Safety Engineering & Technical Services Pty Ltd

WORK HEALTH, SAFETY & ENGINEERING CONSULTANTS

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19 July 2018

The Manager
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Exchange Place
300 Barangaroo Avenue
BARANGAROO NSW 2000

Attention: Ms Anja Niewolik – Design Manager, Healthcare & Scientific Research
Mr James Callaghan - Site Engineer – Randwick Hospital Redevelopment

Dear Sir

re: Hazardous Chemicals (Dangerous Goods) Matters – Advice on the Facilities for Storing and Handling of Hazardous Chemicals/Dangerous Goods for the Proposed Acute Services Building Project, Prince of Wales Hospital, Randwick

Further to my fee proposal of 24 June 2018, I have pleasure in remitting this advice on hazardous chemicals/dangerous goods storage and handling facilities for the 'ECI/Planning' phase for the proposed Acute Services Building ("ASB") at Prince of Wales Hospital at Randwick.

Scope for preparing this advice

This draft report has been prepared in accordance with the following agreed scope of works for the ECI/Planning Phase of the project:

- conduct an initial review of documents provided in respect of the project
- prepare an opinion on whether State Environmental Planning Policy No 33 – *Hazardous and Offensive Development* (SEPP 33) applies to the proposed development
- provide a draft report on the proposed facility design:
  - identifying compliance issues;
  - confirming the nature and quantities of dangerous goods being stored, handled, and used at the proposed ASB building; and
  - describing the requirements for the design and construction of the Facility in order to comply with the mandatory requirements of workplace health and safety legislation.

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CONTEXT

The proposed Acute Services Building is to be constructed to the west of the existing hospital buildings that accommodate the Sydney Children's Hospital and the Royal Hospital for Women, with functional bridge links being provided to integrate the activities of the existing hospital and the proposed ASB. I have been instructed that the proposed ASB will provide the following facilities:

- Adult Emergency on Level B2
- Offices and Cold Shell Space on Level B1
- Admission Centre, Cafe and retail precinct on Ground level
- Operating theatres, on Level 1
- Plant/Services and Clinical Sterilising Department on Level 2
- Intensive Care Unit and Medical Assessment Unit on Level 3
- Haematology, Oncology, Aged Care and Acute on Level 4
- Acute Aged Care on Level 5
- Day Surgery on Level 6
- Acute Spinal, Acute Respiratory, & Respiratory/Infectious Diseases on Level 7
- Stroke, NeuroSciences on Level 8
- Fire Service, Cooling Water and Calorifier on Level 9
- Helipad on Level 10, and
- Lift Machine Room on Level 11.

Nature and quantities of dangerous goods to be stored and handled at the Prince of Wales ASB

A manifest of dangerous goods present at the premises has been developed (see Appendix A) noting those that are above placard quantities (as prescribed in Schedule 11 of the NSW *Work Health and Safety Regulation 2017).*

The dangerous goods described in Appendix A include:

- quantities of compressed oxygen in cylinders – in multiple-element gas containers (MECG) where G-size cylinders are connected via a manifold into a 'bank', or small portable ready use single cylinders (C of CD-size of about 3 L water capacity each) – total aggregate maximum quantity – 8,000 L water capacity
- a quantity of nitrous oxide (again G-size cylinders assembled into MECG packs) and tool air (also G-sized cylinders in MECG packs) – total aggregate quantity – 5,000 L water capacity
- other G-size cylinders of compressed non-flammable gases (carbon dioxide, argon, and helium) – 500 L water capacity
- a small quantity of ethylene oxide –a Division 2.3/2.1 (toxic) - a toxic & flammable gas in sealed cannisters - (gas content of 170 g - < 10 kg in aggregate

- Class 3 flammable liquids in small quantities – maximum aggregate quantity of 100 L – mixture of PG II & III,
- a small quantity (< 20 L in aggregate) of Class oxidising substances of PG III used for equipment sterilization,
- Class 6.2 infectious substances – the maximum quantity of clinical waste (cytotoxic and anatomical wastes) to be kept at the ASB can be managed through the frequency of pickups so that the total of wastes kept will not exceed 250 kg, and
- a small quantity of corrosive substances (< 50 L in aggregate of PG III) – used for cleaning.

No radioactive wastes of Class 7 (radioactive substances) are to be generated or kept in the building.

PLANNING/DEVELOPMENT MATTERS

A critical element of the process for preparing this report, is the review of matters particularly referred to in Regulation 228 sub-clauses (j), (l), and (m) of the *Environmental Planning & Assessment Regulation 2000.* These sub-clauses require assurance that the proponent has properly considered specific hazards in the design of the facilities so that they are fit-for-purpose and adequate to maintain an acceptable level of safety. It is part of a process for ensuring that all the implications of the intended usage of hazardous chemicals are fully described before any consent is granted.

The proposed ASB including its operations and facilities that are the subject of a current Development Application, do not fall within any of the Schedule 3 activities prescribed as being designated development, pursuant to the *Environmental Planning & Assessment Regulation 2000.*

Notwithstanding that the proposed facilities are not designated development, certain high hazard activities are additionally required to undergo a more rigorous process of safety assurance than others of inherently lower risk potential, as part of the development consent process.

