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SYDNEY CHILDREN'S HOSPITAL STAGE 1 / CHILDREN'S COMPREHENSIVE CANCER CENTRE

SEPP 33
PRELIMINARY
HAZARD ANALYSIS
SSD NO. 10831778

wsp

JANUARY 2021

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Sydney Children's Hospital Stage 1 / Children's Comprehensive Cancer Centre
SEPP 33 Preliminary Hazard Analysis
SSDA No. 10831778

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B	28 Jan 2021	Final issue for SSD application after client review to update minor corrections
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ABBREVIATIONS

ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
CCCC	Children's Comprehensive Cancer Centre
DG	Dangerous Goods
EIS	Environment Impact Statement
HTH	Health Translation Hub
IASB	Integrated Acute Services Building
NSW	New South Wales
PG	Packaging Group
PHA	Preliminary Hazard Analysis
POW	Prince of Wales Hospital
POWP	Prince of Wales Private Hospital
RCR	Randwick Campus Redevelopment
RHC	Randwick Hospitals Campus
RHW	Royal Hospital for Women
SCH	Sydney Children's Hospital
SEAR	Planning Secretary's Environmental Assessment Requirements
SEPP33	State Environment Planning Policy No. 33 – Hazardous and Offensive Development
SSD	State Significant Development
UNSW	University of New South Wales
w.c.	Water Capacity

EXECUTIVE SUMMARY

BACKGROUND

In March 2019 the NSW and Federal Government announced a $608 million commitment to fund a new Emergency Department, short stay unit and a Children's Comprehensive Cancer Centre (CCCC) for Sydney Children's Hospital (SCH) Randwick. The initiative is supported by the Sydney Children's Hospitals Foundation, the Children's Cancer Institute (CCI) and the University of NSW (UNSW). The project, known as 'SCH Stage 1/ CCCC' will be the first stage (Stage 1) in the redevelopment of SCH.

The proposed development (i.e. SCH Stage 1/ CCCC) is at the corner of High Street and Hospital Road, Randwick in Sydney NSW in Randwick Hospital Campus (RHC) which also includes the Integrated Acute Services Building (IASB) and existing premises. The development is considered as state significant development (SSD) under application number of SSD-10831778 as per Planning Secretary's Environmental Assessment Requirements (SEARs).

PURPOSE

The purpose of this report is to provide a State Environment Planning Policy No. 33 (SEPP33) screening assessment and a preliminary hazard analysis (PHA) for the SCH Stage 1/ CCCC development in the Randwick Hospital Campus as requested by SEAR Number 21. Hazard and Risks to understand the risk of storage and handling of dangerous goods and control measures.

The analysis focuses on the SCH Stage 1/ CCCC development while also taking the cumulative hazard from other facilities in the Randwick Hospital Campus. It covers acute safety impacts to the public due to the storage and handling of dangerous goods in the Randwick Hospital Campus and forms part of the overall Environmental Impact Statement (EIS).

SEPP33 SCREENING AND HAZARD ANALYSIS OVERVIEW

Based on SEPP33 screening assessment, the proposed development of SCH Stage1/CCCC in the Randwick Hospital Campus is considered as 'potentially hazardous' due to the cumulative storage quantity of medical gas (class 2.2/5.1 oxidizing) and clinical waste (class 6.2) which are likely to exceed allowable thresholds.

Subsequent preliminary hazard analysis was conducted using Hazard Identification process in line with AS/ISO 31000:2018 Risk Management Guidelines and focused on preventing or minimising major hazardous incidents on-site, such as fire and explosion or the release of significant quantities of toxic or biologically harmful chemicals, that could result in significant off-site effects.

The hazard identification exercise comprised a review of:

- Hazards intrinsic to SCH Stage 1/CCCC in the Randwick Hospital Campus, including the storage and handling of dangerous goods
- External hazards, both natural and of human origin
- Possible accident scenarios, their initiating events and consequence and
- Technical and procedural safeguards

Where significant hazards (i.e. fires, explosions or the release of toxic substances) have been identified, representative events and accident scenarios will be carried forward for consequence analysis.

The Hazard Identification tables identify the following for each scenario:

- the hazardous event
- the consequence of the event
- the initiating causes of the event
- safeguards
- whether the scenario has a significant potential offsite impact
- whether consequence analysis is required

FINDINGS

No hazards leading to a consequential major off-site event were found. This report documents the analysis of internal and external events and found no hazards which need to be taken for further consequence analysis. This report finds the hazards are minor risks (where the consequence is small quantity localised chemical spillage) which can be mitigated by engineering design or managed by procedural controls.

RECOMMENDATIONS

No further control measures are recommended at the PHA stage.

Note: Should the storage conditions or volumes change, the contents and findings in the report shall be reviewed and updated, and the risks associated with any change shall be assessed and controlled.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

In March 2019 the NSW and Federal Government announced a $608 million commitment to fund a new Emergency Department, short stay unit and a Children's Comprehensive Cancer Centre (CCCC) for Sydney Children's Hospital (SCH) Randwick.

The initiative is supported by the Sydney Children's Hospitals Foundation, the Children's Cancer Institute (CCI) and the University of NSW (UNSW). The project, known as 'SCH Stage 1/ CCCC' will be the first stage (Stage 1) in the redevelopment of SCH and will include:

- A new Emergency Department
- Short Stay Unit
- Expansion/ relocation of SCH clinical spaces
- Children's Comprehensive Cancer Centre
- Integration with the Prince of Wales Acute Services Building that is currently being developed
- Integration with the announced Health Translation Hub which is a facility being developed by UNSW for education, training and research
- Maximising synergies between SCH and the Randwick Precinct Partners, through sharing high cost and complex services

WSP was engaged by PwC (PricewaterhouseCoopers) on half of Health Infrastructure to provide a SEPP 33 screening assessment and a preliminary hazard analysis (PHA) for SCH Stage 1/ CCCC development as part of Environmental Impact Statement (EIS) submission.

