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PRELIMINARY HAZARD ANALYSIS

ON PROPOSED

BULK OXYGEN TANKS

HORNSBY HOSPITAL

Prepared by Bill Callan
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January 2018

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Mr Alan Sharkey – Steensen Varming

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Issue 2	February 9, 2018	With confirmation of tank arrangement options form the tank and gas supplier

Disclaimer:

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Executive Summary

The Hornsby Hospital campus is undergoing significant development. This development will result in an increase in patient numbers, with a corresponding increase in oxygen offtake. Currently oxygen is supplied from two on-site bulk liquid oxygen tanks, of 15000 litres and 1500 litres capacity respectively. It is therefore proposed to increase the size of these tanks to 30000 litres and 3000 litres capacity. These capacities are calculated taking into effect the expected off-take, variations in the off-take and sensible supply arrangements, i.e. road tanker delivery lead times and frequency.

The planning instrument relating to the proposed development is State Environmental Planning Policy No.33, “Hazardous and Offensive Development Application Guidelines” (“SEPP33”). The mechanism for the application of SEP33 is set out in “Applying SEPP33” (Department of Planning, 2011) which sets out screening thresholds for each of the various classes of dangerous goods.

Liquid Oxygen is classified as a dangerous good of Class 2.2 (non-flammable, non-toxic gas) with a sub-risk of Class 5.1 (oxidizing substance). Class 2.2 materials are not assessed under SEPP33, but Class 5.1 materials (except for some solids) have a threshold of 5 tonnes. The proposed increase in inventory of the liquid oxygen is 18.8 tonnes (at an assumed specific gravity of 1.14) and therefore exceeds the threshold. So the proposed development is assessed under SEPP33 as potentially hazardous and therefore a Preliminary Hazard Analysis (this document) is required to demonstrate that the proposal meets the acceptable risk criteria, which are set out in HIPAP No.4, “Risk Criteria for Land Use Safety Planning”.

The format required of a Hazardous Analysis such as this is set out In HIPAP No.6 “Hazardous Analysis”, and this format is generally followed in this report. There is, however, one difficulty brought about by the particular hazards associated with liquid oxygen. HIPAP6 advises an examination of elements such as dispersion models, fire,

explosion, toxic release, projectiles etc., which are commonly the result of hazardous instances involving flammable or toxic materials. Oxygen is neither flammable nor toxic. The main hazard associated with liquid oxygen is its ability to vigorously accelerate combustion. Therefore, the main risk control measure is to isolate the oxygen from accumulations of materials of a combustible nature. In the absence of such materials, the risk (at least the risk envisaged in SEPP33 being the risk of off-site harm) is very low.

This being the case, the best way to demonstrate the safety of the proposed installation is to demonstrate compliance with the relevant Australian Standard, AS1894, “The storage and handling of non-flammable cryogenic and refrigerated liquids”. This compliance has been documented separately and is attached to this report as Attachment 1.

The Compliance Report contains within it a qualitative risk assessment which summarizes the risks associated with dangerous goods storages in general and with bulk oxygen facilities in particular. The risk elements are taken from the NSW Occupational Health and Safety Regulation, Clause 174Rff, being the “particular risks” which are required to be assessed and mitigated under that Regulation. Note that these headings are taken from legislation which has been superseded by the WHS Regulation, but nevertheless concisely list the main risks which need to be controlled.

SEPP33 also has a transport threshold of greater than 30 road tanker deliveries per week. The proposed facility will receive deliveries of between one and four road tankers per month, so the facility would not be deemed potentially hazardous on this basis.

Note that this proposal covers, firstly, the replacement of the existing tanks, with no other changes, as well as a future development, being a building identified as Stage 2, which will be constructed to the west of the tank compound, on part of the existing car parking area – refer Attachments 2 and 3. The compliance assessment set out in Attachment 1 assumes the existence of the Stage 2 Building.

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The following headings are suggested by HIPAP6. Comments are mostly very brief because the main issues are covered in the attached Compliance Report.

Findings and Recommendations

The proposed upgrade of tank sizes intends to make use of the existing facility, which consists of two tanks of 15000 litres and 1500 litres capacity, located in a compound near the eastern boundary of the site (Derby Street). These two tanks will be replaced by two new tanks of double the capacity, located in the same position as the existing tanks.

It should be noted that the area to the west of the existing tank compound, currently used as a car parking area, will be developed at some time in the future and this future layout is the basis of this assessment.

The recommendation of this report is that the proposed development should be deemed to be not potentially hazardous and should be approved subject to compliance with AS1894, as set out in the attached compliance report.

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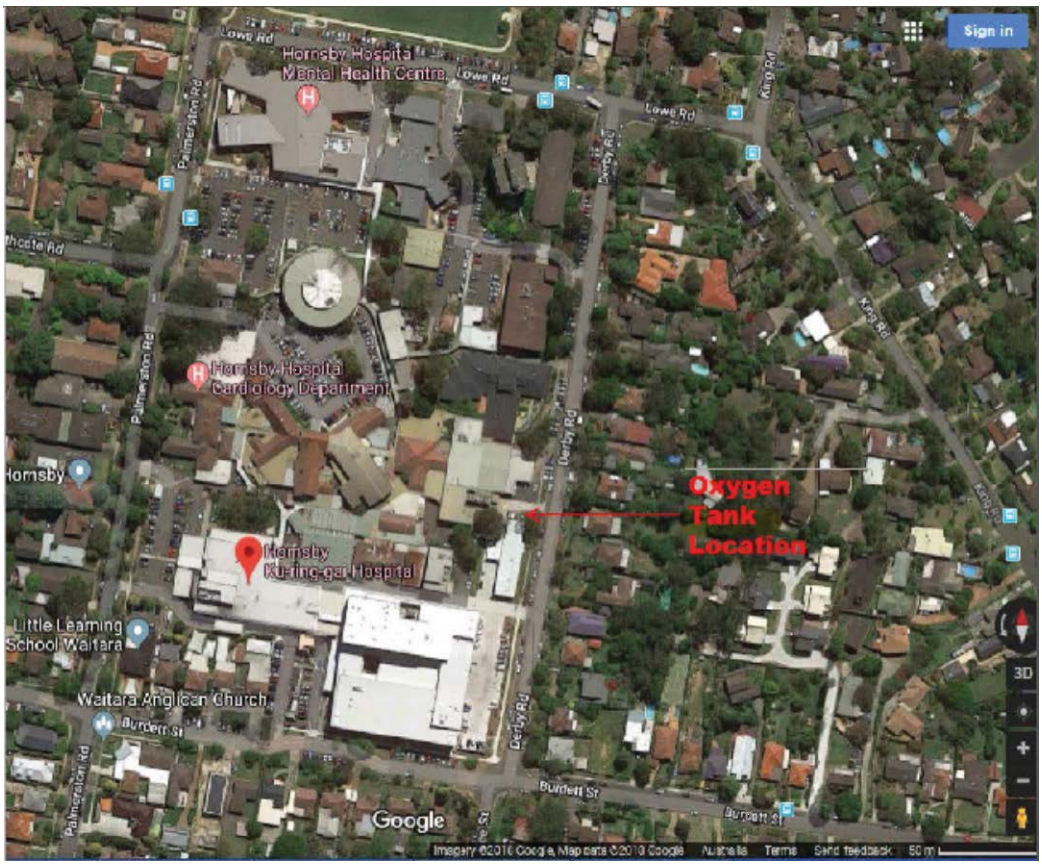
Site Description and Surrounding Areas

The existing oxygen tank compound is located near the Derby Rd boundary near the "Gate 8" entrance.