These high hazard activities are identified by a screening process pursuant to a planning instrument. All development proposals are required to determine whether SEPP 33 applies.

The Applicability of SEPP 33 to the ASB

SEPP 33 is an enabling instrument that links safety and pollution control performance, to the permissibility of an industrial proposal.

SEPP 33 applies to proposals that fall under the policy's definition of:

- '**potentially hazardous industry**' - where the quantities of dangerous goods or transport movements involving dangerous goods exceeds the threshold limits described in the document *Applying SEPP 33*, or
- '**potentially offensive industry**' - a proposal that, in the absence of safeguards, would emit a polluting discharge which would cause a significant level of offence.

Assessing whether a proposal is potentially hazardous industry

The screening process relies on a sorting procedure related to the nature and quantity of dangerous goods present on the site of the proposed development.

Dangerous goods are a group of substances that have been recognised as having some immediate public safety threat due to their hazardous properties. Dangerous goods have been listed in a number of national and international publications (in Australia this list is set out in the *Australian Dangerous Goods Code* – currently in the 7th edition - version 7.5).

A system of classification and labelling of dangerous goods has been adopted by Australia which is consistent with systems used throughout most of the world. This system has been devised to help people quickly recognise dangerous goods and their properties and hazard potential.

All dangerous goods that are handled or transported must be accurately classified into classes that reflect their characteristics (it being the responsibility of the manufacturer or importing agent to ensure that the dangerous goods are accurately classified).

Dangerous goods are divided into nine '**classes'** (and in the case of dangerous goods of Classes 1, 2, 4, 5 and 6 these classes are further subdivided into '**divisions**'). Each 'class group' is comprised of substances which have similar properties or hazards. Goods having more than one hazardous property are classified under their primary class and where they have some additional hazard, they are also assigned a '**subsidiary risk**' – an example in the CSSD space of the ASB is ethylene oxide

sterilant gas that is assigned to Class 2, Division 2.3 (toxic) with a subsidiary risk of Division 2.1 since it has a flash point below the threshold for flammability.

Substances within Classes 3, 4, 5, 6 and 8 are further subdivided into **Packing Groups** (abbreviated as PG) to indicate their relative inherent risk (PG I - high risk, PG II - moderate risk, and PG III - least risk).

The various dangerous goods classes are:
Class 1 – Explosives - are substances and articles used to produce explosions or pyrotechnic effects.

Class 2 – Gases - includes gases which are compressed, liquefied or dissolved under pressure. Some gases have subsidiary risk classes (i.e. other risk characteristics such as 'flammable' or 'corrosive'):

- Division 2.1 - Flammable gases are gases which ignite on contact with an ignition source (such as acetylene, hydrogen, LP gas)
- Division 2.2 - Non-flammable gases are gases which are neither flammable nor poisonous (such as oxygen, nitrogen, medical air, argon)
- Division 2.3 - Poisonous gases are gases liable to cause death or serious injury to human health if inhaled - such as ammonia, chlorine, carbon monoxide

Class 3 - Flammable liquids – are liquids which can be ignited and will burn on contact with ignition sources

C1 & C2 combustible liquids – are liquids that will burn (often fiercely) when they are heated and ignited – C1 combustible liquids are of relatively lower flashpoint and include liquids such as diesel fuel, olive oil and other vegetable oils while C2 combustible liquids have a high flashpoint and include substances such as lubricating and hydraulic oils

Class 4 - Flammable Solids – are solids that have characteristics that pose a risk of fire and/or explosion and includes:

- Division 4.1 - flammable solids that are easily ignited and readily combustible - such as nitrocellulose, phosphorus, matches, hexamine;
- Division 4.2 - spontaneously combustible substances - such as aluminium alkyls, white phosphorus);
- Division 4.3 - substances emitting a flammable gas when wet, or which react violently with water (such as aluminium phosphide, calcium carbide).

Class 5 – Oxidising substances – are substances that can promote or exacerbate the effect of fire and include

- Division 5.1 - Oxidizing agents other than organic peroxides (such as calcium hypochlorite (pool chlorine), ammonium nitrate, hydrogen peroxide); and.
- Division 5.2 - Organic peroxides - liquid or solid - (such as methyl ethyl ketone peroxide, benzoyl peroxides, cumyl hydroperoxide).
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Class 6 – Toxic and Infectious Substances - (this classification does not include poisonous gases), and are further classified as being either:

- Division 6.1 - Toxic substances - which may be liquids or solid) and which are liable to cause death or serious injury to human health if inhaled, swallowed or absorbed through the skin (such as cyanides, arsenic compounds), or which are harmful to human health (such as low toxicity pesticides).
- Division 6.2 – are Infectious substances (such as vaccines, pathology specimens).

Class 7 – Radioactive Substances – are substances that either alone, or in a combination of substances, emit ionising radiation (such as uranium, radioisotopes).

Class 8 – Corrosives - are substances (either solids or liquids) which may harm living tissue or damage equipment - such as hydrochloric acid, sodium hypochlorite (liquid pool chlorine), sodium hydroxide, and lead acid batteries.

Class 9 - Miscellaneous Dangerous Goods - are substances that are not classified elsewhere but which are known to have a safety risk when being transported - such as molten naphthalene, molten bitumen, polyester beads, and lithium batteries.