1.2 STATUTORY AND STRATEGIC CONTEXT

The SCH Stage 1/ CCCC project has been declared as State Significant Development (SSD), application number is SSD-10831778. As the NSW Planning Secretary's Environmental Assessment Requirement (SEAR) for the application, an EIS must be prepared in accordance with and to meet the minimum requirements of clauses 6 and 7 of Schedule 2 the Environmental Planning and Assessment Regulation 2000 (the Regulation), including addressing requirements in State Environmental Planning Policy No. 33 - Hazardous and Offensive Development.

1.3 SCOPE

The report provides a SEPP 33 preliminary risk screening for SCH Stage 1/ CCCC development, regarding dangerous goods storage and a PHA as per requirement in SEAR Number 21. Hazard and Risks (1).

2 DESCRIPTION OF DEVELOPMENT

2.1 PROJECT LOCATION

The proposed development is in Randwick in Sydney NSW (Figure 2.1).

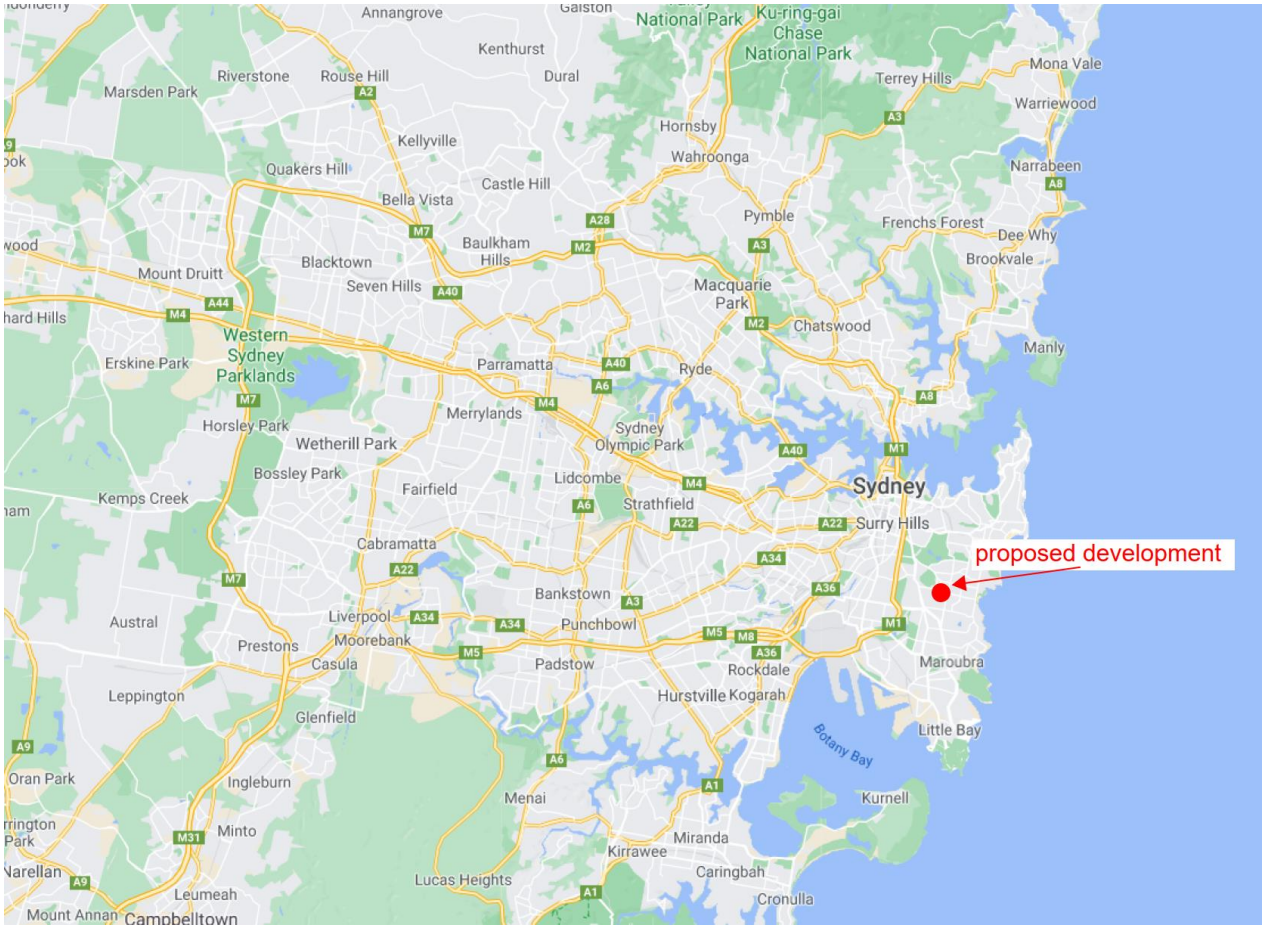

Figure 2.1 Project Location

2.2 PROJECT AREA IN THIS SSDA

As shown in Figure 2.2 below, the proposed development of the SCH Stage 1 / CCCC site is at the corner of High Street and Hospital Road, located in Randwick Campus Redevelopment (RCR) area which is bounded by High Street to the north, Magill Street to the south, Hospital Road and the existing campus to the east, and Botany Street and UNSW to the west inside Randwick Hospital Campus (RHC).

Figure 2.2 Randwick Hospital Campus Overview

There are other premises inside Randwick Hospital Campus but are outside the scope of this SSDA. They are:

- Integrated Acute Services Building (IASB)

The site for the SCH occupies the northern portion of this expansion zone, with the IASB located immediately adjacent in the southern portion of the site. The western portion of the expansion zone will be occupied by the UNSW Health Translation Hub (HTH) development. The IASB is under SSD 10339 for application.

- Existing Premises:

Royal Hospital for Women (RHW), Prince of Wales Hospital (POW), and the Prince of Wales Private Hospital defined by High Street to the north, Barker Street to the south, Avoca Street to the east and Hospital Road to the west.

2.3 DANGEROUS GOODS STORAGE

Schedule of dangerous goods of each premise is provided in Appendix A- Dangerous Goods Schedule of this document.

