

Safety Engineering & Technical Services Pty Ltd

OCCUPATIONAL HEALTH, SAFETY & ENGINEERING CONSULTANTS

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The Manager
Health Infrastructure
C / - Capital Insight Pty Ltd
77 Berry Street
NORTH SYDNEY NSW 2060

Attention: Mr Chris Milne

Dear Sir

re: Dangerous Goods & Hazardous Substances – Contribution to Environmental Assessment – Response to DGEARs Relating to Dangerous Goods and Hazardous Substances for Inclusion in the Part 3A Planning Submission – Westmead Millennium Institute

This letter of advice has been prepared pursuant to your request to contribute to the written Part 3A submission for planning approval for the proposed Westmead Millennium Institute (WMI) Project.

EXECUTIVE SUMMARY

This report addresses those parts of the Director General's Environment Assessment Requirements (DGEARs) for hazards posed by the proposed use of dangerous goods and hazardous substances at the Westmead Millennium Institute, including issues pertaining to wastes.

The report:

- describes the nature and quantities of goods and substances that will be present at the premises
- provides a reasoned conclusion that State Environmental Planning Policy 33 (SEPP 33) does not apply to the proposed development
- identifies hazards posed by the presence of dangerous goods and hazardous substances and describes the means (generally through compliance with relevant Australian Standards, health policies, and other codes of practice) by which those hazards are to be managed, and
- concludes that the proposed facilities for the storage, handling and use of dangerous goods and hazardous substances, will be, by design, in compliance with all relevant legislative requirements in accordance with best practice principles for the management of risk to health and safety posed by the materials to be kept and used, and will as a consequence secure a level of safety and environmental performance described in the relevant standards and codes of practice applying to medical research facilities.

SCOPE OF THIS ADVICE

The DGEARs have specified that information be provided in respect of the following issues:

13. Hazards, including

- *An assessment against the SEPP 33 – Hazardous and Offensive Development; and*
- *A description of the proposed storage, use and management of any hazardous material and measures to be implemented to manage hazards and risks associated with the storage.*

14. Waste, including

- *Identity, quantify and classify the likely waste streams to be generated during construction and operation;*
- *Describe the measures to be implemented to minimize, reuse, recycle and safely dispose of this waste;*
- *Describe the measures to be implemented to manage the disposal of nuclear waste;*
- *Describe the measures to be implemented to manage the disposal of contaminated and potential contaminated biological and sewage waste.*

A DESCRIPTION OF THE WMI FACILITIES RELEVANT TO THIS REPORT

The Westmead Millennium Institute (WMI) is one of the largest medical research institutes in Australia. Established in 1996, WMI's research focus spans infectious and immune diseases, cancer and leukaemia, mental illness and liver, kidney, eye, heart and respiratory disease. WMI is organised in five divisions with 11 Centres of research, the divisions being:

- cancer;
- infection and immunity;
- liver and metabolic;
- neurosciences and vision; and
- cardiorespiratory.

WMI is closely affiliated with Westmead Hospital and The University of Sydney.

The Westmead Millennium Institute Cluster will accommodate WMI wet laboratory, dry laboratory and administrative functions and associated shared facilities.

The wet laboratory functions will be accommodated in generic PC2 laboratory modules with discrete areas for laboratory bench-based activities, laboratory support activities

requiring a dedicated space and clean write-up activities. Each laboratory module will be designed to accommodate between 48 to 60 researchers with a high degree of visibility between each of the laboratory areas. PC2 circulation routes will allow wet laboratory researchers to move between laboratory areas without the need to de-gown.

Dry laboratory space will accommodate researchers engaged in desk and instrument based research including epidemiological studies, bioinformatics, data mining, analysis of physiological measurement data etc. In addition to office space for researchers, discrete facilities will be provided for the assessment and consultation of human subjects.

Back of House support facilities will include the loading dock, central wash-up, autoclaving and media preparation, stores, cryogenic facility and -80° freezer farm, cleaning and waste management, building maintenance, the Data Centre, staff amenities, and a biological shipping facility.