Findings arising from the presence of dangerous goods being stored and handled at the ASB at PoW Hospital

Table 2 overleaf shows the outcome of applying the screening method from *Applying SEPP 33* for the quantities of dangerous goods listed in Appendix A.

SEPP 33 applies if	**SEPP 33 Threshold**	**Actual**
Class 2 non-flammable gases, non-toxic gases, and cryogenic liquids exceed limit described in Appendix 4 - Table 3 in *Applying SEPP 33*	No limit is set	SEPP 33 - does not apply
Class 2, Division 2.3 toxic gases exceed the threshold limit as described in Appendix 4 -Table 3 in the section Risk Screening in the document *Applying SEPP 33*	100 kg limit	Maximum 10 kg of ethylene oxide – SEPP 33 does not apply
Class 3 dangerous goods (flammable liquids) exceed the lower threshold limit) and are not sufficiently separated from the boundary by the distance given in the section Risk Screening - Figure 9 of the document *Applying SEPP 33*	Lower threshold of 5 tonnes (assuming goods are of PG II & III)	Less than 100 L maximum - Quantities below SEPP 33 threshold limit - SEPP 33 does not apply
C1 combustible liquids (Class 3 Category 4 as defined by GHS)	No limit is set	SEPP 33 - does not apply
Quantity of goods of Class 4 substances exceeds threshold limit	Threshold quantities: • 1 tonnes	None reported - SEPP 33 does not apply
Quantity of goods of Class 5.1 substances exceeds threshold limit	Threshold quantities: • 5 tonnes	Only small quantity (< 20 L) reported - SEPP 33 does not apply
Quantity of goods of Class 5.2 substances exceeds threshold limit	Threshold quantities: • 10 tonnes	None reported - SEPP 33 does not apply
Quantity of goods of Class 6.1 exceeds threshold limit	Threshold quantities: • 0.5 tonnes for PG I; • 2.5 tonnes PG II/III	Less than 2 kg - Quantities below SEPP 33 threshold limit - SEPP 33 does not apply
Quantity of goods of Class 6.2 exceeds threshold limit	Threshold quantities: • 0.5 tonnes	Maximum quantity 250 kg - Quantities below SEPP 33 threshold limit - SEPP 33 does not apply
Quantity of goods of Class 8 exceeds threshold limit	Threshold quantities: • 5 tonnes for PG I • 25 tonnes PG II; • 50 tonnes PG III	Only small quantity (< 50 L in aggregate) – Quantities below SEPP 33 threshold limit - SEPP 33 does not apply

Table 2 – Applicability of SEPP 33 for potentially hazardous industry

When assessing the impact of transport movements involving dangerous goods:

SEPP 33 applies if	SEPP 33 Threshold	Actual
Number of significant transport movements meeting the specified criteria are exceeded	Number of traffic movements of dangerous goods greater than 1 tonne capacity exceed the frequencies set in the screening threshold	It is not expected that there will be any transport movements of loads greater than 1 tonne capacity - SEPP 33 does not apply

Table 2 – Applicability of SEPP 33 for potentially hazardous industry

(continued)

Assessing whether a proposal is potentially offensive industry

The primary consideration in assessing whether any proposal falls within the 'potentially offensive industry' category is whether the consent authority is satisfied that there are adequate safeguards to ensure that any emissions from a facility can be controlled to a level at which they are not significant. Where proposed activities do not require a licence pursuant to *Protection of the Environment Operations Act 1997*, or where they do require a licence but in the opinion of the environmental regulator the proponent can fully meet its licence requirements, a proposal is not deemed to be 'offensive industry'.

I am advised that no licence is required pursuant to Chapter 3 of the *Protection of the Environment Operations Act 1997* hence the proposed development is not potentially offensive industry in accordance with the screening method for the application of SEPP 33.

Conclusion on the applicability of SEPP 33

As a consequence of being neither potentially hazardous nor potentially offensive industry, SEPP 33 does not apply to the proposed Acute Services Building.

SOME FURTHER COMMENTS ON THE PROPOSED STORAGE, USE AND MANAGEMENT OF DANGEROUS GOODS AT PoW ASB

The design of the facilities for the receiving, storage, handling and use of hazardous materials, and the proposed activities of the Acute Services Building will be in accordance with:

- the National Construction Code 2017
- the NSW *Work Health and Safety Act* 2017 and the Work *Health and Safety Regulation 2017* (particularly Chapter 7 – *Hazardous Chemicals)*
- the various standards relating to the storage and handling of specific classes of dangerous goods, including:

- AS 1894-1997 *The storage and handling of non-flammable cryogenic and refrigerated liquids*
- AS/NZS 4332-2004 *The storage and handling of gases in cylinders*
- AS 1940-2004 *The storage and handling of flammable and combustible liquids*
- AS/NZS 4452-1997 *The storage and handling of toxic substances*
- AS 3780-2008 *The storage and handling of corrosive substances, and*
- AS/NZS 4681-2000 *The storage and handling of Class 9 (miscellaneous) dangerous goods and articles*

- standards covering the classification of hazardous areas that describe the spaces from which ignition sources must be excluded, particularly
  AS/NZS 60079.10.1- 2009 Explosive Atmospheres – *Part 10.1 : Classification of areas – Explosive gas atmospheres (IEC 60079-10-1, Ed. 1.0(2008) MOD)*
- the *Code of Practice – Managing risks of hazardous chemicals in the workplace – July 2014* – WorkCover NSW.