3 SEPP 33 SCREENING ASSESSMENT

3.1 SEPP 33 APPLICABILITY

3.1.1 SCREENING TEST METHODOLOGY

SEPP 33 applies to any proposals which fall under the policy's definition of 'potentially hazardous industry' or potentially offensive industry' under the Hazardous and Offensive Development Application Guidelines – Applying SEPP 33, published by New South Wales Department of Planning (2).

- **'potentially hazardous industry'** – '*when all locational, technical, operational and organizational safeguards are employed continues to pose a significant risk.'* (2) Applying SEPP 33 includes a screening method, based on the quantities of dangerous goods on a site and their vehicle movements, to assist in determining if a development is likely to be potentially hazardous industry.
- **'potentially offensive industry'** – the primary consideration 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 license pursuant to Protection of the Environment Operations Act 1997, or where they do require a license but in the opinion of the environmental regulator the proponent can fully meet its license requirements, a proposal is not deemed to be 'offensive industry'.

3.1.2 CONSIDERATION OF EXISTING FACILITIES

Section 6 Common Queries in 'Apply SEPP 33' (2) clarifies the implications of SEPP 33 for an existing development. SEPP 33 applies to the SCH Stage 1 / CCCC site because the facility interacts with the existing premises and adds to the overall quantity of dangerous goods stored. The cumulative hazards from the Randwick Hospital Campus may be increased and therefore considered in this report.

3.1.3 OTHER RISK FACTORS

In some cases, the applicability of SEPP 33 is not immediately apparent. In such instances, applicants should be requested to address the matters listed in Appendix 2 of 'Apply SEPP 33' (2), to provide Councils with adequate information to base a judgement on SEPP 33 applicability.

3.2 POTENTIALLY HAZARDOUS INDUSTRY ASSESSMENT

3.2.1 STORAGE QUANTITIES SCREENING AGAINST SEPP33 THRESHOLD

The aggregate storage quantities in SCH Stage 1/CCCC, IASB and the Existing premises are listed individually in Table 3.1 below. The storage quantities in the Randwick Hospital Campus are the sum of all premises. If the storage quantity in individual premise or the Randwick Hospital Campus exceeds the threshold, then a 'Yes' is given in the last column of the table.

Table 3.1 SEPP 33 General Screening Threshold Quantities, ref: Applying SEPP 33, Table 1 and Table 3 (2)

DG CLASS	DESCRIPTION	SEPP 33 THRESHOLD	DESCRIPTION	SCH STAGE 1 / CCCC	IASB	RHW, POW, POWP	RANDWICK HOSPITAL CAMPUS TOTAL	DOES SEPP33 APPLY
				(TONNE)				
2.1	Flammable gases	10 tonne or 16 m^3	If stored above ground	-	10	-	10	No
		40 tonne or 64 m^3	If stored underground or mounded	-	-	-	-	N/A
2.2	Non-flammable, non-toxic gases	No limit is set	Non-flammable, nontoxic gas	24	13	15	52	No
2.3	Toxic gases	5 tonne	Anhydrous ammonia	-	-	-	-	No
		1 tonne	Chlorine and sulphur dioxide stored as liquefied gas in containers <100kg	-	-	-	-	No
		2.5 tonne	Chlorine and sulphur dioxide stored as liquefied gas in containers >100 kg	-	-	-	-	No
		100 kg	Liquefied gas kept in or on premises	-	-	-	-	No
		100 kg	Other poisonous gases	-	10	-	10	No
3	Flammable liquids	2 tonne	PG I	0.02	-	-	0.02	No
		5 tonne	PG II/III	1.4	0.1	1.6	3.1	No
4.1	Flammable solids, self-reactive substances and solid desensitised explosives	5 tonne	None	0.012	-	-	0.012	No

DG CLASS	DESCRIPTION	SEPP 33 THRESHOLD	DESCRIPTION	SCH STAGE 1 / CCCC	IASB	RHW, POW, POWP	RANDWICK HOSPITAL CAMPUS TOTAL	DOES SEPP33 APPLY
				(TONNE)				
5.1	Oxidizing agents i.e. ammonium dichromate	25 tonne	Ammonium nitrate — high density fertiliser grade, kept on rural zoned land where rural industry is carried out, if the depot is at least 50 metres from the site boundary	-	-	-	-	No
		5 tonne	Ammonium nitrate — elsewhere	-	-	-	-	No
		2.5 tonne	Dry pool chlorine — if at a dedicated pool supply shop, in containers < 30 kg	-	-	-	-	No
		1 tonne	Dry pool chlorine — if at a dedicated pool supply shop, in containers > 30 kg	-	-	-	-	No
		5 tonne	Any other class 5.1	10.1	8.9 (See note 1)	0 (See note 2)	19	Yes
5.2	Organic peroxides i.e. ethyl methyl ketone peroxide	10 tonne	None	-	-	-	-	No
6.1	Toxic substances i.e. cyanides, arsenic compounds and lead acetate	0.5 tonne	PG I	4	-	-	4	No
		2.5 tonne	PG II and III	-	-	-	-	No
6.2		0.5 tonne	Includes clinical waste	0.25	0.25	0.5	1	Yes
7	Radioactive material	all	all	varies, small quantities of I-131, Lutate-117 and other ionizing radiation therapies	-	-	-	Yes
8	Corrosive substances	5 tonne	PG I	0.03	-	-	0.03	No

DG CLASS	DESCRIPTION	SEPP 33 THRESHOLD	DESCRIPTION	SCH STAGE 1 / CCCC	IASB	RHW, POW, POWP	RANDWICK HOSPITAL CAMPUS TOTAL	DOES SEPP33 APPLY
				(TONNE)				
		25 tonne	PG II	0.13	-	-	0.13	No
		50 tonne	PG III	-	-	-	-	No
9	Miscellaneous dangerous substances and articles	No limit is set	PG I, II and III	0.15	-	-	0.15	No

Notes:

1. The quantity of class 5.1 dangerous goods in IASB is calculated from the Appendix A – List of dangerous goods storage depots at the proposed ASB in Prince of Wales Hospital Expansion Stage 1 Environmental Impact Statement Appendix BB_Hazardous Chemicals_Dangerous Goods_Matters Advice. Verification of the information is not included in the scope of this report. Ref: https://majorprojects.accelo.com/public/e1642fb59652119750ebbb8fc7058a18/Appendix%20BB_Hazardous%20Chemicals%20_Dangerous%20Goods_%20Matters%20Advice.pdf
2. The quantity of class 5.1 dangerous goods in the existing premises is provided in the WorkCover NSW Acknowledge Number: NDG018496, issued on 12 May 2015 to Premises: Barker St, Randwick NSW 2031, Australia, where oxygen was not classified as 'class 5.1'. Verification of the information is not included in the scope of this report.

