles Toxic thermal decomposition	3	4	12	**Basic control philosophy is exclusion of ignition sources from Hazardous Areas, plus first response fire fighting capability to deal with incidental fires, and auto call out of NSWFB.**	3	1	3

2	1.1 Burner flames e.g. flare stack, furnaces, boiler burners	Escaped vapour - explosion or fire	1	4	4	No naked-flame equipment on site.	1	1	1
3	1.2 Burning operations e.g. rubbish	Potentially uncontrolled fire	2	3	6	No fires allowed on site.	1	1	1
4	1.3 Hot embers e.g. Hot soot from chimneys, adjacent sites, bushfires	Wind-borne embers in operational areas where there is a potential to ignite combustibles or flammables	2	3	6	Cease operations in adverse conditions (most likely severe bushfires).	2	1	2
5	1.4 Smoking Materials e.g. Cigarettes/Matches/Lighters	Unwitting or subversive	3	2	6	No smoking site. Signage. Trained employees. Supervision. Induction of visitors.	2	1	2
6	1.5 Smouldering material e.g. Oil soaked rag	Spontaneous ignition	2	3	6	Housekeeping. Training. Inspections.	1	2	2
7	1.6 Hot process equipment e.g. Unlagged surfaces	High temperature surfaces	1	3	3	No heated processes. Risk assessment required for introduction of such processes (unlikely).	1	1	1
8	1.7 Distressed machinery e.g. Faulty Pump bearing/Dry run seal	Pump seizure, hot bearing or seal	2	3	6	Maintenance procedures, pump overload cut-out, ESD.	1	3	3
9	1.8 Small process fires e.g. Escalation from Pump fires/Flange fires	Escalation to Class 3 area or impingement on toxics storage	2	4	8	First response fire fighting, ESD's as appropriate to minimise fuel exposure, separation of toxics.	1	3	3

10	1.9 Solar e.g. Broken bottle and sunlight	Lens effect unobserved by operational personnel	1	4	4	Housekeeping	1	1	1
11	**2. Welding Cutting and Grinding**	Fire or explosion due to contact with flammable liquid or vapour. Toxic fumes due to thermal decomposition	3	4	12	**Basic control philosophy is Hot Work Permit system to control maintenance activities and prohibit unauthorised work.**	2	1	2
12	2.1 Oxy-acetylene cutting	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	HW Permit. Supervision. Job risk assessment. Ongoing watch to ensure no change of permit conditions.	2	1	2
13	2.2 Arc welding	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	HW Permit. Supervision. Job risk assessment. Ongoing watch to ensure no change of permit conditions.	2	1	2
14	2.3 Hot cutting	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	HW Permit. Supervision. Job risk assessment. Ongoing watch to ensure no change of permit conditions.	2	1	2
15	2.4 Blow torches	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	Use unlikely. HW Permit.	1	1	1

16	2.5 Brazing/Soldering	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	Use unlikely. HW Permit.	1	1	1
17	2.6 Grinding	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	HW Permit. Supervision. Job risk assessment. Ongoing watch to ensure no change of permit conditions.	2	1	2
18	2.7 Grit Blasting	Explosion of flammables in contained system (eg pipe or tank). Fire due to incomplete gas-freeing and containment	3	3	9	HW Permit. Supervision. Job risk assessment. Ongoing watch to ensure no change of permit conditions.	2	1	2
19	**3. Mechanical sparks**	Fire or explosion due to spark ignition of vapours	2	4	8	**Basic control philosophy is elimination of risk source where possible, restraint where applicable, and Work Permit system.**	1	3	3
20	3.1 Metal tools e.g. Non-sparking/hard particles embedded	Sparks during maintenance or undue use of force in normal operations, eg hammering a tight fitting	3	2	6	Non-sparking tools used for maintenance and routine operations work. No other tools allowed in Class 3 area unless under Work Permit.	1	2	2
21	3.2 Falling Objects e.g. Tank wash equipment/Crane hooks and loads	Impact sparks	2	3	6	Work procedures. Permit system for non-routine work. Training.	1	3	3
22	3.3 Cigarette lighter flints	Unintentional, accidental or subversive use	1	4	4	Lighters prohibited in operational areas.	1	1	1