REQUIREMENTS FOR THE SAFE STORAGE OF THE HAZARDOUS CHEMICALS TO BE KEPT IN THE PROPOSED PoW ASB

As stated earlier, the listing of dangerous goods depots to be provided at the ASB is attached to this advice (as Appendix A).

Each of the appropriate design standards for a specific class of dangerous goods (other than those goods to be kept in bulk storage arrangements such as tanks), provides for a break point between what is termed ‘Minor Storage’, and ’package’ or ‘cylinder’ storage, where these quantities are exceeded.

Storage of gases

The Minor Storage limits for gases in cylinders, are:

- Division 2.1 (flammable gases) – 500 L cylinder water capacity (about 10 x G-size)
- Division 2.2 (compressed non-flammable gases) - 2,000 L water capacity (“w.c.) (about 40 x G-size)
- Division 2.2, Sub-Risk 5.1 oxidising gases – 1,000 L w.c. (about 20 x G size), and
- Division 2.3 toxic gases – 50 L w.c. (1 x G-size cylinders),

with additional limitations that not only must these sub-class limits not be exceeded, the aggregate quantity is not to exceed 2,000 L, and that the total capacity of cylinders of gases within a building are not to exceed a single minor storage limit in any 200 m^2 of floor area.

The design of each gas store where cylinders in an aggregate quantity less than Minor Storage threshold limits must conform with the requirements of Section 2 of AS 4332-2004, including:

- ensuring that the cylinders are kept away from any artificial sources of heat, e.g. radiators, boilers or steam pipes, clear of combustible materials, vegetation and refuse for a distance of not less than 3 m from any cylinder
- all cylinder stores shall be provided with adequate ventilation at all times - the ventilation system shall—
  (i) be capable of diluting and removing any vapour or gas from the store to levels within workplace exposure limits and below any possible explosive levels;
  (ii) provide sufficient fresh air from the outside to reduce any risk of asphyxiation;
  (iii) ventilate the atmosphere within the store, at both high and low levels relative to the floor; and
  (iv) ventilate or mechanically exhaust directly to the outside, to a location away from building entrances, doors or windows, air conditioning intakes, sources of ignition and areas where people are likely to congregate.
- different divisions of gases must be segregated within the store, but need not be separated.
- the floor is to be flat, solid, and constructed from non-combustible materials – it is to drain away from the cylinders
- stores of Class 2 gases in cylinders shall be separated from other dangerous goods stores by a minimum distance of 3 m and be located not less than 1 m from any door, window, air vent or duct - the indoor use and storage of gas cylinders is to be avoided wherever possible.
- where it is impractical to provide an outdoor cylinder store, the keeping of cylinders indoors shall be restricted (the total capacity of gas in cylinders allowed for any particular indoor location shall include cylinders in use, spare cylinders not in use, and used cylinders awaiting removal; the total capacity of the gases kept shall not exceed one minor storage quantity per 200 m^2 of floor area)
- Minor Stores having an aggregate capacity of less than 1000 L (i.e. 20 x G-size cylinders) may be protected with a single, permanently connected water hose, provided that it is capable of depositing water on any part of the store – stores with an aggregate capacity of > 1,000L up to 2,000 L water capacity must be provided with a hose-reel
- while no fire resistance level (“FRL”) is specified for separation between a Minor Store and other occupancies within a building footprint, good practice is to provide any separation walls with a minimum FRL of 120/120/120 – in the interests of future-proofing where the Minor Storage limit may be exceeded, such walls would be required to have an FRL of 240/240/240.

For gas cylinder stores in excess of minor storage limits, the different Divisions of gases must be separated into separate stores for each Division (in the case of the ASB, the inventory is composed of divisions 2.2 and 2.2/5.1) .

Separation distances are dependent on the quantity of cylinders (for quantities of Class 2.2/5.1, the maximum separation distance is likely to be a minimum of 5 m).

The ventilation requirement (that applies to both Minor Storage quantities and quantities in excess of Minor Storage) can be met by either—

(i) a natural ventilation system, as specified in Clause 4.3.2 of AS 4332-2004; or

(ii) a mechanical ventilation system, as specified in Clause 4.3.3.

A naturally ventilated store complies if it is designed so that:

- there are two opposing external sides that are open from floor to ceiling
- one external side is open, provided that the length of the open side is at least twice the distance of that wall from the opposite side
- vents have been provided in at least one pair of opposing external sides provided that—
  - (i) the distance between the opposing external walls does not exceed 10 m;
  - (ii) in every two metre length of the opposing external walls, there are at least two vents; one positioned immediately above the floor and the other positioned immediately below the ceiling;
  - (iii) the total area of the vents per metre length of wall shall be at least 0.1 m^2; and
  - (iv) the vents shall be evenly distributed.

Any nearby embankments, excavations or retaining structures must not compromise the effectiveness of a natural ventilation system.