3.2.2 VEHICLE MOVEMENTS

Table 3.2 below sets out the transportation screening thresholds of dangerous goods in accordance with SEPP 33. The vehicle movements are expected to be below the threshold. The transportation of class 6.2 clinical waste will be assessed in the preliminary hazard analysis (PHA).

Table 3.2 Transportation Screening Thresholds, ref: Applying SEPP33 Table 2 (2)

DG CLASS	VEHICLE MOVEMENTS		MINIMUM QUANTITY (SEE NOTE 1)		DOES SEPP33 APPLY
	Cumulative	**Peak**	**per load (tonne)**		
	Annual	**Weekly**	**Bulk**	**Packages**	
2.1	> 500	> 30	2	5	N/A
2.2	No limit is set	No limit is set	No limit is set	No limit is set	No
2.3	> 100	> 6	1	2	N/A
3 PG I	> 500	> 30	1	1	No
3 PG II	> 750	> 45	3	10	No

DG CLASS	VEHICLE MOVEMENTS		MINIMUM QUANTITY (SEE NOTE 1)		DOES SEPP33 APPLY
	Cumulative	Peak	per load (tonne)		
	Annual	Weekly	Bulk	Packages	
3 PG III	> 1,000	> 60	10	No limit	No
4.1	> 200	> 12	1	2	No
4.2	> 100	> 3	2	5	N/A
4.3	> 200	> 12	5	10	N/A
5	> 500	> 30	2	5	No (See note 3)
6.1	All	All	1	3	N/A
6.2	See note 2	See note 2	See note 2	See note 2	See note 2
7	See note 2	See note 2	See note 2	See note 2	See note 2
8	> 500	> 30	2	5	No (See note 3)
9	> 1000	> 60	No limit	No limit	No (See note 3)

Notes:

1. If quantities are below this level, the potential risk is unlikely to be significant unless the number of traffic movements is high (ref: Applying SEPP33 Table 2).
2. Where proposals include materials of class 1, 6.2 or 7, the Department of Planning should be contacted for advice (ref: Applying SEPP33 Table 2).
3. It is assumed that all dangerous goods vehicle movements and quantities for the Randwick Hospital Campus are less than the threshold levels stated above, with the exception of class 6.2 clinical waste which is subject to note 2.

3.3 POTENTIALLY OFFENSIVE INDUSTRY ASSESSMENT

The Randwick Hospital Campus is unlikely to be an 'potentially offensive industry'.

3.3.1 SCH STAGE 1/CCCC

According to the Clinical and Related Waste Management for Health Services (Document number: PD2017_026, date: 14 Aug 2017), published by NSW Health (3),

- No EPA licence is required for cytotoxic waste (this includes any residual cytotoxic drug or laboratory chemical) and pharmaceutical waste.
- An EPA licence will be required for radioactive waste because I-131, Lutate-117 and other ionizing radiation therapies are proposed be used in SCH Stage 1/CCCC.

Therefore, SCH Stage1/CCCC is a 'potentially offensive industry'.

3.3.2 IASB

According to the statement in Appendix BB_Hazardous Chemicals _Dangerous Goods_ Matters Advice (Hazardous Chemicals (Dangerous Goods) Matters – Advice on the Facilities for Storing and Handling of Hazardous Chemicals/Dangerous Goods (4) for the Proposed Acute Services Building Project, Prince of Wales Hospital, Randwick), IASB is not a potentially offensive industry.

'*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'* (4).

3.3.3 EXISTING PREMISES

The existing premises is managed under Clinical and Related Waste Management for Health Services (Document number: PD2017_026, date: 14 Aug 2017) (3), published by NSW Health.

3.4 SEPP 33 – OTHER RISK FACTORS

Appendix 2 of Applying SEPP 33 (2) outlines other risk factors for consideration to identify hazards outside the scope of the risk screening method. A review of these risk factors was undertaken as shown in Table 3.3.

Multiple risk factors were found to trigger a PHA, including storage of incompatible materials, hazardous waste, risk of uncontrolled release and storage in high pressure vessel.

Table 3.3 SEPP 33 Other Risk Factors

SEPP 33 OTHER RISK FACTORS CHECKLIST	COMMENTS	PHA REQUIRED
Any incompatible materials (hazardous and non-hazardous materials)	There are incompatible dangerous goods stored in hospitals. Material incompatibility and segregation will be managed by the design of the storage facilities and operational controls.	Yes
Any wastes that could be hazardous	There will be chemical waste generated from wet labs in SCH Stage 1/CCCC and clinical wastes from hospitals.	Yes
The possible existence of dusts within confined areas	Dust within confined areas is unlikely to exist in hospital environment.	No

SEPP 33 OTHER RISK FACTORS CHECKLIST	COMMENTS	PHA REQUIRED
Types of activities the dangerous goods and otherwise hazardous materials are associated with (storage, processing, reaction, etc.)	No dangerous activities are expected of handling dangerous goods is expected in a hospital environment. Bulk chemicals will be handled by qualified contractors, packaged chemicals will be handled in small packages by hospital and laboratory personnel.	No
Incompatible, reactive or unstable materials and process conditions that could lead to uncontrolled reaction or decomposition	Bulk cryogenic liquids have the potential to be released in an uncontrolled manner which triggers a PHA.	Yes
Storage or processing operations involving high (or extremely low) temperatures and/or pressures; and	Cryogenic liquids are stored in vessels under high pressure which triggers a PHA.	Yes
Details of known past incidents (and near misses) involving hazardous materials and processes in similar industries.	No significant hazardous events due to fire, explosion or toxic release.	No

3.5 CONCLUSION ON THE APPLICABILITY OF SEPP 33

The screening result shows SEPP33 thresholds are exceeded in the proposed development for a 'Potentially Hazardous Industry and a 'Potentially Offensive Industry'. Therefore, SEPP33 applies to SCH Stage 1/CCCC in the Randwick Hospital Campus and a PHA is required.