The existing tanks are contained in a block-work compound which provides separation from a gas cylinder store, located at the rear of the compound. An Engineering Office is located to the south of the cylinder store.

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The existing bulk liquid oxygen tanks

The attached Compliance Report deals with the separations between the facility and a range of infrastructure.

The location of the existing tanks is on the Derby Street (eastern) side of the site. These tanks will be replaced by new tanks of approximately double the capacity. The new tanks will utilise the existing tank compound, tanker unloading area, fill point and facilities such as fire protection and security arrangements.

The tank and gas supplier (BOC) has confirmed that the original compound is suitable for the new tanks, provided the base is re-engineered for the increased loading of the larger tank.

Process

Liquid oxygen evaporates into the ullage space of the tank, and is drawn off from the ullage space as gaseous oxygen by pipeline to the various points of oxygen consumption in the Hospital. Evaporators are installed to aid the vaporisation of oxygen if demand requires. The tank is filled from the supplier's road tanker connected to a fill point inside the compound.

There are no process conditions which impact on this assessment.

Hazard Identification

The Risk Assessment in the attached Compliance Report gives a qualitative analysis of the hazards associated with an oxygen storage. Some quantitative component is introduced by a simple assessment of both likelihood and consequence, but the main purpose of this assessment is to act as a "word diagram" of hazard assessment, as envisaged in HIPAP6.

It is recognised that this assessment does not deal adequately with low likelihood/high consequence incidents. Therefore it is appropriate to deal briefly with such an occurrence. The characteristics of liquid oxygen are such that several conditions need to be satisfied in order to produce such an incident. An example might be an aircraft crash, which would produce a significant loss of containment of the oxygen, introduce a

significant fuel load, and undoubtedly include an ignition source. The point is that the likelihood of each of these conditions is very small and the conflation of all becomes almost inconceivably remote.

Consequence analysis

Two points require comment. The first is that consequence is determined by the availability of a fuel source, so absence of this element is the major risk control measure. The second point is that, in contrast to most scenarios involving flammable liquids or gases, even a catastrophic event may have low consequence. The attached Compliance Report contains, in the Emergency Response Summary, a listing of the major issues which might befall an oxygen storage and the appropriate emergency response measures.

Estimation of Likelihood

Various scenarios may be invoked, but it is unlikely that any mathematical expression of likelihood will be helpful. The importance of separation of the oxygen from fuel sources is emphasised.

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Attachment 1 – AS1894 Compliance Report

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HAZARDOUS CHEMICAL COMPLIANCE REPORT

BULK OXYGEN TANKS

HORNSBY HOSPITAL

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January 2018

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Issue 2	February 9, 2018	With further information from the tank and gas supplier

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Background

The current redevelopment of Hornsby Hospital will require an increase in the storage of bulk liquid oxygen. It is proposed to replace the existing bulk tanks (15000 litres and 1500 litres capacity) with new tanks of double these capacities (30000 litres and 3000 litres). The new tanks will be located in the existing compound, and will be of similar layout, the only significant difference being the increase in height.

The gas supplier (BOC) has indicated that the existing compound is suitable except that the base will require reinforcement to take the weight of the larger tank. Two alternatives are offered. The first involves decommissioning the small tank, reinforcing that area of the base and then installing the 30000 litre in the left side (west) of the compound. The existing 15000 litres could then be decommissioned and replaced by the 3000 litre tanks. This work can be carried out without disruption to the Hospital's oxygen supply. The second alternative would be to install a temporary tank while the two existing tanks are replaced with the larger ones in the same configuration, i.e. the large tank on the right of the compound. This configuration has an advantage in that there is less shadowing on the evaporators, so gasification is more efficient. Note that these alternatives have no bearing on the compliance issues such as separation distances which are discussed below – the Standard requires the same separations for all tanks in the size ranges considered here. The choice concerning these alternatives will probably depend on construction scheduling – if the tank replacements are done before the Stage 2 Building is erected, the option of a temporary supply is probably preferable given the availability of a clear area in the existing car park.

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The purpose of this report is to review compliance of this proposal with relevant legislation and the Australian Standards for the materials involved.

The site layout is shown in Appendix 1, and the existing oxygen tank facility is shown in Appendix 2. The proposed layout of the new tanks is shown in Appendix 3. (Note that these drawings have been reduced on account of file size. Full size drawings will be forwarded separately).

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Executive Summary

The proposed location for the oxygen tanks satisfies the important criteria for location of dangerous goods bulk installations, namely

- Inherent safety – the location is away from vulnerable installations such as wards, and away from places where people congregate.

- Safe product transfer – the supply tanker and filling arrangements will comply with the relevant legislation (the “ADG Code”).

- The proposal complies with the relevant Australian Standard (AS1894 – The storage and handling of non-flammable cryogenic and refrigerated liquids).

The most important safety issue relating to oxygen storage is the isolation of the oxygen from materials of a combustible nature, as the nature of oxygen is such that it will fiercely accelerate any combustion with which it might come into contact. In the proposed location, the area in and around the tank compound is free of combustible materials, including vegetation, bark mulch and the like.

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Legislation

The legislation covering the storage and handling of dangerous goods is contained in the

- Work Health and Safety Regulation 2012.

This Regulation refers to a number of Australian Standards of which the following may be relevant to the proposed facility:

- AS1894-1997 Storage and handling of non-flammable cryogenic and refrigerated liquids
- AS2896 –1998 Medical gas systems – installation and testing of non-flammable medical gas pipeline systems

This report deals only with AS1894-1997 compliance.

Further guidance is provided by SafeWork NSW's Code of Practice, "Managing Risks of Hazardous Chemicals in the Workplace".

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AS1894 Requirements for Bulk Oxygen

The proposed capacities of the new oxygen tanks are 30000 litres and 3000.

The following clauses of the Standard (AS1894, The Storage and Handling of Non-Flammable Cryogenic and Refrigerated Liquids) are applicable to the bulk tanks. Many other clauses, such as Emergency Management, are also relevant but do not impinge on the underlying compliance of the proposed design. Clauses not mentioned below are considered to be not relevant to the proposal, or alternatively have no impact on the consideration of the design.