The design for any mechanical ventilation system must meet the following requirements:

- exhaust ventilation must be provided.
- the minimum system capacity is required to be
  - for stores in which cylinders are kept but no gases are transferred..... 0.005 m^3 per sec per m^2 of floor area, or
  - for stores where gases are transferred.....0.0075 m^3 per sec per m^2
- the air velocity at the air entry register shall be at least 5 m/s.

- where localised exhaust ventilation is used, not more than 75% of its capacity can be located at any one point - at least 25% of the capacity shall be available to ventilate the remainder of the store.
- any air intake or exhaust duct shall terminate in the open air, at distances of at least—
  - 2 m from any opening to a building;
  - 4 m from the outlet of any chimney or flue; and
  - 3 m above the ground.
- the ventilation system needs to be designed such that it operates:
  - continuously; or
  - for sufficient time to allow two complete air changes before entry.

The inventory requirement for the ASB project includes a small volume of cryogenic nitrogen (up to say 30 L). The minimum ventilation for a shared cryogenic/compressed cylinder store with more than 30 L of liquefied gas would have to have a rate of at least 10 m^3/min per 1,000 m^3 of vessel full gas volume, in the event that this was greater quantum requirement than would otherwise be required for compressed gas storage as described earlier in this advice.

Storage of flammable liquids

The facilities for storing flammable liquids are required to comply with AS 1940-2004 *The storage and handling of flammable and combustible liquids*.

There are two 'permitted' storage 'regimes' for packaged flammable liquids:

- 'Minor Storage'; and
- storage within a purpose designed facility (either a flammable liquid cabinet, or in a flammable liquid package store).

The Minor Storage limits for flammable liquids within Hospitals laboratories is 10 L per 50 m^2 of floor area for the aggregated quantity of PG I & PGII, plus 25 L per 50 m^2 of floor area of PG III. Additionally, where viscous liquids or gels and hand wipes (referred to as 'manufactured product' in AS 1940-2017) are kept as part of the inventory, a further component of such manufactured product may also be kept (10 L for PG I & PG II, and 25 L of PG III) .

These limits are set deliberately low so as to encourage keeping any significant quantities of flammable liquid in either an approved cabinet, or a compliant with (AS 1940) store.

Flammable liquid storage in approved cabinets

AS 1940 permits cabinets of up to 850 L capacity per 250 m^2 of floor area on a ground floor and 250 L per any 250 m^2 of floor area.

Ventilation of cabinets is usually not required (nor is it generally desirable).

Requirements for a flammable liquid package store

Stores are required to comply with Section 4 of AS 1940-2004.

Construction must meet the requirements of Section 4.4 of AS 1940-2004 including having a spillage containment capacity of 25% of the maximum store capacity, plus the volume of the largest container to be kept, plus the output of the discharge from any fire sprinkler system for 20 minutes of operation.

While in some instances natural ventilation may be an option, it is very likely that any purpose-built flammable liquid storage room would require mechanical ventilation as described in Clause 4.5.5 of AS 1940-2004, as follows.

4.5.5 Mechanical ventilation

Any mechanical ventilation system for package stores containing flammable liquids shall
comply with the requirements set out below:

(a) The termination points within the room for both the fresh air supply and the draw-off ducts shall be—

(i) immediately above the upper limit of the spillage compound; and
(ii) on opposite walls.

The distance between any two inlets or any two outlets shall not exceed 5 m.

NOTES:

1 *It is recommended that the outlets be located along the longest side of the building for optimum effect.*
2 *If a single fan system is adopted, the fan should be in the exhaust duct.*
3 *The air supply may be in the form of natural ventilation in an external wall at low level, as described in Clause 4.5.4.1.*

(b) If the ventilation system incorporates fans on both the supply and exhaust ducts, the capacities of the fans shall be so adjusted that the room is under negative pressure.

NOTE:

The capacities of the fans on the exhaust ducts should be greater than those on the supply ducts.

(c) The system shall be capable of exhausting 0.3 m^3 per square metre of floor area per minute or 5 m^3/min, whichever is the greater, and the air velocity at the air supply outlet shall exceed 300 m/min.

NOTE:

Vapours from flammable liquids are heavier than air, so the ventilation system should be designed to scavenge vapours from the lower parts of the store

(d) The system shall be provided with an airflow failure-warning device.

(e) Any intake or exhaust duct shall terminate in open air at least 2 m from any opening into a building, or 4 m from the outlet of any chimney or flue and 3 m above the ground. The external termination of any inlet duct shall be at least 5 m from the external termination of any exhaust duct.

(f) Any duct that passes through a building other than the storage area shall be constructed of or protected by material having an FRL of at least −/180/180.

NOTE:

A common enclosure may be used for both intake and exhaust ducts.

(g) The system shall be designed so that it operates—

(i) continuously; or

(ii) whenever work is being carried out in the store; or

(iii) whenever a person is in the store.

(h) Fans shall be suitable for hazardous areas. Relevant potential ignition sources, e.g. frictional sparking, static electricity and hot spots, shall be taken into account when selecting and installing fans (see also AS/NZS 2381.1, AS/NZS 1020 and AS/NZS 2430 series – now AS/NZS 60079.10.1-2009). Fan blades and nearby components shall be made of materials that have minimal potential for giving off sparks when struck.

NOTE:

Materials known to be unsatisfactory are steel with steel, or steel with aluminium or aluminium-magnesium alloys.