- The storage quantities of class 5.1 (oxidizing) dangerous goods in the proposed SCH Stage 1/CCCC alone exceed the threshold in SEPP33 which is due to the storage of Medical Gas such as Oxygen and Nitrox Oxide.
- The storage quantity of class 6.2 clinical waste in the proposed Randwick Hospital Campus (i.e. SCH Stage 1/CCCC, IASB and existing premises) is estimated to exceed SEPP 33 threshold. Note: the threshold of class 6.2 is not exceeded in any single premise.
- Nuclear medicine will be used in SCH Stage 1/CCCC which generates radioactive waste that requires an EPA licence.

4 PRELIMINARY HAZARD ANALYSIS OVERVIEW

4.1 OVERALL APPROACH

The PHA is a tool for systematically identifying and assessing the hazards and risks associated with SCH Stage 1 /CCCC in the Randwick Hospital Campus. The greatest benefit of hazard analysis is not the numerical outputs but rather the insight into the risks and their implications provided by the analytical processes (5).

Hazard Identification process was adopted in this report and conducted in line with AS/ISO 31000:2018 Risk Management Guidelines (6). It concludes the following steps:

- Establish context
- Identify hazards
- Assess consequences
- Assess likelihood
- Determine the risk
- Evaluate the risk
- Mitigate the risk if required

4.2 CONTEXT

The context of the risk assessment was set by SEARs to undertake an assessment of:

- a preliminary risk screening regarding all dangerous goods and hazardous materials associated with the development
- a Preliminary Hazard Analysis

The assessment covers acute safety impacts to the public due to the storage and handling of dangerous goods in the Randwick Hospital Campus and forms part of the overall EIS.

4.3 GUIDANCE

The following documents were used as guidance in this assessment:

- Potential hazardous impacts were identified following the NSW Department of Planning, Hazardous and Offensive Development Application Guidelines, Applying SEPP33, January 2011 (referred to as SEPP 33 in this document)
- The hazard analysis followed the requirements of the NSW Department of Planning Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, Hazard Analysis, January 2011

4.4 METHODOLOGY

The PHA for the SCH Stage 1/CCCC was carried out in accordance with HIPAP 6 (5), and included the following steps:

- Identification of hazards resulting from the SCH Stage 1/CCCC and identification of potentially hazardous impacts and risk to the public

- Analysis of consequences for those scenarios that were judged to be potentially hazardous and a risk to the public
- Assessment whether further analysis is required if there is an offsite impact due to fires, explosions or the release of toxic substances in the consequence analysis

5 HAZARD IDENTIFICATION

5.1 OVERVIEW

The hazard identification exercise comprised a review of:

- Hazards intrinsic to SCH Stage 1/CCCC in the Randwick Hospital Campus including storage and handling of dangerous goods
- External hazards, both natural and of human origin
- Possible accident scenarios, their initiating events and consequence and
- Technical and procedural safeguards

Once all significant hazards (fires, explosions or the release of toxic substances) have been identified, representative events and accident scenarios will be carried forward for further studies.

5.2 HAZARD IDENTIFICATION WORD DIAGRAM

The hazard identification tables identify the following for each scenario:

- the hazardous event
- the consequence of the event
- the initiating causes of the event
- safeguards
- whether the scenario has a potential offsite impact
- the proposed level of assessment

5.3 HAZARD IDENTIFICATION

5.3.1 INTERNAL EVENTS

Table 5.1 Hazardous Identification Table – Internal Events

HAZID ID	HAZARDOUS EVENTS	POTENTIAL CONSEQUENCES / EFFECTS	THREATS / CAUSES	SAFEGUARDS	ASSESSMENT / RECOMMENDATIONS	SIGNIFICANT POTENTIAL OFFSITE IMPACT	COMMENTS
1	Chemicals delivered to hospitals	Chemical spills causing contamination of environment	Vehicle collision Dropped load	Tankers and package chemicals are designed to Codes and Standards for safe transportation. Qualified Contractors are used to deliver dangerous goods.	Insignificant offsite impact	No	No additional assessments required.
2	Storage of dangerous goods including wastes in hospitals	Unexpected chemical reaction	Inadequate separation in storage	Storage areas designed to codes and standards including segregation, separation of incompatible material, store ventilation and fire protection.	Localised impact	No	No additional assessments required
3	Use of chemicals in hospitals	Chemical contamination to personnel	Spills	Chemicals are handled in small quantities in hospitals and will be managed by procedural controls and training.	Localised spillage	No	No additional assessments required
4	Cryogenic liquids (O_2 and NO gases) storage	Localised oxygen enrichment	Loss of containment	Medical gases will be supplied from existing cryogenic liquids vessels to SCH Stage 1/CCCC. No modification is proposed to the existing vessel.	Localised impact	No	No additional assessment required
5	Cryogenic liquids (O_2 and NO gases) supply system	Oxygen enrichment in buildings	Leaks in systems	Medical gas supply system to SCH Stage 1/CCCC will tie into existing medical gas supply and is designed to codes and	Localised impact	No	No additional assessment required

HAZID ID	HAZARDOUS EVENTS	POTENTIAL CONSEQUENCES / EFFECTS	THREATS / CAUSES	SAFEGUARDS	ASSESSMENT / RECOMMENDATIONS	SIGNIFICANT POTENTIAL OFFSITE IMPACT	COMMENTS
				standards. Gas monitoring system available.			
6	Cryogenic liquids (CO_2 and N_2 gases) storage	Oxygen depletion	Loss of containment	Ventilation and location of cryogenic liquids vessel has been designed in liaison with suppliers and design engineers.	Localised impact	No	No additional assessment required
7	Cryogenic liquids (CO_2 and N_2 gases) supply system	Oxygen depletion	Loss of containment	Medical gas supply system is designed to codes and standards. Gas monitoring system available.	Localised impact	No	No additional assessment required
8	Radioactive waste contamination from nuclear medicine	Low-dose ionizing radiation to personnel	Loss of containment in decay tank	Requirements are governed by NSW Health's policy - Clinical and Related Waste Management for Health Services (Document number: PD2017_026, date: 14 Aug 2017). Waste is to be classified with reference to the Safety Guide for the Classification of Radioactive Waste and in accordance with the EPA waste classification guidelines. Handling and storage to comply with Radiation Management Plan in accordance with the Code of Practice for Radiation Protection in the Medical Application of Ionizing Radiation published by Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).	Localised impact	No	No additional assessment required