Services provided by WMI & WRH are to include:

- PC2 Wet Lab with associated PC lab support spaces and office spaces.
- Dry Lab research facilities for subject assessment and consultation.
- Offices associated with the dry labs.
- WMI Small Animal Facility
- WMI Histology Lab
- WMI PC3 Lab
- WMI Administration Offices
- WRH Flow Cytometry Lab
- WRH Cell Imaging Lab
- WRH Genomics Lab
- WRH Proteomics Lab
- WRH Human Applications Lab
- WRH Small Animal Imaging and Support Facility
- WRH Biobank (Stage 2)
- back of house facilities to service the above

I am advised that, the use of the various floors will be:

- Level B1 (Basement) – Sub-ground tanks
- Level 00 (Lower Ground) – On-grade external car parking, bicycle parking, secondary building entrance, WRH & WMI PC2 laboratories, animal house, PC3 laboratory, and back of house including loading dock, plant rooms, substation, main switchboard, and staff amenities
- Level 00M (Lower Ground Mezzanine) – Plant Rooms, accessible ceiling space
- Level 01 (Upper Ground) – Main building entrance, WRH PC2 laboratories, WMI dry lab research facilities subject assessment consultation, conference facilities, and café

- Level 02 – WRH PC2 laboratory, WMI dry lab, offices, WMI administration offices and boardroom, bridge link to adjacent research institute (CMRI)
- Level 03 to Level 06 – WMI PC2 wet laboratories and dry labs, including associated offices
- Level 07 – Plant rooms

HAZARDS

There is a statutory obligation in respect of all developments, to identify hazards, assess risks, and implement and maintain control measures that adequately minimise the risk to people, property, and the natural and built environment. All development proposals are required to document information about these identified hazards in the form of a statement of environmental effects to assist consent authorities fully understand the extent of any environmental or societal risk posed by the proposed activities so that they can make an informed consent decision (with specific conditions imposed as deemed to be appropriate, to adequately manage all hazards).

This report, by addressing the items specified in the DGEARs, that directs the proponent to properly consider specific hazards and to provide an assurance that the design of the facilities is fit-for-purpose and adequate to maintain an acceptable level of safety, is part of a process for ensuring that all the implications of the intended usage of dangerous goods and hazardous substances are fully described before any consent is granted.

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, State Environmental Planning Policy 33 (SEPP 33). All development proposals are required to determine whether SEPP 33 applies.

THE APPLICABILITY OF STATE ENVIRONMENTAL PLANNING POLICY 33 (SEPP 33)

State Environmental Planning Policy (SEPP) 33 is an enabling instrument that links the safety and pollution control performance, to the permissibility of an industrial proposal. SEPP 33 applies to any 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).

A system of classification and labelling of dangerous goods has been adopted throughout 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 occurring frequently in clinical areas is compressed oxygen which is assigned to Class 2 gases, Class 2.2, Sub risk 5.1, to indicate that not only is it a compressed non-flammable gas, but that it also has oxidising properties (that render it capable of making the severity of a fire situation worse).

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, LPG)
- 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 – Oxidisers – 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).

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.

NATURE AND QUANTITIES OF DANGEROUS GOODS BEING STORED AND HANDLED AT WMI

A manifest of dangerous goods present at the premises has been developed (see APPENDIX A) using the convention that the facilities for keeping any dangerous goods of any particular classes or divisions of dangerous goods have not been listed if their quantity is less than 10% of the minor storage limit. *(Minor storage is a concept incorporated in all the relevant standards for keeping the various classes of dangerous goods. Minor storage recognizes that for small quantities of dangerous goods and where the goods are sufficiently dispersed, the presence of the dangerous goods adds marginally little to the overall hazard of the proposed facility and/or its operations).*

The dangerous goods described in APPENDIX A include:

- Class 2 Division 2.2 & 2.2/5.1 compressed non-flammable and oxidizing gases in cylinders
- Class 2, Division 2.2 cryogenic liquefied nitrogen and carbon dioxide
- C1 combustible liquid (diesel for the emergency generator set)
- Class 3 flammable liquids (in very small quantities only)
- Class 5.1 (oxidizing substances) and Class 5.2 (organic peroxides) – both in small quantities only
- Class 6.1 toxic substances including cytotoxic drugs (with small quantities of active ingredients) and cytotoxic contaminated waste, and
- Class 6.2 infectious substances
- Class 8 corrosive substances
- Class 9 miscellaneous dangerous goods (e.g. dry ice).