Clause 1.6 - This clause requires that all storage areas are appropriately secured against access by unauthorised persons. The proposed compound meets this requirement, by means of a locked compound, together with the normal security arrangements on site, such as CCTV.

Clause 3.3 – This clause covers design requirements and requires consultation with the gas supplier if there is to be a change of service. Such a change of service is unlikely.

Clause 3.4 - This covers foundations and supports. It is usual for the gas supplier to deal with these details.

Clause 3.5 - This clause covers the location of storage vessels.

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Clause 3.5.1 - requires the installation to be located to minimise risk to personnel, local population and property. The location is distant from areas where people can assemble, from wards and from other buildings.

The clause also requires consideration to other potentially hazardous processes in the vicinity. No such processes are proposed for the surrounding areas.

It is a requirement of this Standard that the location must be acceptable to both the gas supplier and the user – a process of consultation with the existing supplier is in place.

Clause 3.5.2 - requires protection against vehicular damage. The tanks and fill point are protected by the tank enclosure, which is of block wall construction together with bollards.

Clause 3.5.3 – requires that any spill of liquid oxygen flows away from locations where people are at risk. The tanker transfer area is essentially flat and any flow of liquid is likely to be towards the existing car parking area.

Clause 3.9.1 – This covers the location of the transfer area. The main requirements are that the delivery tanker has a level, accessible filling position, with quick, direct and unobstructed exit. The existing location is level and acceptable to the gas supplier. The tanker unloading location is shown in Appendix 2.

Clause 3.9.3 - requires that controls and instrumentation be visible from the fill point. No problems are envisaged with this requirement, as the fill point is located immediately adjacent to the tank enclosure.

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Clause 3.13 - requires in-service inspection and maintenance. While this is normally carried out by the gas supplier, it is prudent for the occupier to ensure that the work is carried out.

Section 4 of the Standard relates to separation of the facility from protected areas, other dangerous good storages etc.:

Section 4.3 – the new proposed location needs to be separated from the

- Property boundary
- Street, road boundary
- Gases in cylinders
- Areas where ignition sources are permitted
- Drains and pits
- Compressor intakes
- Areas where patients are confined to bed
- Places of public assembly
- Dangerous goods including pipelines.

Separations are measured from the tank shell and/or the associated valves and manifolds and can be measured around a screen wall. In this facility, the tank enclosure is surrounded on the north, east and west sides by a concrete block wall. The required separation is the sum of two distances, the “safety distance” (“D”) and “safety limit” (“S”). “S” is measured from potential leak points and therefore varies according to the arrangement of valves etc. and the orientation of the tank. Unless otherwise stated, the worst case (i.e. the maximum value of “S”) is used below. It should also be noted that the Standard specifies

separations based on ranges of tank capacity (for example, 1000 to 30000 litres). At this facility both the existing tanks and the proposed tanks fall within the same range, so a separation which is compliant in the existing situation will also be compliant when the proposed tanks are installed.

In all instances, separations from items mentioned above exceed requirements, in particular:

- The required separation of the tanks from the property boundary is 4 metres (S = 2, D = 2). The edge of the compound is 4.5 metres from the boundary fence, with a further 0.9 metres to the nearest valve on the small tank.
- The separation distance from a street or road boundary is also 4 metres.
- The adjacent cylinder store is separated more than 6 metres, measured laterally around the tank compound block wall (requirement is 4 metres). No other dangerous goods (or dangerous goods pipelines) are stored or used in this area.
- Areas where open flames, smoking and sources of ignition are permitted are also required to be separated by 6 metres. This is achieved primarily by the nature of the surrounding area and the absence of facilities which would attract members of the public or others. Smoking is prohibited on the site as a whole. A proposed sub-station to the north of the oxygen tanks is more than 15 metres away.
- The nearest drain (stormwater) is more than 10 metres away, exceeding the requirement of 5 metres.
- Compressors located in the cylinder storage room behind the tank compound are about 8 metres from the tanks (requirement is 7 metres).

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- There are no issues with separation of the areas of buildings where patients are confined to bed, at least within the current building configuration. None are within the required separation of 12 metres. However, the Stage 2 Building will be separated by approximately 9 metres from the nearest tank, so the 12 metre zone will intrude into two of the rooms on each level on the eastern edge of the building, which is of four levels. One of the rooms is an entrance lobby with lifts wells so this is not an issue. The other room varies according to level – Ground level houses a sprinkler control room, Level 1 a meeting room, Level 3 a lounge area and Level 4 a Health Assessment Area. These do not present a problem but Level 2 has a one-bed room within this lateral separation. AS1894 makes provision for vertical separation (Note 4 to Table 4.1) by applying a factor of 0.6 to the horizontal distance. The application of the resulting distance (7.2 metres in this case) is not explained in the Standard, so applying this literally is not advised. However, a reasonable risk based argument can be made as follows: The main risks to the one-bed room on Level 2 arise from a potential inability to evacuate the patient in a timely manner in the event of an impacting event arising from the oxygen tanks. The likely events originating at the tanks are a spill of liquid oxygen on the ground with potential personal exposure, acceleration of a fire (for example, the delivery tanker on fire), contribution to ignitibility of nearby materials such as garden mulch or an oxygen enriched atmosphere. The common factors of these possibilities are that they originate at or close to ground level and their effects are diluted by distance. The building at ground level is 9 metres away from the seat of the incident and is well compliant in this regard (the Standard requires only 5 metres for a building or structure with combustible exterior). The façade of the building is brick metal cladding and glass. The Level 2 room

is located 8.7 metres above ground level, so it is hard to see that the risk presented is any more than that experienced by a similar ground-level room at 12 metres separation.

- There are no places nearby which could be described as places of public assembly. There are rooms within the building which are accessible by members of the public, such as waiting areas, but these will be sparsely populated and there will be no areas where assembly of large numbers would present an evacuation hazard.

- The Hornsby Campus will utilise a number of other hazardous chemicals of various classifications, in small quantities. These will be located in cleaning stores, laboratories etc. No incompatible materials will be stored or used in the vicinity of the bulk oxygen compound. Medical gas cylinders are stored in a gas cylinder room at the rear of the compound. The cylinders stored there are compatible, being, oxygen, nitrous oxide (also a Class 2.2/5.1 gas) and medical air.

Clause 4.4 – the transfer area should consist of a concrete hard-stand of at least 2.5 m X 2.5 m, on which the tankers couplings can stand. The design of this area should avoid joints within 1 metre of the position of the hose couplings. Asphalt or bitumen are not suitable for this area. The existing transfer area is concrete and will be retained.

Clause 4.10 – Electrical Equipment – the gas tank supplier usually ensures that all such equipment is suitable for this service. Equipment should have a rating of

not less than IP54 in accordance with AS1939. Flameproof equipment is not required.

Section 6 Operational and Personnel Safety

Clause 6.3.5 - Control of Entry: This requires that unauthorised persons are not permitted in the storage areas and that persons other than employees are accompanied at all times and also be made aware of the hazards associated with the store. The tank compound is kept locked.