23	**4. Chemical Energy**	Heat, fire, loss of containment due to chemical reaction	2	3	6	**Basic philosophy is separation by distance bunding, packaging and vapour control of materials which might interact.**	1	2	2
24	4.1 Metallic smears e.g. CS with Aluminium or Magnesium plus impact	Rare instances have been reported, eg build up of Al in tanker dipstick resulting in ignition on impact	1	3	3	No known instances at Chemsal.	1	1	1
25	4.2 Pyrophoric iron sulphide e.g. H2S crude oil on steel tank walls	Spontaneous ignition of corrosion products due to impinging air when tank opened	1	3	3	No products known to cause pyrophoric residues are stored.	1	1	1
26	4.3 Chemical reactions e.g. Exothermic polymerisation/oxidation	Interaction of incompatibles, or substances which react dangerously. Enhancement of flame by oxidisers.	3	4	12	Physical separation of DG Classes. Containment of spills. Prompt clean up.	1	3	3
27	**5. Engines**	Fire or explosion due to vapour contact with engine, or spillage of flammables onto hot surfaces such as exhausts	2	3	6	**Basic philosophy is elimination of spark-ignition engines form hazardous areas.**	1	3	3
28	5.1 Vehicles e.g. Spark ignition/dynamo/battery/exhaust temp	Fire or explosion due to vapour contact with engine, or spillage of flammables onto hot surfaces such as exhausts	2	3	6	Flameproof forklifts used. ADG Classification RT1 specified for Class road tankers. Site Traffic control rules.	1	3	3
29	5.2 Generators	Non-motor vehicle ignition source, usually introduced fro maintenance or emergency response reasons	2	3	6	Hot Work permit system. Emergency plan.	1	3	3

30	**6. Arson**	Intentional actions	2	4	8	**Basic philosophy is proper security arrangements, particularly outside business hours.**	1	2	2
31	6.1 Vandalism e.g. Fireworks	Setting of fires by intruders or by throwing incendiaries from outside boundaries	1	4	4	Security fence, intrusion alarm, separation of susceptible storages from boundaries.	1	2	2
32	6.2 Terrorism	Attempt to create public impact	1	1	1	Not glamorous enough to be credible.	1	1	1
33	**7. Microwaves**	High energy source	1	4	4	**No microwave equipment on site or in neighbouring premises.**	1	1	1
34	**8. Self Heating**	Spontaneous combustion or explosion	1	4	4	**Basic philosophy is good housekeeping practice**	1	3	3
35	8.1 Soaked Porous materials e.g. Waste rags	Clean up rags soaked with oils such as linseed	2	3	6	Housekeeping, training and proper waste disposal arrangements. Separation of wastes from different DG Class areas.	1	3	3
36	8.2 Dust layers	Dust explosion	1	4	4	Good housekeeping. Unlikely to achieve critical mass of dust.	1	1	1
37	8.3 Product on lagging	Unobserved accumulation of combustible or flammable materials under lagging, ie in heated area	2	3	6	No lagged vessels or pipes.	1	1	1
38	**9. Static electricity**	Friction induced accumulation of electric charge, particularly on an isolated conductor.	3	3	9	**Basic philosophy is elimination of static inducing materials and processes from Hazardous Areas.**	1	3	3

39	9.1 Lightning	Atmospheric discharges including conventional lighting and St Elmo's fire	2	3	6	Electrical continuity and grounding in tank farm area.	1	2	2
40	9.2 Liquid-Solid e.g. Flow through pipes/Filters/Splash filling	Pumping on non-polar solvents leading to charge accumulation which is discharged on contact with air	3	3	9	Grounding of road tankers, drums and decanting vessels. Low probability of non-polar solvents being pumped. Filters selected for Class 3 use if required. Generally low pumping rates (<1m per second).	1	1	1
41	9.3 Liquid-Liquid e.g. Immiscible liquids/Tank cleaning	Switch-loading, or layered mixtures	1	3	3	API recommendations on switch loading. RT1 tankers with EPA licensed drivers. Cleaning under Permit System only.	1	3	3
42	9.4 Gas-Liquid e.g. Cleaning or Leakage of wet steam/Blowing lines	High friction due to large pressure change, high velocity	1	3	3	Unlikely process at Chemsal. Line blowing or pigging if required will be by nitrogen or other inert gas.	1	2	2
43	9.5 Gas-Solid e.g. Fluidised beds/Pneumatic conveying	Large surface area with good oxygen supply plus charge accumulation	1	1	1	Not used at Chemsal	1	1	1
44	9.6 Solid-Solid e.g. Belt drives/Human body/Grit blasting	Static discharge most likely from a person wearing rubber soles on a hot, dry day	2	3	6	Approved PPE. Blasting done under permit with atmospheric monitoring etc.	1	2	2
45	9.7 Accumulation on isolated conductors e.g. Tank cleaning machine	High flow through a potentially isolated conductor such as a cleaning head on a rubber hose	2	3	6	Such equipment will be used rarely and always under permit system. Hoses to be electrically continuous. CHECK STANDARD.	1	3	3