It is intended that Class 7 (radioactive substances) will be present in the building for diagnostic imaging (x-ray) and for irradiating specimens for research. I am advised that a specialist consultant has been engaged to provide advice on the nature of any radiation hazard, the control measures to be employed (including the storage and disposal of any nuclear wastes). This will be the subject of a separate report.

Based on the quantities of goods listed in APPENDIX A, and in accordance with the outcome of the screening method for potentially hazardous development summarised in Table 1 overleaf, the provisions of SEPP 33 do not apply to the proposed development.

SEPP 33 applies if	Threshold	Actual
Class 2 non-flammable gases and cryogenic liquids exceed limit described in Table 1 in the section Risk Screening - Figure 9 of the document <i>Applying SEPP 33</i>	No limit is set	SEPP 33 - does not apply

SEPP 33 applies if	Threshold	Actual
Class 3 dangerous goods (flammable liquids) exceed the lower threshold limit) <u>and</u> are not sufficiently separated from the boundary by the distance given in the section Risk Screening - Figure 9 of the document <i>Applying SEPP 33</i>	In the case of Class 3 PG II/PG III flammable liquids, the lowest threshold limit below which SEPP 33 does not apply is 2,000 L	Quantities below threshold limit - 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	Quantities below 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	Quantities below threshold limit - SEPP 33 does not apply
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	SEPP 33 does not apply – number of transport movements are below threshold limit

Table 1 – Applicability of SEPP 33 for potentially hazardous industry

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 legislation, 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 the Chapter 3 of the *Protection of the Environment Operations Act* hence the WMI activity is not potentially offensive development 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 WMI project.

THE PROPOSED STORAGE, USE AND MANAGEMENT OF HAZARDOUS MATERIALS

The design of the facilities for the receiving, storage, handling and use of hazardous materials, and the proposed operations of the WMI activity, will be in accordance with:

- the Building Code of Australia
- the NSW *Occupational Health and Safety Act 2000* and the *Occupational Health and Safety Regulation 2001* (particularly Part 6 – Hazardous substances and Part 6A Dangerous goods)
- 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 design and operation of laboratories and equipment for use in laboratories, particularly:
 - AS/NZS 2982.1-2010 *Laboratory design and construction – Part 1: General requirements* (especially Section 7 - Storage of hazardous substances), and
 - The AS/NZS 2243 series of standards *Safety in Laboratories* (now superseded)
 - AS 4775-2007 *Emergency eyewash and shower equipment*
- 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 – Storage and Handling of Dangerous Goods (2005)* – WorkCover NSW.
- the Department of Health and Aging, Office of Gene Technology Regulator, *Guidelines for Certification of a Physical Containment Level 2 Laboratory, Version 3.1– Effective 1 July 2007*

Radiation hazards

Diagnostic and irradiation equipment will be present and used in WMI. A radiation consultant has been engaged by WMI and 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 architect.

Shielding requirements for imaging equipment is make/model dependant and is identified and specified by the equipment suppliers. When the equipment selection is finalised, WMI will develop detailed design options that will support a protocols for the safe management of any radiation hazard.

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

- AS/NZS 3200.1.3:1996 - *Approval and test specification - Medical electrical equipment, Part 1.3: General requirements for safety - Collateral Standard: Requirements for 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 – 1998 - *Safety in laboratories. Part 4: Ionizing radiations*
- AS/NZS 2211.1:2004 – *Safety of laser products – Equipment classification, requirements and users guide (EC 60825-1:2005, MOD)*
- AS/NZS 4173:2004 - *Guide to the safe use of lasers in health care.*
- 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 of WMI will be in accordance with best-practice achievable for a bio-medical clinical facility, and will secure an acceptable level of safety.

WASTES

This section of the report addresses the DGEARs relating to the generation, storage, pre-treatment (if any), and the proposed method of disposal of the likely waste streams from:

- the Wet Laboratories
- Hub activities (including all shared and service activities), and
- Animal House activities

The preliminary options for waste disposal described in this report are to be further refined then ratified by the WMI/WRH Board.

Construction

A Waste Management Plan (Construction) will be prepared as part of the Construction Environment Management Plan. This plan will in addition to describing the objectives of the plan, detail the involvement of the waste contractor and any other specific requirements as identified during the pre-planning of demolition and construction works. The preparation of a WMP (Construction) within the CEMP is a draft commitment to be included in the Part 5.0 Draft Commitments of the Part 3A Planning Submission report

This separate study which will be undertaken with the full participation of the successful tenderer prior to construction or demolition works commencing, will address the waste streams likely to be generated, including those that may contain dangerous goods and hazardous substances expected to be created during demolition and construction.