HAZID ID	HAZARDOUS EVENTS	POTENTIAL CONSEQUENCES / EFFECTS	THREATS / CAUSES	SAFEGUARDS	ASSESSMENT / RECOMMENDATIONS	SIGNIFICANT POTENTIAL OFFSITE IMPACT	COMMENTS
				When radioactive waste is to be transport, health service is to comply with the Code of Practice for Safe Transport of Radioactive Material published by ARPANSA.			
9	Diesel fuel storage	Diesel fire and possible explosion	Fire escalates to diesel storage	Segregation and separation from ignition sources and incompatible chemicals. Designed to follow codes and standards.	Localised impact	No	No additional assessment required
10	Clinical wastes transported off site	Contamination of environment and personnel	Loss of containment	Clinical wastes will be collected by qualified Contractors, governed by NSW Health's policy -Clinical and Related Waste Management for Health Services (Document number: PD2017_026, date: 14 Aug 2017),	Insignificant offsite impact	No	No additional assessments required

5.3.2 EXTERNAL EVENTS

Table 5.2 Hazardous Identification Table – External Events

HAZID ID	HAZARDOUS EVENTS	POTENTIAL CONSEQUENCES / EFFECTS	THREATS / CAUSES	SAFEGUARDS	RECOMMENDATIONS	COMMENTS
1	Heavy Rain	Site flooding	External flooding	Facility to be designed to current codes and standards	Covered in EIS flooding assessment	No additional assessments required
2	Earthquakes	Injuries on site	Earthquakes	Facility to be designed to current codes and standards	None	No additional assessments required
3	Land slip/subsidence	Injuries on site	Land slip/subsidence	Facility to be designed to current codes and standards	None	No additional assessments required

HAZID ID	HAZARDOUS EVENTS	POTENTIAL CONSEQUENCES / EFFECTS	THREATS / CAUSES	SAFEGUARDS	RECOMMENDATIONS	COMMENTS
4	Cyclones	Injuries on site	Cyclones	Not in a cyclone area	EIS Wind Report addresses in greater details	No additional assessments required
5	Tsunami/storm surge tides	Injuries on site	Tsunami/storm surge tides	Inland location, not a potential threat	None	No additional assessments required
6	Lighting	Struck by lightning. Fire/Explosion	Lighting	Facility to be designed to current codes and standards	None	No additional assessments required
7	Plane Crash	Struck by plane causing fire/explosion	Plane crash	None	Planes are likely to travel above the hospitals due to nearby airports within 20km. The likelihood of plane crash is extremely low.	No additional assessments required
8	Helicopter Crash	Struck by helicopter causing fire/explosion	Helicopter crash	Pilot qualifications Engineering designs to followed codes and standards	Qualified pilot to use helicopters for landing and taken off. The likelihood of helicopter crash is extremely low.	No additional assessments required
10	Vehicle Crash	Fire / Explosion or Chemical leaks	Vehicle crash	Facility to be designed to current codes and standards and the Project traffic management plan	None	No additional assessments required
11	Sabotage/vandalism	Loss of items	Sabotage/vandalism	Site security management systems	None	No additional assessments required
12	Power Failure	System and utility failure	Power failure	Emergency generator	None	No additional assessments required
13	Bushfire	Fire / explosion	Bushfire	None	Urban area, there is no risk of bushfire	No additional assessments required

6 CONSEQUENCE ANALYSIS

HIPA No.6 Hazard Analysis states that the PHA should emphasise on '*preventing or minimising major hazardous incidents on-site, such as fire and explosion or the release of significant quantities of toxic or biologically harmful chemicals, that could result in significant off-site effects. Furthermore, neither quantified nor qualitative analysis should be pursued for its own sake. For example, if the earlier steps in the analysis show there to be no hazards of concern, no significant consequences, or frequencies so low as to be considered noncredible, then proceeding with the analysis beyond such points may well be fruitless*' (5).

No significant hazards have been identified in the previous hazard identification process for SCH Stage 1/CCCC development in the Randwick Hospital Campus. Therefore, consequence analysis will not be proceeded in this report and is deemed not necessary for the proposed SCH Stage 1/CCCC.

7 CONCLUSIONS

Based on SEPP33 screening assessment, the development of SCH Stage1/CCCC in the Randwick Hospital Campus is considered as ‘potentially hazardous’ due to the cumulative storage quantity of medical gas (class 2.2/5.1 oxidizing) and clinical waste (class 6.2) exceeding the threshold.

Subsequent preliminary hazard analysis concludes that risks are managed by engineering and procedural controls, there is no significant off-site risk that requires further analysis.

No further control measures are recommended at the PHA stage.

Should the storage conditions or volumes change, the contents and findings in the report shall be reviewed, and the risks associated with any change shall be assessed and controlled.