46	**10. Electrical equipment**	High ignition potential in flammable atmosphere	2	3	6	**Basic philosophy is that all electrical equipment in operational areas is intrinsically safe and properly maintained. Introduced equipment is subject to Hot Work Permit system.**	1	3	3
47	10.1 Switching e.g. Switches/Motors	Almost always have sufficient energy to ignite a vapour cloud in the flammable range	2	3	6	Intrinsically safe equipment in Hazardous Zones. HW Permit.	1	3	3
48	10.2 Electric current heating e.g. Hot filament	Process heating equipment	2	3	6	No such equipment in Hazardous Areas.	1	1	1
49	10.3 Shorting e.g. Break down of insulation	Unforeseen discharge path for electrical energy	1	3	3	IS equipment is designed to exclude contact between deteriorated insulation and flammable vapour. Maintenance procedures.	1	2	2
50	10.4 Shorting e.g. severed cable, dropped portable equipment	Accidental exposure of electrical discharge path	2	3	6	IS protection. Approved electrical equipment only, permit system. Minimised use of portable equipment.	1	3	3
51	10.5 Portable electrical equipment, mobiles, pagers etc.	Non-approved ignition sources introduced to Hazardous Areas, perhaps unwittingly	1	3	3	Site induction and signage. Training, supervision. Considered low risk based on current experience.	1	2	2

Code of Practice: No one code of practice covers this subject entirely. However, the following Standards and Codes have been used as guidance:

AS/NZS1020 The control of undesirable static electricity

AS1940 The storage and handling of flammable and combustible liquids

AS/NZS2340 Classification of Hazardous Areas
AIP CP 08 – Precautions Against Electrostatic Ignition During Tank Vehicle Loading

PREMIER

RISK RATINGS

Likelihood / Consequences		Almost Certain 4	Likely 3	Unlikely 2	Rare 1
Catastrophic	4	16	12	8	4
Major	3	12	9	6	3
Moderate	2	8	6	4	2
Minor	1	4	3	2	1

R = RISK = L (LIKELIHOOD) X C (CONSEQUENCE)

RED 16 to 8	High Risk	**Unacceptable - Urgent action required**. Report to Senior Management and implement corrective action plan immediately.
BLUE 6 to 4	Medium Risk	Determine relevant corrective actions and put in place as soon as possible.
GREEN 3 to 1	Low Risk	Do something where / when possible or manage by routine procedures. 'Low risk' does not mean 'no risk'.

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PREMIER

PREMIER RISK MANAGER
DEFINITIONS

'L' = Likelihood		
How Likely?		Description
4	Almost Certain	**The event is very likely to occur at any time** or the event has happened more than once in the past
3	Likely	**The event will probably occur at some time** or the event has happened in the past ("I've heard of it happening")
2	Unlikely	**There is some chance that the event could occur but it is not expected to happen**
1	Rare	**Practically impossible for the event to occur** or may only occur in exceptional circumstances

'C' = Consequences		
Level		**If the event occurred, expected consequences could be:**
4	Severe / Catastrophic	• Death and/or permanent disability to one or more persons; and/or • Major off-site and/or on-site release and serious detrimental effects to environment; and/or • Major property damage and/or major disruption to activities and/or major financial costs expected.
3	Major	• Serious injury(s) to one or more persons – leading to time off work and/or work restrictions; and/or • Serious on- or off-site release requiring outside assistance for recovery, possible detriment to environment; and/or • Property Damage and/or disruption to activities and/or substantial financial costs expected.
2	Moderate	• Minor injury(s) to one or more persons which may result in outside medical treatment but does not lead to time away from work or any work restrictions; and/or • On-site release - contained or recovered with outside assistance • Minor property damage and/or some disruption to activities and/or some financial costs expected.
1	Minor / Insignificant	• No injury or First Aid treatment only – does not require any outside medical treatment and does not lead to time away from work or any work restrictions; and/or • No on-site release **or** minor on-site release contained immediately; and/or • Minor or no property damage and/or no disruption to activities and/or minimal financial costs expected. Nuisance and/or annoyance.