Clause 6.3.6 - Clear access must be available for emergency equipment, personal protective equipment, cleanup equipment, as well as entry, exit and emergency escape.

Clause 6.3.7 - Lighting at the bulk tank is required to allow easy reading of all markings and signs.

Clause 6.11 - First Aid: The standard requires provision of a suitable First Aid kit and instructions including the MSDS.

Clause 8 - Fire Protection: No specific requirements are given in the Standard for fire protection equipment selection (although it is prescriptive regarding the Standards applicable to equipment once selected) and it should be borne in mind that the fire protection requirements are basically those to prevent a fire adjacent to the storage impinging on the storage itself. The Standard requires that the relevant regulatory authorities should determine the fire protection requirements,

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and it is normal practice for this to be dealt with by the oxygen tank supplier. It is recommended that at least one hose reel is available in the vicinity, to be used for fire control in the vicinity, for cooling the tanks in the event of an impinging fire, and for vapour dispersal. Clause 8.3.2 also calls for “alarms”. Presumably, this can be met by the building fire alarm system. It is recommended that the fire protections chosen are evaluated against this Clause (Clause 8) and Appendix M of the Standard.

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Work Health and Safety Regulation Requirements

As well as the risk management requirements discussed above, there are a number of other legislative requirements to be met. These include:

- Risk management needs to be formally addressed, communicated and monitored, including induction, training, contractor management etc. A draft risk assessment has been prepared and is attached as Appendix 5. The definitions and ratings used in the assessment are included as Appendix 4.

- Notification of Hazadous Chemicals on Premises and Dangerous Goods, Register and Manifest. The existing documents will need to be updated.

- Review of Emergency Plan - the revised Site Emergency Plan should be resubmitted to Fire and Rescue NSW, in the format required on their website. (Further information on Emergency Plan requirements are contained in Appendix L of AS1894). A draft “Emergency Response Summary” has been prepared and is attached as Appendix 6.

- The oxygen tanks are supplied with placarding suitable for a bulk facility.

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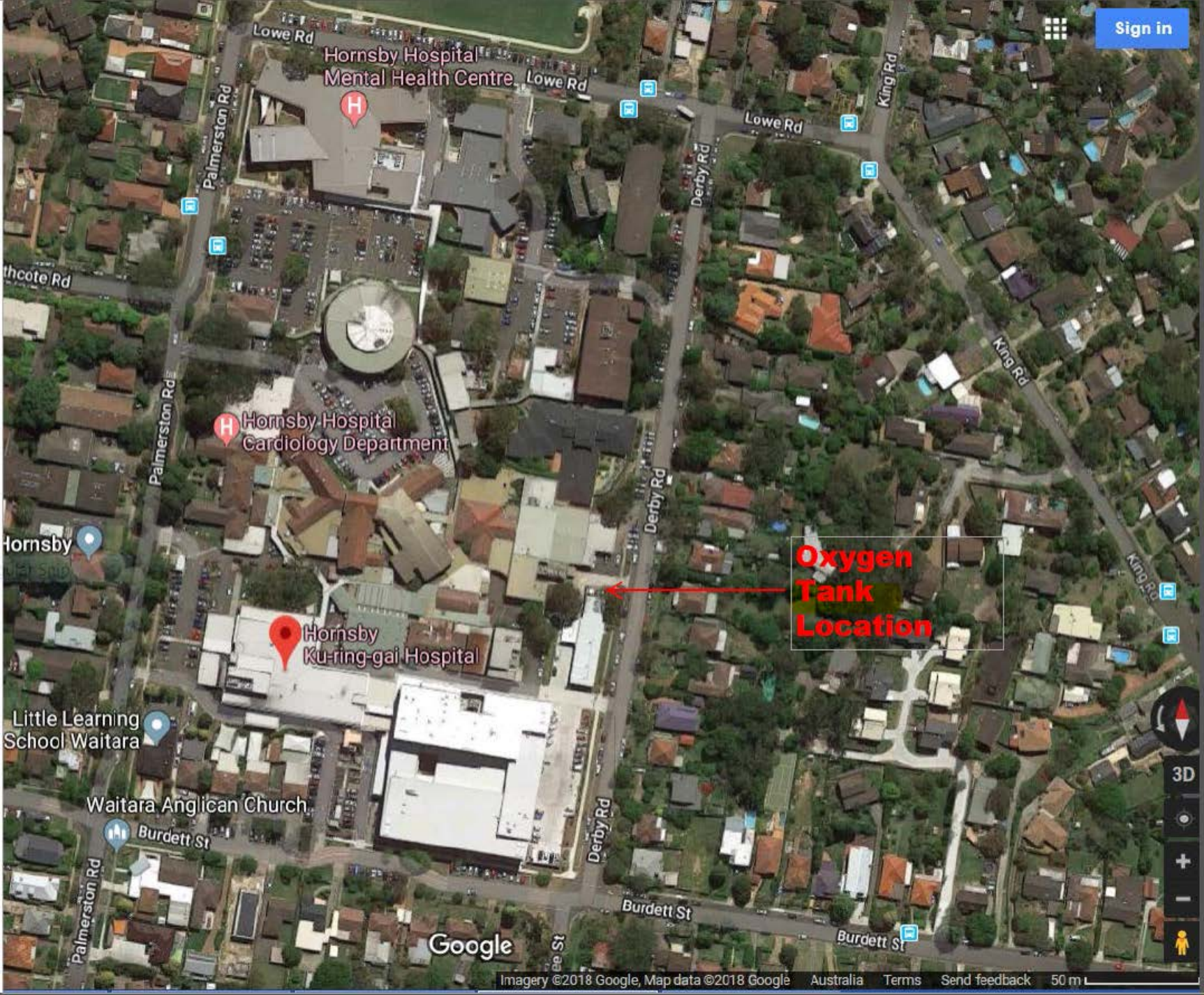
Appendix 1 – Site Layout


Sign in
Lowe Rd
Hornsby Hospital
Mental Health Centre
Lowe Rd
Lowe Rd
King Rd
Palmerston Rd
Derby Rd
thcote Rd
Palmerston Rd
King Rd
Hornsby Hospital
Cardiology Department
Derby Rd
Hornsby
Oxygen
Tank
Location
King Rd
Hornsby
Ku-ring-gai Hospital
Little Learning
School Waitara
3D
Waitara Anglican Church
Burdett St
Derby Rd
Palmerston Rd
Burdett St
Burdett St
Google
Imagery ©2018 Google, Map data ©2018 Google
Australia
Terms
Send feedback
50 m

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Appendix 2 – Existing Oxygen Enclosure