8 REFERENCES

1. ***Planning Secretary's Environmental Assessment Requirements (SEARs), SSD-10831778.*** **2 Dec 2020.**

2. ***Hazardous and Offensive Development Application, Apply SEPP 33.*** **s.l. : NSW Planning, Jan 2011.**

3. ***Clinical and Related Waste Management for Health Services (Document number: PD2017_026, date: 14 Aug 2017).*** **s.l. : NSW Health.**

4. ***Appendix BB_Hazardous Chemicals _Dangerous Goods_ Matters Advice (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.***

5. ***Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, Hazard Analysis.*** **s.l. : NSW Department of Planning, January 2011.**

6. ***AS/ISO 31000:2018 Risk Management Guidelines.***

7. ***Ref: WorkCover NSW Acknowledge Number: NDG018496, issued on 12 May 2015 to Premises: Barker St, Randwick NSW 2031, Australia. Verification of the data is not included in the scope of this report.***

APPENDIX A

DANGEROUS GOODS SCHEDULE

A1 SCH STAGE 1 / CCCC DANGEROUS GOODS SCHEDULE

Table A.1 Summary of Dangerous Goods Storage Projection at SCH Stage 1/CCCC

LEVEL	ROOM NAME	DG CLASS	PG	HAZARDOUS CONTENT	AGGREGATE QUANTITY (L / KG) *	NOTE
Underground	Emergency Generator Fuel Tank	C1	N/A	Diesel	15,000 L	Diesel stored in in double skinned storage tank
Loading Dock	Flammable Cabinets	Assume class 3	Assume PG II/III	Flammable liquids	500 L	2 off 250 L flammable cabinets for transit storage
	Medical Gas Store	2.2/5.1	N/A	Oxygen - 10*15 man packs (G size) Nitrous Oxide - 3*15 man packs (G size)	7,600 L oxygen 2,250 L nitrous oxide	Assume all gas cylinders are G size = 50 L (w.c.)
	Non-Flammable Portable Gas Bottle	2.2	N/A	UHP Nitrogen 2*G size Oxygen – 2*G size Argon – 2*G size Special gas mix – 2*G size	100 L nitrogen 100 L argon 100 L special gas	Assume all gas cylinders are G size = 50 L (w.c.)
	Chemical Waste Store	Various	Various	Refer to Table A.2 for detailed waste hazardous content	128 kg	Assume 6,650 kg/year and weekly collection, which requires approx.128 kg storage capacity at SCH Stage 1/CCCC waste store.
Level B1	Cleaner's Room*3	3	II	Methylate spirits	6 L	assume 2L per room
Level 00	Liquid N_2 (bulk)	2.2	N/A	Liquid nitrogen in vessel 2 off 8 Man Packs	10,800 L	Vessel = 10,000 L Assume all gas cylinders are G size = 50 L (w.c.)

LEVEL	ROOM NAME	DG CLASS	PG	HAZARDOUS CONTENT	AGGREGATE QUANTITY (L / KG) *	NOTE
	Liquid CO_2 (bulk)	2.2	N/A	Liquid CO_2 in vessel 2 off 8 Man Packs	2,200 L	Vessel = 1,400 L Assume all gas cylinders are G size = 50 L (w.c.)
Level 01	Cleaner's Room * 2	3	II	Methylate spirits	4 L	Assume 2 L per room
Level 02	Cleaner's Room*1	3	II	Methylate spirits	2 L	Assume 2 L per room
	Plant Room (Emergency Generator Room)	C1	N/A	Diesel	2,000 L	In double skinned day tank, 1,000 L each
Level 03 - 05	MSSU - Cleaner's Room*1	3	II	Methylate spirits	2 L	Assume 2 L per room
	Wet Lab	2.2	N/A	Non-flammable (portable gas bottle)	348 L	Laboratory use chemicals are stored on level 03, 04 and 05
		2.2	N/A	Non-flammable (Liquid nitrogen cryogenic storage)	1,000 L	
		3	I, II & III	Flammable liquids	PG I – 18 L PG II/III – 788 L	
		C1 & C2	I, II & III	C1 & C2 Combustible liquid	420 L	
		4.1	III	Flammable solids	12 kg	
		5.1	II & III	Oxidizing agents	110 kg	
		6.1	I, II & III	Toxic substances	PG I – 4 kg PG II/III – 150 kg	
		8	I, II	Corrosive substances	26 kg	

LEVEL	ROOM NAME	DG CLASS	PG	HAZARDOUS CONTENT	AGGREGATE QUANTITY (L / KG) *	NOTE
		9	III	Miscellaneous	22 kg	
Level 06 - 08	Cleaner's room * 6	3	II	Methylate spirits	12 L	Assume 2 L per room
Level 09	Plant Room	6.1	II	Biocide	100 L	-

*Note: Units of kilograms apply to solids and units of litres to liquids. The maximum quantities specified in terms of 'kg or L' are the sum of the number of kilograms (kg) of solids plus the number of litres (L) of liquids.

Table A.2 Estimated Chemical Waste Generated from Wet Lab

DG CLASS	DESCRIPTION	AGGREGATE QUANTITY (L / KG) PER YEAR
3	Flammable	2,420
5.1	Oxidizing	30
6.1	Toxic (including Cytotoxic)	3,746
8	Corrosive	246
9	Miscellaneous	208
N/A	**Total**	**6,650**

*Note: Units of kilograms apply to solids and units of litres to liquids. The maximum quantities specified in terms of 'kg or L' are the sum of the number of kilograms (kg) of solids plus the number of litres (L) of liquids.

A2 IASB DANGEROUS GOODS SCHEDULE

Table A.3 Summary of Dangerous Goods Storage Projection at IASB (4)

LEVEL	ROOM NAME / FACILITY	DG CLASS	PG	HAZARDOUS CONTENT	QUANTITY
Loading Dock / Service Area	Emergency Generator Set reserve fuel tank [97.B2.009]	C1	N/A	Diesel	15,000 L
	Emergency Generator Room	C1	N/A	Diesel	3 × 1,000 L
	Roofed gas cylinder store – compressed non-flammable and oxidizing gases [ST-AS BOT – 97.B2.009]	2.2 & 2.2/5.1	N/A	Cylinders of tool air, carbon dioxide, argon, helium (all Class 2.2) and nitrous oxide (Class 2, Division 5.1)	5,500 L (w.c.) capacity of which 1,350 L would be Class 2.2, Division 5.1
	Roofed gas cylinder store – oxidising gases [ST-OXY BOT - 22.47.007]	2.2/5.1	N/A	MECG packs of compressed oxygen	7,500 L (w.c.)
	Clinical Waste Store	6.2	N/A	Cytotoxic and Anatomical clinical waste	50 kg Note: maximum of 250 kg was used for SEPP33 screening in Prince of Wales Hospital Expansion Stage 1 Environmental Impact Statement Appendix BB_Hazardous Chemicals_Dangerous Goods_Matters Advice
	Medical Imaging	3	II/III	Flammable liquids	20 L
Ground Level (RL 56.3)	Cleaners Store (04.08.018)	3	II	Methylate spirits	2 L
Level 1	Operating Theatres/Surgery	3	II	Flammable antiseptics	50 L