CONSEQUENCE definitions are colour coded to show the area of major impact (but overlaps are common):

- **Health and Safety**
- **Environmental**
- **Property Damage or Financial Costs or Disruption to Activities**

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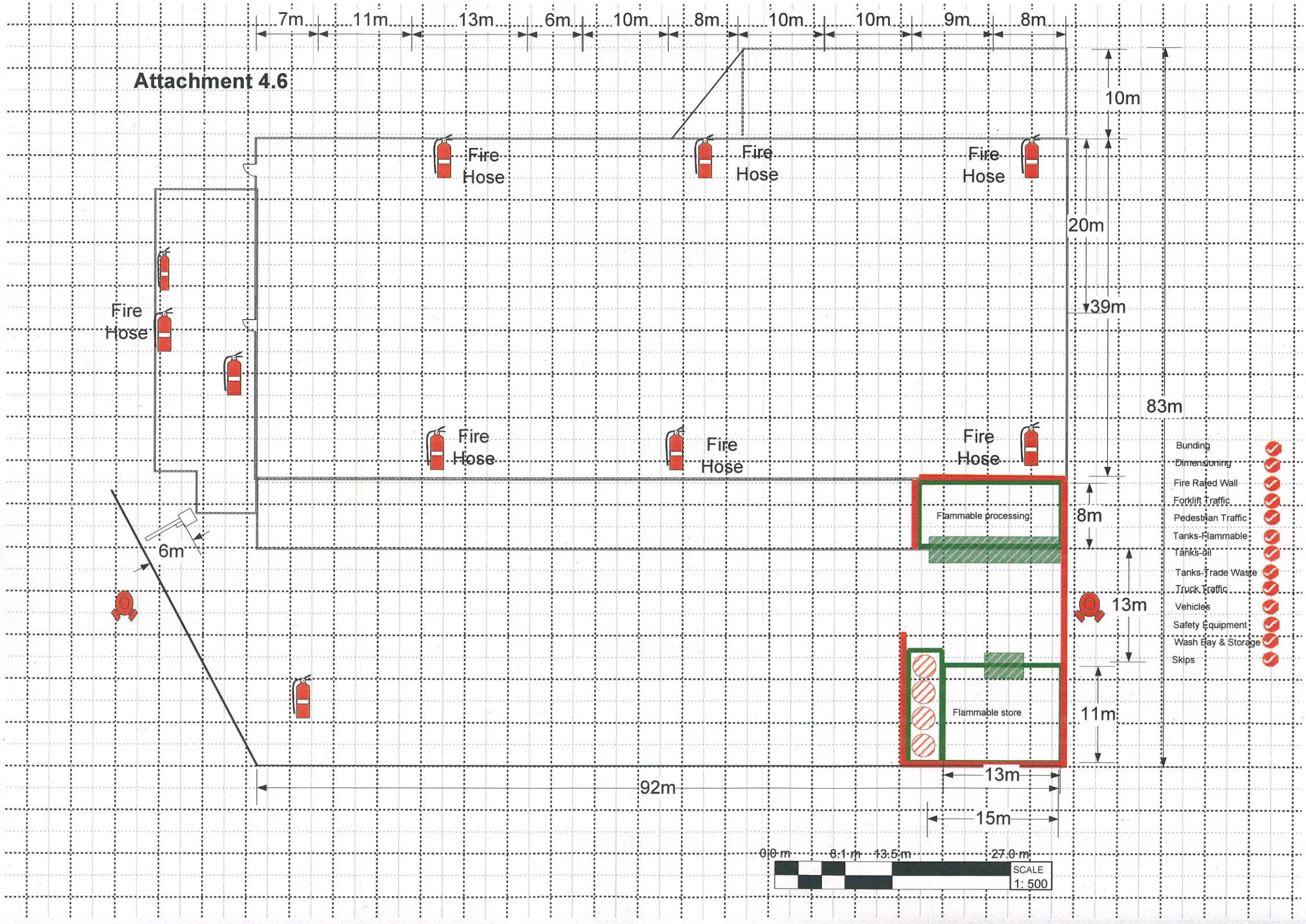
Attachment 4.6
7m
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9m
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10m
20m
39m
83m
Fire Hose
Fire Hose
Fire Hose
Fire Hose
Fire Hose
Fire Hose
Fire Hose
6m
Flammable processing
Flammable store
8m
13m
11m
13m
92m
15m
Bunding
Dimensioning
Fire Rated Wall
Forklift Traffic
Pedestrian Traffic
Tanks-Flammable
Tanks-oil
Tanks-Trade Waste
Truck Traffic
Vehicles
Safety Equipment
Wash Bay & Storage
Skips
0.0 m
8.1 m
13.5 m
27.0 m
SCALE
1: 500