BOC
Medical
Liquid Oxygen
BOC
Medical
Liquid Oxygen
OXYGEN
1073
2P
000 POLICE OR FIRE BRIGADE
BOC AUST LTD 1800 624 006
DANGER
NO SMOKING
NO IGNITION SOURCES WITHIN 5m
AUTHORISED PERSONNEL ONLY
OXYGEN
1073
2P
000 POLICE OR FIRE BRIGADE
BOC AUST LTD 1800 624 006
25/01/2018 13:41

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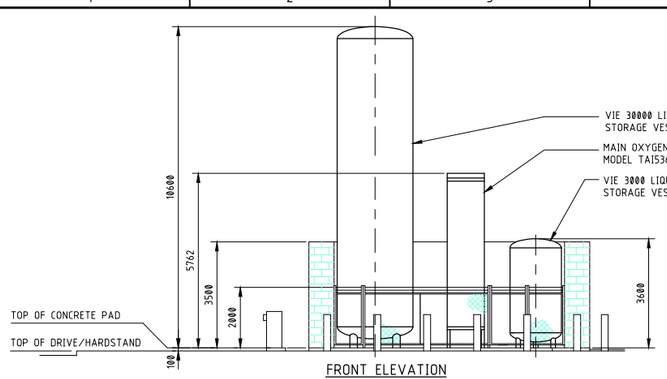
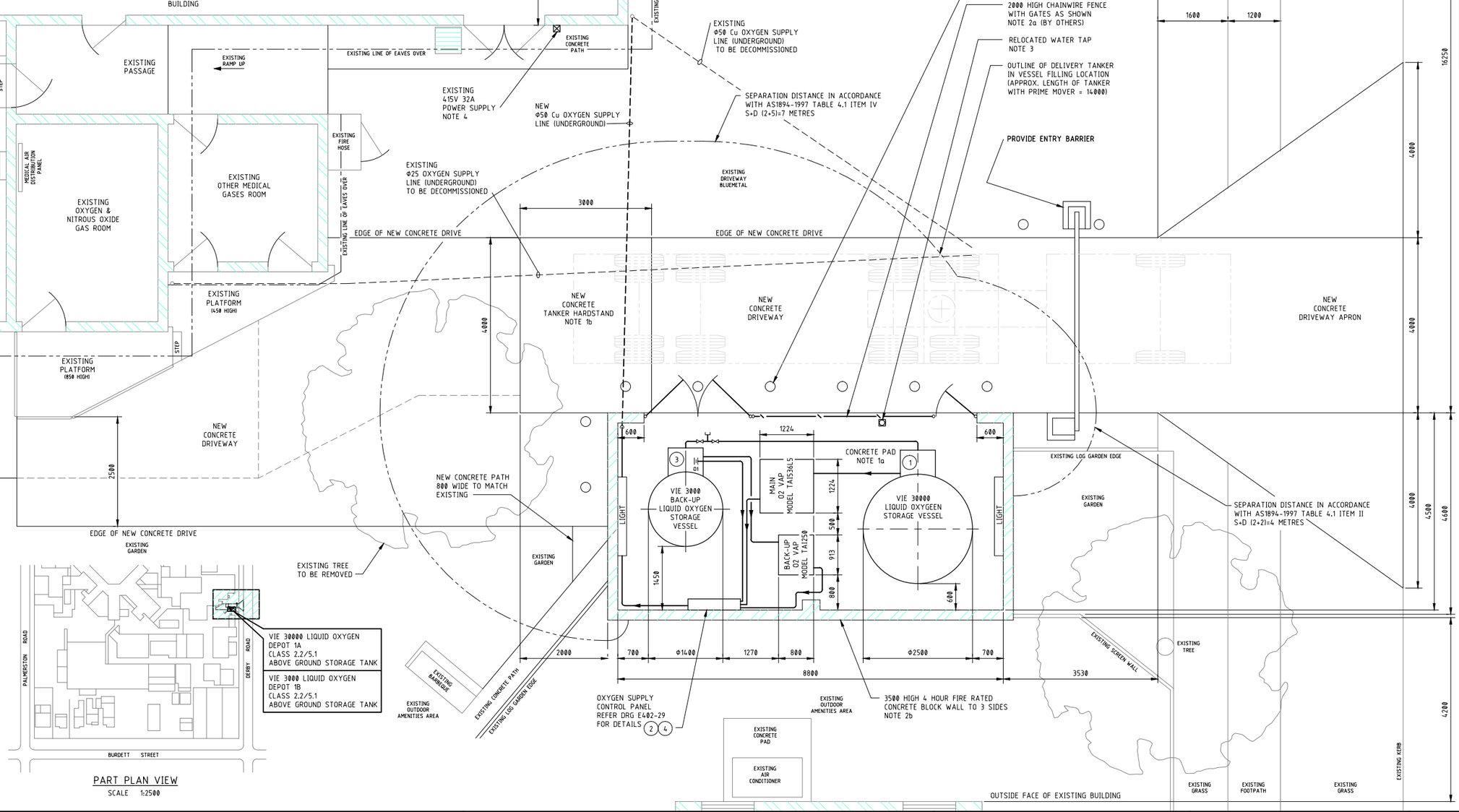
Appendix 3 – Proposed New Tank Layout



FRONT ELEVATION
SCALE 1:100



PART PLAN VIEW
SCALE 1:2500

MANDATORY ALARMS:		
1	RE-ORDER OXYGEN	PRIMARY VESSEL CONTENTS GAUGE
2	EMERGENCY OXYGEN SUPPLY OPERATING	OXYGEN SUPPLY CONTROL PANEL
3	BACK-UP OXYGEN SUPPLY LOW PRESSURE	BACK-UP VESSEL
4	OXYGEN SUPPLY FAILURE	EMERGENCY FILL FACILITY

NOTES:

1a. CONCRETE PAD: (EXISTING MODIFIED)
CONCRETE PAD TO BE 300 THICK AS PER ANZIGA DRG. 142-002 REV.A6.
F'c 32 MPa (GRADE N32R, 80 SLUMP)
REINFORCING: F92 TOP, F72 BOTTOM, 40 COVER ON TOP, 65 COVER BOTTOM AND SIDES
EMPTY VESSEL MAY BE INSTALLED AFTER 7 DAYS AND VESSEL FILLED AFTER 14 DAYS.
CONCRETE WORKMANSHIP TO BE IN ACCORDANCE WITH AS3600.
FOR MORE DETAILS, SEE ANZIGA DRG. 142-002 REV.A6.
VESSEL CONCRETE PAD SIZE: 8800 x 4500 (INTERNAL) x 250 THICK

1b. TANKER CONCRETE HARDSTAND: (EXISTING)
TANKER CONCRETE HARDSTAND SIZE: 4000x3000x225 THICK
FOR MORE DETAILS, SEE ANZIGA DRG. 142-002 REV.A6.