LEVEL	ROOM NAME / FACILITY	DG CLASS	PG	HAZARDOUS CONTENT	QUANTITY
	Cleaner's Store	3	II	Methylate spirits	2 L
	Portable cylinders gas store – compressed and oxidising gases [ST-GAS – 27.04.003]	2.2 & 2.2/5.1	N/A	Small (CD-size) cylinders of oxygen and of breathing air	60 L (w.c.)
Level 2 (RL 65.2)	CSSD	2.3/2.1	N/A	Sterigas (ethylene oxide gas cannisters)	<10 kg
	CSSD Cleaners store	3	II	Methylated spirits	2 L
Level 3 (RL69.7)	ICU Cleaner's Store (06.04.029 & 06.04.037).	3	II	Methylated spirits	4 L
	MAU Cleaner's Store (23.41.016)	3	II	Methylated spirits	2 L
Level 4	Haematology Cleaner's Store (20.41.022)	3	II	Methylated spirits	4 L
	Aged Care Rehabilitation Subacute Aged Care Cleaner's Store (21.41.022)	3	II	Methylated spirits	2 L
Level 5	Ortho-Geriatrics Cleaner's Store (17.41.022)	3	II	Methylated spirits	2 L
	Acute Aged Care Cleaner's Store (18.41.022)	3	II	Methylated spirits	2 L
Level 7	Respiratory/ Infectious Cleaner's Store (09.41.022)	3	II	Methylated spirits	2 L
	Acute Spinal/Acute Respiratory Cleaner's Store (08.41.022)	3	II	Methylated spirits	2 L
Level 8	Neurology IPU (L8) – Epilepsy Room Flammable liquid storage [12.24.053]	3	II / III	Flammable liquids (acetone, diethyl ether)	10 L

LEVEL	ROOM NAME / FACILITY	DG CLASS	PG	HAZARDOUS CONTENT	QUANTITY
	HDU Cleaner's Room (12.41.022)	3	II	Methylated spirits	2 L

Source: The quantities of dangerous goods storage were extracted from Prince of Wales Hospital Expansion Stage 1 Environmental Impact Statement Appendix BB_Hazardous Chemicals_Dangerous Goods_Matters Advice.
https://majorprojects.accelo.com/public/e1642fb59652119750ebbb8fc7058a18/Appendix%20BB_Hazardous%20Chemicals%20_Dangerous%20Goods_%20Matters%20Advice.pdf

Note: Verification of the data is not included in the scope of this report.

A3 EXISTING PREMISES DANGEROUS GOODS SCHEDULE

Table A.4 Summary of Dangerous Goods Storage Projection at Existing Premises (7)s

STORAGE ID	STORAGE TYPE	MAXIMUM STORAGE CAPACITY (KG / L)	UN NUMBER	PRODUCT NAME	CLASS / DIVISION	TYPICAL QUANTITY (L)	PACKAGING GROUP
AP03	Roofed Store	600	1307	Xylenes	3	100	III
			1170	Ethanol (Ethyl Alcohol)	3	300	II
DG03	Above Ground Tank	10600	00C1	Diesel	C1	10,600	N/A
GM01	Roofed Store	5400	1070	Nitrous Oxide	2.2	1,800	N/A
			1002	Air, Compressed	2.2	3,600	N/A
LN01	Above Ground Tank	6000	1977	Nitrogen, Refrigerated Liquid	2.2	4,000	N/A
NE01	Flammable Liquids Cabinet	250	1170	Ethanol (Ethyl Alcohol)	3	25	II
			1230	Methanol	3	90	II
OX01	Above Ground Tank	30000	1073	Oxygen, Refrigerated Liquid	2.2	24,000	N/A
OX02	Above Ground Tank	3000	1073	Oxygen, Refrigerated Liquid	2.2	2,400	N/A
OX03	Above Ground Tank	4000	1073	Oxygen, Refrigerated Liquid	2.2	3,000	N/A
PH01	Roofed Store	600	1170	Ethanol (Ethyl Alcohol)	3	450	II
SF01	Roofed Store	3000	1170	Ethanol (Ethyl Alcohol)	3	200	II
			1230	Methanol	3	430	II

Source: Ref: WorkCover NSW Acknowledge Number: NDG018496, issued on 12 May 2015 to Premises: Barker St, Randwick NSW 2031, Australia. Verification of the data is not included in the scope of this report.

APPENDIX B

QUALIFICATIONS

SHARON WANG, SENIOR PROCESS ENGINEER

8 YEARS EXPERIENCE

Sharon is a professional chemical process engineer graduated from UNSW with 8-years' experience of process engineering, safety and quality assurance within nuclear, defence, pharmaceutical, mining, building and water industry.

Sharon has extensive hands-on experience and knowledge of laboratories and highly hazardous industry including chemical storage facility, explosive dust environment, radioactive environment. She started her career as a process safety engineer and then became a nuclear medicine engineer in ANSTO prior to joining WSP.

Sharon is experienced in highly regulated industries and now leading a number of process safety, dangerous goods and hazardous area related projects in WSP.

Email: sharon.wang@wsp.com

CAMERON MACPHAIL, PRINCIPAL PROCESS ENGINEER

28 YEARS EXPERIENCE

Cameron is a professional engineer with 28-years' experience of process engineering and safety assurance within highly regulated industries including pharmaceutical and nuclear facilities.

Cameron is driven by pragmatic approach to problem resolution. In the last 15-years Cameron has held several senior roles within Engineering Lead Teams.

Prior to joining WSP, Cameron was the capital programme manager at GSK, validation team lead and process safety lead. Cameron also has 22-years' experience in the UK nuclear industry, where he was the head of system engineering, safety case author and HAZOP chair.

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