Any electrical installation within a deemed hazard zone would need to be specified to Zone 2 standard if only closed packages are store and handled, or Zone 1 if packages are opened and decanted.

Emergency Generating Sets Fuel Storage

It is proposed to install 3 generating sets fuelled by diesel distillate (a C1 combustible liquid – GHS classification Class 3 flammable liquid Category 4), each provided with its own 1,000 L day tank, with a reserve tank of 15,000 L capacity installed in a tank chamber.

The maximum capacity for the indoor storage of C1 combustible liquids in tanks inside a building is limited to 1,000 L (multiple 1,000 L tanks are allowed provided that they 3m apart), unless the tanks are installed below lowest floor level, or installed in a tank chamber having a fire rating (FRL 240/240/240) and spillage containment (bunding).

The bulk reserve tank is to have integral secondary containment as allowed by AS 1940-2004.

Battery charging area

When lead acid batteries are being charged (especially where there is any possibility of their being overcharged), hydrogen gas (a highly flammable lighter-than air gas that is readily ignitable) may be involved in sufficient quantities to form an explosive mixture in air.

Any battery charging area is to be well ventilated, particularly at ceiling height above any charging battery, to prevent any accumulation of hydrogen.

Radiation hazards

Diagnostic and clinical treatment radiation equipment will be co-located with the Emergency Department.

When the equipment is specified, a radiation consultant will be engaged by the proponent. Once the selection of diagnostic imaging equipment has been finalised, an expert report of the shielding requirements for the structure internally and surrounding this department will be prepared for coordination with the project manager.

Shielding requirements for imaging equipment is make/model dependant and is identified and specified by the equipment suppliers. The proponent will follow all the shielding guidelines nominated by the equipment supplier/s and as recommended by the radiation consultant.

The design will be developed so as to fully comply with the following Australian Standards:

- AS/NZS IEC 6061.1.3- 2015 *Medical electrical equipment, Part 1.3: General requirements for basic safety and essential performance – Collateral standard: Radiation protection in diagnostic X-ray equipment*
- AS 2814-1985 - *Diagnostic X-Ray facilities – Safe practices* (reference only – standard withdrawn)
- AS 1319 – 1994 - *Safety signs for the occupational environment.*
- AS 2243.4 – 2018 - *Safety in laboratories. Part 4: Ionizing radiations*
- AS/NZS 4173:2018 - *Safe use of lasers and intense light sources in healthcare*
- AS/NZS 4543.1:1999 - *Protective devices against diagnostic medical X-radiation. Part 1: Determination of attenuation properties of materials.*
- AS/NZS 4543.2:1999 - *Protective devices against diagnostic medical X-radiation - Part 2: Protective glass plates.*

Adherence to these standards and to those listed earlier in relation to dangerous goods safety, ensures that the facilities and activities at the ASB will be in accordance with best-practice achievable for a bio-medical clinical facility, and will secure an acceptable level of safety.

GENERAL CONCLUSION

As stated earlier in this advice, based on the information provided to me as described in this report, it is my opinion that SEPP 33 does not apply to the proposed ASB at Randwick.

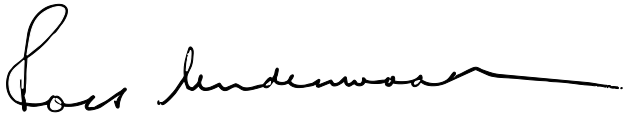
Further, the proposed facilities for the storage, handling and use of hazardous chemicals, will be when designed and constructed in compliance with the advice provided in this report, satisfy relevant legislative requirements.

This is consistent with best practice principles for the management of risk to health and safety posed by the materials to be kept and used. It will therefore secure a level of safety and environmental performance described in the relevant standards and codes of practice applying to clinical facilities, thereby meeting deemed compliance obligation pursuant to relevant statutory instruments and obligations.

Should you need to clarify any of this advice, or raise any other issues, I would be happy provide further assistance.

I thank you for the opportunity to provide advice in these matters.

Yours faithfully
Safety Engineering & Technical Services Pty Ltd



Ross Underwood, MIEAust, CPEng, MSIA, MAIDGC
General Manager

DISCLAIMER

This opinion in relation to the compliance of the proposed facilities to be provided at the ASB to be associated with the Prince of Wales Hospital, Randwick was prepared impartially, and the assessment completed independently, by Safety Engineering & Technical Services Pty Ltd. The report reflects our best judgement based on the information available at the time of preparation. Any use that any party makes of the documentation, however, is the responsibility of such party. Safety Engineering & Technical Services Pty Ltd accepts no responsibility whatsoever for damages (if any) suffered by any party in reliance on information contained in this report.