2a. SECURITY FENCE: (EXISTING)
TO BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH AS1725 AND AS2423.
END AND CORNER POSTS: 50 DN. GALV. PIPE
TOP AND BOTTOM RAILS: 32 DN. GALV. PIPE
EXTENSION POSTS: 2 STRANDS OF BARBED WIRE
CHAIN MESH: 50x3.25x1000 HEAVY GAUGE
FIXINGS: FLANGE BOLTED TO CONCRETE SLAB
DOUBLE SWING GATE: 2400 WIDE (TOTAL WIDTH)
PEDESTRIAN SWING GATE: 900 WIDE
OVERALL HEIGHT: 2000 MIN.

2b. SECURITY WALL: (EXISTING)
WALL TO BE 3500 HIGH AND 4 HOUR FIRE RATED CONCRETE BLOCK WALL TO 3 SIDES AS SHOWN.

3. WATER SUPPLY: (EXISTING)
3/4" STOP SCREWED TAP, 600mm ABOVE GROUND LEVEL, TO BE PROVIDED IN ENCLOSURE OR WITHIN CLOSE PROXIMITY.

4. TANKER POWER OUTLET: (EXISTING)
OUTLET - CLIPSAL 4 MODULE BASE CAT. No. 56E4VHGY
SWITCH - 32A CAT. No. 56SW332LEGY
SOCKET - 4 PIN 32A CAT. No. 565D432LEGY
RCD - CAT. No. 4RC463/30 (30mA)
RCD COVER - CAT. No. 56RC4NGY WITH NEON ACROSS 2 PHASES
SUPPLY CIRCUIT BREAKER - MCB 32A D CURVE, WIRING AND INSTALLATION IN ACCORDANCE WITH AS3000-2000.
RCD MUST BE MOUNTED AT THE OUTLET TO LET THE DRIVER TEST BEFORE USE. DO NOT MOUNT RCD AT SUPPLY DISTRIBUTION BOARD.

5. REFERENCES:
THIS DRAWING HAS BEEN PREPARED IN ACCORDANCE WITH THE DANGEROUS GOODS (GENERAL) REGULATION 1999, AUSTRALIAN STANDARD AS1894-1997 'THE STORAGE AND HANDLING OF NON-FLAMMABLE CRYOGENIC AND REFRIGERATED LIQUIDS' AND AUSTRALIA AND NEW ZEALAND INDUSTRIAL GAS ASSOCIATION (ANZIGA) DRAWING No. 1962-01 REV.3.

6. 240V AC POWER POINT EXISTING.

7. LIGHTING MOUNTED ON THE WALLS EXISTING.

8. MANDATORY OXYGEN ALARMS NEED TO BE MONITORED ON A MEDICAL GAS ALARM PANEL WHICH IS TO BE LOCATED IN A 24 HOUR MANNED LOCATION WITHIN THE HOSPITAL.

UNDER REVISION

REV.	DATE	DRAWN	REVISIONS	PASSED	APPROVED
1A	9-2-18	DJP	UNDER REVISION		

REFERENCE DRAWINGS

PROJECT ???? SCALE 1:50

BOC
A Member of The Linde Group
10 JULIUS AVENUE NORTH RYDE NSW 2113

LAYOUT – VESSEL INSTALLATION (PROPOSED) VIE 30000 AND VIE 3000 LIQUID OXYGEN HORNSBY HOSPITAL – HORNSBY NSW CUSTOMER ENGINEERING DEPT NSW

A1 FORM Nº DEP-002-F02/4
DRAWING Nº C208-PROP
SHEET 1
REVISION 1

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Appendix 4 – Risk ratings and Definitions

RISK ASSESSMENT
RATINGS AND DEFINITIONS

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

Consequences		
• **Health and Safety** • **Environmental** • **Property Damage / Financial Costs / Disruption to Activities/**		
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-site or off-site release requiring outside assistance for recovery, possible detrimental effects 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.

RISK ASSESSMENT MATRIX

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

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.**

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Appendix 5 – Draft Risk Assessment

Hazard Identification, Risk Assessment & Control Record

Location	**Hornby Hospital - Derby Rd entrance**	Plant Item / Operational Area:	**Liquid Oxygen Tanks - Class 2.2/5.1 - 30000L and 3000L with vaporisers (replacing existing 15000 and 1500 litre tanks).**	No:	
Area	Existing tank compound adjacent to Gate 8. Liquid Oxygen Tanks - 1 X 30000VIE and 1 X 3000VIE in a compound	Task Details:	**Risk Assessment of tanks and unloading facilities, compliance with Standard AS1894.**		
Prepared By:	BC - Draft			Date	02/02/2018
Review Date:		Reviewed By:		Due:	

NO.	ACTIVITY OR CIRCUMSTANCE	POTENTIAL SAFETY HAZARD OR ENVIRONMENTAL ASPECT	INHERENT RISK			CONTROL MEASURE	RESIDUAL RISK		
			L	C	R		L	C	R
1	Inventory reduction or substitution?					Medical requirement. No practical way to reduce inventory. Inventory is specified in Medical Oxygen Standard.			
2	Stability	No issues found	1	1	1	Product is stable - refer MSDS.	1	1	1
3	Separation from other DG storages	Dangerous reaction, heating, toxic fumes - possibility of increase in flammability of combustibles or spontaneous combustion	2	4	8	Tanks are separate from buildings containing DG's. Nearest DG depot is a cylinder store behind the tank compound. Only compatible gases are store.	1	1	1

4	Separation from water	Heating, spitting	1	1	1	Not relevant.	1	1	1
5	Separation from boundaries	Spill off site, potential for vandalism	2	2	4	Tank is in a locked compound. Risk of leak is greatest when tanker is delivering - supplier has procedures in place. Area has normal site security arrangements including CCTV.	1	2	2
6	Interaction with other dangerous goods	Violent reaction with heat and toxic reaction products - increase in flammability of combustibles	2	4	8	Incompatible DG stored away from tank. Nearest DG storage is cylinder store noted above.	1	2	2
7	Ignition sources	Fire/explosion	1	4	4	Ignition only relevant when flammables or combustibles present. Compound must be kept clear of accumulations of leaves and rubbish.	1	2	2
8	Ventilation and atmospheric emissions	Off site odours	1	1	1	Not applicable.	1	1	1
9	Contamination of food and personal products	Toxic effects to personnel	1	1	1	Not toxic. Appropriate PPE mandatory for tank filling operations. No eating or drinking in operational area. (Note that an oxygen enriched atmosphere can render clothing extremely flammable - refer Emergency Response Summary).	1	1	1

10	Construction of bulk containers	Tank leak or catastrophic failure	2	3	6	Tanks supplied and maintained by reputable supplier. Tanks to AS1210.	1	2	2
11	Impact damage	Catastrophic loss of containment	1	4	8	Tank located in a compound with no vehicle access, protected by walls, fencing and bollards.	1	2	2
12	Containment of spills	Potential environmental damage and personnel exposure. Oxidising effect.	1	4	4	Dissipation is correct method of spill management.	1	2	2
13	Transfer - overfill due to lack of ullage	Personnel exposure and / or loss of containment.	2	4	8	Fill limit is indicated by tri-cock situated at the fill point.	1	2	2
14	Transfer - leak	Personnel exposure and / or loss of containment.	2	4	8	Pump and pipework monitored during transfer. Dedicated fittings. Hardstand area provided and slopes away from tank enclosure.	1	2	2
15	Introduction of incompatible material	Violent reaction, loss of containment, personnel exposure to fumes, splashing if wrong gas delivered	2	3	6	Correct placarding, one supplier only, dedicated fittings. Locked compound.	1	2	2