APPENDIX A List of dangerous goods storage depots at the proposed ASB

Room Name/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments	Actions
Level B2 (-02) -Loading Dock/Service Area						
Emergency Generator Set reserve fuel tank [97.B2.009]	C1 [GHS Class 3, Category 4]	n/a	Diesel	15,000 L	• tank has integral secondary containment • inner shell constructed to AS 1692	• tank spacing from oxygen store must exceed 5 m - the greater of 5 m (as specified in AS 4332-2004) or 3 m (as required by AS 1940-2017)
Emergency Generator Room	C1 [GHS Class 3, Category 4]	n/a	Diesel	3 x 1,000 L fuel day tanks	• Each generator set has a dedicated fuel day tank	• AS 1940-2017 requires that each 1,000 L tank is separated from any other tank by at least 3 m
Roofed gas cylinder store – compressed non-flammable and oxidising gases [ST-GAS BOT – 97.B2.009]	2.2 & 2.2/5.1	-	Cylinders of tool air, carbon dioxide, argon, helium (all Class 2.2) and nitrous oxide (Class 2, Division 5.1)	5,500 L water capacity of which 1,350 L would be Class 2.2, Division 5.1	• primary supply of nitrous oxide used as an anaesthetic gas (27 x G size cylinders – having a water capacity of 1,350 L) • tool air for operating theatre use (72 x G size – having a water capacity of 3,600 L • other gases include carbon dioxide (6 x G-size), argon (3 x G-size), & helium (3 x G-size) • above placard quantity as specified in Schedule 11	The quantities of gases significantly exceed the minor storage provisions of Australian Standard AS 4332-2004 – *The storage and handling of gases in cylinders* • the store requires subdividing into 2 compartments
Roofed gas cylinder store – oxidising gases [ST-OXY BOT - 22.47.007]	2.2/5.1	-	MEC packs of compressed oxygen	7,500 L water capacity	• compressed oxygen in 10 x 15-cylinder multi-element packs • above placard quantity	The aggregate quantity of gas significantly exceeds the minor storage provisions of Australian Standard AS 4332-2004 – *The storage and handling of gases in cylinders* • the store must comply with the construction & location requirements of AS 4332-2004 requires subdividing into 2 compartments

Room Name/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments	Actions
Clinical Waste Store	6.2	n/a	Cytotoxic and Anatomical Clinical Waste	50 kg	• Clinical Wastes are managed in accordance with Health guidelines – these are intended to avoid any significant accumulation of wastes in the ASB	• Clinical waste(incl. cytotoxic and anatomical) will be collected twice daily from the ASB port by the preferred contractor [currently Daniels] 6 days a week • the waste will not be taken into the main array and stored there before collection, rather it will be collected directly from the ASB. • there will not be a collection on a Sunday [which is a day of lower waste generation activity].
Medical Imaging	3	II/III	Flammable liquids	20 L	• May be kept dispersed or under Minor Storage conditions	• Storage practices to be reviewed prior to occupation to ensure Minor Storage conditions are met
Ground Level (RL 56.3)						
Cleaners Store (04.08.018)	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Level 1						
Operating Theatres/Surgery	3	II	Flammable antiseptics	50 L	• mainly antiseptics – also a small quantity of acetone– complies with minor storage conditions when dispersed	• Storage practices to be reviewed prior to occupation – if an aggregation of reserve stock is required, a flammable liquid storage cabinet is to be provided
Cleaner's Store	3	II	Methylated spirits	2 L	• minor storage	• no further action required

Room Name/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments	Actions
Portable cylinders gas store – compressed and oxidising gases [ST-GAS – 27.04.003] L1 Periop	2.2 & 2.2/5.1	-	Small (CD-size) cylinders of oxygen and of breathing air	60 L water capacity	• assume 10 each of oxygen (x CD size) and 10 x C size of medical air – average size, say, 3 L water capacity • below placard and below manifest quantity • the aggregate quantity of gas does not exceed the minor storage provisions of Australian Standard AS 4332-2004 – *The storage and handling of gases in cylinders*	• cylinder restraints or racking to be provided
Level 2 (RL 65.2)						
CSSD	2.3/2.1	-	Sterigas (ethylene oxide gas cannisters)	<10 kg	• ethylene oxide is a highly toxic and flammable gas used for sterilising equipment • each sealed cannister contains 170 g of ethylene oxide • maximum of 12 cartridges to be kept in Steriliser Room • reserve stock (say 48 cartridges) to be kept in a flammable liquid cabinet in the original transport packaging (outer shippers) • total inventory is <10 kg • the gas comes fully sealed in non-valved aerosol containers that are placed as required into the steriliser apparatus which pierces the can within the confines of the sterilising unit to extract the contents – the atmosphere within the room space in which the unit is located has gas detection/monitoring instrumentation with audible and visual alarms • loss of containment of ethylene oxide from cannisters while in storage is very unlikely	• sign to be placed on storage cabinet door describing the contents as being ethylene oxide in a quantity of < 10 kg to avoid any fire combat agency over-reacting disproportionately to the hazard posed by the goods

Room Name/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments	Actions
CSSD	5.1	II	Hydrogen peroxide solution	6 L	• may be stored in a cupboard	• will require a spill tray - no further action required
CSSD Cleaners store	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Level 3 (RL69.7)						
ICU Cleaner's Store (06.04.029 & 06.04.037).	3	II	Methylated spirits	4 L	• minor storage	• no further action required
MAU Cleaner's Store (23.41.016)	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Level 4						
Haematology Cleaner's Store (20.41.022).	3	II	Methylated spirits	4 L	• minor storage	• no further action required
Aged Care Rehabilitation Subacute Aged Care Cleaner's Store (21.41.022)	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Level 5						
Ortho-Geriatrics Cleaner's Store (17.41.022)	3	II	Methylated spirits	2 L	• minor storage	• no further action required

Room Name/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments	Actions
Acute Aged Care Cleaner's Store (18.41.022)	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Level 7						
Respiratory/ Infectious Cleaner's Store (09.41.022)	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Acute Spinal/Acute Respiratory Cleaner's Store (08.41.022	3	II	Methylated spirits	2 L	• minor storage	• no further action required
Level 8						
Neurology IPU (L8) – Epilepsy Room Flammable liquid storage [12.24.053]	3	I/II	Flammable liquids (acetone, diethyl ether)	10 L	• up to an aggregate quantity of 10 L can be kept on open shelving or in a cupboard (as Minor Storage as defined in AS 1940-2017 • flammable liquids in aggregate quantities exceeding 10 L is to be kept in an approved (to AS 1940-2017) flammable liquid storage cabinet	• ignition sources (e.g. a power point or electrical equipment) to be placed so that they are at least 300 mm away from any container
HDU Cleaner's Room (12.41.022)	3	II	Methylated spirits	2 L	minor storage	no further action required

NOTES:

Note 1. Definitions: **PG** - Packing Group – a measure of the relative hazard of a dangerous good of Class 3, 4, 5, 6, 8 & 9 – *(PG I goods are those of highest hazard, PG II goods are of moderate hazard, and PG III are goods of relatively low hazard)*

NCADG Not classified as dangerous goods

Minor Storage is a concept incorporated in all the relevant standards for keeping the various classes of dangerous goods. Minor storage recognises that for small quantities of dangerous goods and where the goods are sufficiently dispersed, the presence of the dangerous goods does not add in a significant manner to the overall hazard of the proposed facility and/or its activities*).*

APPENDIX B Who prepared this report?

This report was prepared by Ross Underwood, a graduate mechanical engineer with postgraduate qualifications in industrial engineering from the University of New South Wales, with over 49 years of experience in industrial practice in high hazard environments.

The first 12 years of his professional career were spent in the petrochemical industry where he was involved in a variety of different functions including engineering maintenance, major new plant construction, project work associated with energy conservation and improving environmental performance, and chemical plant production management. He then spent 3 years managing reconstruction works at the Pyrmont Sugar Refinery, before being appointed as Personnel and Administration Manager for a major manufacturing activity, a position he held for 5 years.

In 1986 he established Safety Engineering and Technical Services Pty Ltd, a safety consulting and engineering contracting/consulting business. His company has undertaken a substantial number of consulting tasks in safety management for a very diverse range of private sector industrial and government clients including what was then the NSW WorkCover Authority.

Ross has conducted specific training programs and seminar sessions in safety awareness, accident investigation & other safety skills at all organisational levels. He was formerly accredited by WorkCover NSW as a trainer in workplace consultation, building industry induction, hazardous substances and risk management courses. He has trained management & employee safety committee representatives from over 80 different organisations. He has lectured in OH&S for both undergraduate and postgraduate students at the universities of UNSW, Sydney, Western Sydney and the University of Technology. He has undertaken longer term engineering contracting/consulting assignments in the brewing, building and manufacturing/industrial, warehousing and transport, government and military sectors.

His particular areas of expertise include:- dangerous goods storage, handling and transport matters; laboratory design, classification of hazardous areas; occupational health and safety performance auditing; construction management; plant & machinery safety, maintenance; industrial relations; accident investigation; workplace and safety system auditing; product packaging and labelling; and, the formulation and maintenance of safe work systems (including the preparation of emergency response and environment management plans). He has also been involved in the pre-planning and design of a number of major manufacturing plant and warehouse projects and has prepared risk and hazard analyses as part of the process for securing development approval for these facilities.

He has provided a number of expert opinion reports for litigated matters related to oh&s and dangerous goods matters.

He has provided specialist advice on dangerous goods and more general occupational health and safety issues associated with several major building/re-building projects most recently including:- the Ingham Health Research Institute at Liverpool Hospital; the Hunter Medical Research Institute; the Australasian Institute for Innovative Materials at the University of Wollongong; a Veterinary Diagnostic laboratory at Charles Sturt University at Wagga Wagga; the Special Operations Working Accommodation Upgrade Project; the 171 Aviation Squadron (Blackhawk helicopter) Relocation Project; HMAS CRESWELL Redevelopment at Jervis Bay, the ASC Shipyard Redevelopment, and the upgrade of HMAS PENGUIN – all for the Australian Defence Forces; and, the major redevelopment of the University of New South Wales North Mall (including new facilities for Applied Science and Chemistry)

Ross has contributed as an author to a number of technical journals and to the CCH International *Occupational Health & Safety Manual*, the *Plant Safety* manual, the *OHS Manager- The Hands on Guide* and the *2003 Australian master OH&S & environment guide*.

He is a Member of the Institution of Engineers, Australia, a Member of the Safety Institute of Australia, a Chartered Member of the Australian Human Resources Institute, and a founding member of the Australasian Institute of Dangerous Goods Consultants.

He has completed Certificate IV courses in Workplace Safety, and Workplace Assessment and Training, the Risk & Liability Management short course convened by Engineering Education Australia, classification of hazardous areas course convened by Illawarra TAFE.