16	Fire protection	Toxic decomposition and/or loss of containment, or overpressure due to impinging adjacent fire.	1	2	2	Refer Emergency Plan.	1	1	1
17	Emergency planning	Spill, chemical burn to personnel. Intensification of fire.	2	2	4	Refer Hospital Emergency Plan and specific Emergency Response Summary for this storage.	1	2	2
18	Confined space	Asphyxiation	1	4	4	Confined Space Entry Procedure would apply, but not likely as supplier would probably replace tank rather than attempt on site entry and repair.	1	2	2

Code of Practice: AS1894 Storage and handling of non-flammable cryogenic and refrigerated gases

Note: These tanks are filled and maintained by the gas supplier, so this assessment does not address such issues as valve identification, maintenance and inspections issues etc. which are handled by the supplier. Hospital staff are not involved in handling liquid oxygen at this location, so personal safety issues are also not covered, as these will be covered by the supplier's procedures for their delivery staff.

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Appendix 6 – Draft Emergency Response Summary

Date of Issue: 04/02/2018
Review date due: TBA
Issued by: Draft for comment

HORNSBY HOSPITAL

EMERGENCY RESPONSE PLAN
DANGEROUS GOODS INFORMATION

DANGEROUS GOODS DEPOT No.: **TBA**

DANGEROUS GOODS STORED IN THIS DEPOT:

Substance:	**Oxygen, Refrigerated Liquid**	CAPACITY:	1 x 30000 litres
UN No.:	1073		1 x 3000 litres
DG Class:	2.2/5.1	TYPICAL INVENTORY:	20000 litres
Hazchem:	2PE	SUPPLIER:	**BOC**
		SUPPLIER EMERGENCY CONTACT:	1800624006
		FIRE BRIGADE:	000

DEPOT DESCRIPTION: Above-ground tanks for **bulk liquid oxygen.**
Oxygen supply is reticulated.
Main medical oxygen supply for Hospital.

DESCRIPTION OF SURROUNDINGS:

Tanks are located in a compound off Derby Rd at Gate 8. Firewall to north, east and west. Fill points at the eastern end of the tank compound.

See reverse for emergency responses

Health
Northern Sydney
Local Health District

HORNSBY HOSPITAL

EMERGENCY RESPONSE PLAN

DANGEROUS GOODS DEPOT No.: **TBA**

EMERGENCY SCENARIO	MAJOR RISKS	ACTIONS BY FIRST RESPONDER	INFORMATION FOR EMERGENCY SERVICES
ADJACENT FIRE	Fire could cause overpressure in bulk tank, violent venting through pressure relief, or catastrophic tank failure (but tank failure is unlikely). Released oxygen will greatly accelerate combustion.	Evacuate area. RAISE THE ALARM (always raise the alarm before attempting fire fighting) IF SAFE TO DO SO, attack fire with extinguisher or water. If possible, cool heat-exposed side of tank. Make clear access for emergency vehicles. Provide manifest and emergency plan to Fireand Rescue Notify gas supplier and SafeWork.	Likely fire sources: vehicle fire on adjacent roads or vandalism.
LEAK OF LIQUID OXYGEN	Oxygen causes combustibles (even things like bitumen roads) to become extremely flammable. Strongly supports combustion.	Evacuate area including neighbouring houses. RAISE THE ALARM Do not allow motor vehicles to start or access the area. If safe to do so, use water mist to aid dispersion of gas. Notify gas supplier andSafeWork.	Most likely source of leak is transfer from road-tanker. Road tanker standing area is concrete pad immediately in front of tank.
PERSONNEL EXPOSURE to a leak	Frostbite, cold burns, hypothermia	Treat as burn. Tissue damage can be severe even for small exposures. Flush burns with unheated water. Advise medical staff of possibility of lung damage due to inhalation of cold vapour.	Cold vapour is heavier than air. Liquid oxygen will cause embrittlement of equipment and PPE. Oxygen enriched clothing is extremely flammable. If necessary to access enriched atmosphere, soak clothing in water prior to entry. See reverse for product and emergency info.

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Attachment 2 – Site Plan of Proposed Tank Compound (existing)

NOTES:
EXISTING SERVICES SHOWN INDICATIVELY AND FOR INFORMATION ONLY. CONTRACTOR TO REFER TO THIRD PARTY SURVEY AND OTHER RELEVANT AS-BUILT DOCUMENTATION FOR DETAILS

LEGEND:
- EXISTING PNEUMATIC TUBE, ø110
- NEW PNEUMATIC TUBE, ø110
- EXISTING MEDICAL GASES PIPEWORK
- NEW MEDICAL GASES PIPEWORK
- NEW DUCTWORK, ø200

ALLOW FOR THE DEMOLITION OF BUILDING 17 PALMERSTON BUILDING. PENDING CONFIRMATION FROM HI. DECOMMISSION AND REMOVE ALL REDUNDANT MECHANICAL SERVICES WITHIN THE BUILDING AND INCOMING SERVICES AS PART OF DEMOLITION WORKS IN STAGE 2 PHASE H

DECOMMISSION AND REMOVE ALL REDUNDANT MECHANICAL SERVICES WITHIN THE BUILDING AND INCOMING SERVICES AS PART OF DEMOLITION WORKS IN STAGE 2 PHASE H

EXISTING MEDICAL GASES PLANT AND CYLINDER STORE
EXISTING 15,000LTR AND BACK-UP 1,500LTR BULK OXYGEN TANKS
PROVIDE NEW 3,000LTR TANK TO REPLACE EXISTING 1,500LTR TANK

EXISTING MEDICAL GASES
50MM O2
40MM MA
32MM N2O

EXISTING MEDICAL GASES
50MM O2

EXISTING MEDICAL GASES IN TRENCH
50MM O2
40MM MA
32MM N2O
25MM TA
25MM CO2
25MM SPARE

EXISTING MEDICAL GASES IN TRENCH
50MM O2
40MM MA (SITE SUPPLY)
32MM N2O

EXISTING MEDICAL GASES ATTACHED TO EXISTING WALKWAY
50MM O2
40MM MA (SITE SUPPLY)
32MM N2O

EXISTING MEDICAL GASES
32MM O2
32MM MA (SITE SUPPLY)

EXISTING MEDICAL GASES
32MM O2
32MM MA (SITE SUPPLY)
20MM N2O

EXISTING MEDICAL GASES
32MM O2
32MM MA (SITE SUPPLY)
20MM N2O

EXISTING MEDICAL GASES IN TRENCH SERVING GEORGE LUMBY UNIT
32MM O2
32MM MA (SITE SUPPLY)
20MM N2O

EXISTING MEDICAL GASES
32MM O2
32MM MA (SITE SUPPLY)
20MM N2O

DECOMMISSION AND REMOVE ALL REDUNDANT MECHANICAL SERVICES WITHIN THE BUILDING AND INCOMING SERVICES AS PART OF DEMOLITION WORKS IN STAGE 2 PHASE H

EXISTING ICU PNEUMATIC TUBE STATION

PROVIDE NEW MEDICAL GAS CONNECTION TO EXISTING MEDICAL GASES SERVING BUILDING 2
32MM O2
32MM MA
20MM N2O

EXISTING PNEUMATIC TUBE SERVING ICU AND COLLECTIONS

EXISTING MEDICAL GASES IN TRENCH
32MM O2
32MM MA (SITE SUPPLY)
20MM N2O

EXISTING EMERGENCY OXYGEN SUPPLY PANEL, INSTALLED WITH STAR BUILDING
25MM O2

EXISTING PNEUMATIC TUBE RISES SERVING ABOVE FLOORS

EXISTING PNEUMATIC TUBE SERVING PATHOLOGY

EXISTING PNEUMATIC TUBE DIVERTER STATION

EXISTING PNEUMATIC TUBE SERVING FLOOR ABOVE

EXISTING PNEUMATIC TUBE PLANTROOM SERVING STAR BUILDING ZONE 1

EXISTING MEDICAL GASES IN CORRIDOR VALVED FOR MEDICAL IMAGING
32MM VAC
32MM O2
32MM MA
25MM N2O

EXISTING MEDICAL GASES PLANROOM
80MM VAC
25MM N2O MANIFOLD

PROVIDE DUCTWORK AND SUPPLY DIFFUSER IN CORRIDOR, BRANCH OFF EXISTING DUCTWORK

EXISTING PNEUMATIC TUBE SERVING MEDICAL IMAGING AND PAEDIATRICS (PROVIDED BY EARLY WORKS PACKAGE)

EXISTING MEDICAL GASES SERVING DEMOUNTABLE
32MM VAC
20MM O2
20MM MA
15MM N2O

EXISTING MEDICAL GASES SERVING EMERGENCY DEPARTMENT
25MM O2
25MM MA
20MM N2O

PROVIDE NEW 4-WAY DIVERTER STATION TO REPLACE EXISTING CONNECTS TO EXISTING PNEUMATIC TUBE

DECOMMISSION AND REMOVE ALL REDUNDANT MECHANICAL SERVICES WITHIN THE BUILDING AND INCOMING SERVICES AS PART OF DEMOLITION WORKS IN STAGE 2 PHASE H

DECOMMISSION AND REMOVE ALL REDUNDANT MECHANICAL SERVICES WITHIN THE BUILDING AND INCOMING SERVICES AS PART OF DEMOLITION WORKS IN STAGE 2 PHASE H

NEW ICT ROOM WITHIN ED EXPANSION TO BE ESTABLISHED AND OPERATIONAL BEFORE REMOVAL OF EXISTING HOPE BUILDING COMMS ROOM

PROVIDE NEW DIVERTER STATION TO SERVE ICU/COLLECTION STATIOS. USE EXISTING PNEUMATIC TUBE WHERE POSSIBLE.

EXISTING PHARMACY COLLECTIONS PNEUMATIC TUBE STATION

DERBY ROAD
LOWE ROAD
PALMERSTON ROAD
LEIGHTON LODGE (6)
PALMERSTON BUILDING (17)
COMMUNITY HEALTH (14)
ENGINEERING (24)
MASONIC TOWERS (9)
DENTAL (10)
EPIS (25)
SHED (45)
HYDRO POOL (30)
CHAPEL (32)
OT (43)
FLORIST (43)
MHICU (29)
ROFE
LIBRARY (3)
LUMBY BUILDING (4)
RADIOLOGY (2)
MENTAL HEALTH CENTRE (52)
ICU
PHARMACY (1)
MULTI-STOREY CAR PARK
AAU
PILLAR Y
PILLAR B
PILLAR D
STAR BUILDING (26)
BURDETT STREET
HOPE BUILDING (50)
DEMOUNTABLE
CHILD CARE (93)
AUDIOLOGY (31)

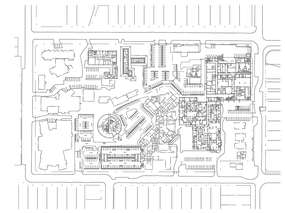
STATUS
DESIGN DEVELOPMENT

NOTES

AMENDMENTS

REV	DESCRIPTION	DATE
A	TENDER ISSUE	15.09.2017
B	TENDER ISSUE	28.09.2017

KEY PLAN



FOR TENDER
THIS IS NOT A WORKSHOP DRAWING
NOT FOR CONSTRUCTION. IT IS THE CONTRACTORS RESPONSIBILITY TO COMPLETE DESIGN FINALISATION AND TO PROVIDE CONSTRUCTIONAL DIMENSIONED WORKSHOP DRAWINGS IN ACCORDANCE WITH THE RELEVANT SECTIONS IN THE SPECIFICATION

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PROJECT
HORNSBY KU-RING-GAI HOSPITAL
STAGE 2
PALMERSTON ROAD HORNSBY 2077

DRAWING TITLE
MECHANICAL SERVICES
SITE PLAN

0 25m 50m

A0

CREATED	DRAWN	DESIGNED	CHECKED
MAY'17	PSC	AB	MH

APPROVED	SCALE	NORTHPOINT
MH	1 : 500	

PROJECT No.	DRAWING No.	REVISION
14792	SV-ME-S2-DD1002	B

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Attachment 3 – Site Plan of Proposed Tank Compound with Stage 2 Building

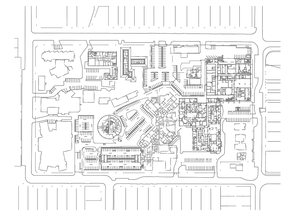
STATUS

DESIGN DEVELOPMENT

NOTES

AMENDMENTS		
REV	DESCRIPTION	DATE
A	TENDER ISSUE	15.09.2017
B	TENDER ISSUE	28.09.2017

KEY PLAN



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STEENSEN VARMING

PROJECT
HORNSBY KU-RING-GAI HOSPITAL
STAGE 2
PALMERSTON ROAD HORNSBY 2077

DRAWING TITLE
MECHANICAL SERVICES
FUTURE SITE PLAN

0 5m 10m

A0

CREATED	DRAWN	DESIGNED	CHECKED
MAY'17	TFS	AB	MH

APPROVED	SCALE	NORTHPOINT
MH	1 : 500	

PROJECT No.	DRAWING No.	REVISION
14792	SV-ME-S2-DD1003	B

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