Wherever practicable measures will be implemented to minimise, re-use, and recycle any construction and demolition wastes. Where this cannot be reasonably achieved, wastes will be disposed of responsibly and in full compliance with all statutory requirements, using licensed waste transport and waste disposal contractors with fully compliant documentation to prove due diligence has been exercised over the transport, custody and disposal processes.

Operations

A draft operational plan for wastes has been proposed that is based upon WMI's current operation (where Westmead Hospital provides all the back end waste services).

Waste streams from operations will include:

- general waste (including putrescible garbage and recyclable waste)
- confidential waste
- contaminated waste including clinical waste and sharps (including a small quantity of Class 6, Division 6.2 infectious waste)
- cytotoxic waste (Class 6, Division 6.1)
- chemical waste (of dangerous goods classes 3, 5.1, 5.2, 6.1 , 8 & 9), and
- trade waste and sewage.

The plan covers the following areas:

Offices & Public Areas - offices (including dry laboratories) will house waste bins; common and public areas will have waste kiosks. Waste kiosks will accommodate 3 classes of waste: general, paper recycling and co-mingled recycling.

Laboratories – a 'bin bay' will be located outside each standard 48-60 person laboratory module. These bays will accommodate 240L SULO type bins, each bin bay will house:

- 3 clinical waste (yellow),
- 2 general waste (green),
- 1 cytotoxic waste (purple),

- 1 paper recycling, and
- 1 co-mingled (glass/paper) recycling.

A waste accumulation area is to be provided on Level 1 near the Loading Dock.

Cleaning staff will normally be employed five days per week (Monday to Friday) but may as required, be employed on weekends if the WRH auditorium and conference area is being used for a conference or special function.

Each of the designated waste streams will be segregated in appropriate waste containers at the point of generation placed in waste holding bays located adjacent to work areas on each level of the building. This is to ensure that there is no cross contamination of the various streams nor the inadvertent creation of unnecessary quantities of higher hazard wastes. The wastes will be conveyed to the Level 1 accumulation space for pick up by authorised waste disposal contractors.

In assessing quantities it has been assumed that:

- a 240 L bin will have contain approximately 20 kg waste;
- waste will principally accumulate on working days only (there being, say, an average of 22 working days per month); and
- the worst case accumulation of waste would be 3 days generated output.

General Waste

Offices and public areas

Individual office waste bins will be emptied by cleaning staff on a daily basis. Public and common area waste kiosks will be emptied at least daily, with the option of additional disposal capacity on an as “as needs” basis. Local receptacles will be emptied into 240L SULO bins brought from the Level 1 bin storage area and returned when full or at the end of the cleaning shift.

1 - 2 x 240L SULO bins will be provided for secure document destruction in the Administration area to be emptied weekly.

General waste will be deposited into 50L green bins with liners. Cleaning staff will remove waste in liner bags to 240L bins housed outside each laboratory in a bin area describe above. Bins will be transported to the Level 1 bin storage area and replaced with clean/empty bins on a daily basis.

Recyclable Waste

Offices and public areas

Waste kiosks will be emptied on as “as needs” basis, but as a minimum, at least once per day. Local receptacles will be emptied into 240L SULO bin brought from the Level 1 bin storage area and returned when full or at the end of the cleaning shift.

Laboratories

Recyclable waste bin the bin bays will be removed by cleaning staff to the level 1 bin storage area and replace with clean/empty bins on an “as needs” basis, usually daily.

Clinical Waste

Laboratories and Laboratory Service Rooms

Clinical waste (non-PC2 biological waste) is to be deposited into 50L yellow bins with liners. Laboratory staff will then remove waste in full and closed liner bags to 240L bins housed outside each laboratory. Laboratory staff will also replace bin liner. 240L bins will be transported to the Level 1 bin storage area and replaced with clean/empty bins on a daily basis by cleaning staff. All used bins taken to the storage area are to be locked to prevent spillage and unauthorised access to the waste.

Clinical waste is not to be generated in offices or public areas

Biohazard (PC2/PC3) waste

PC2 Laboratories (main lab modules)

Waste directly contaminated with Genetically Modified material will be deposited in 30L white autoclave bins. These bins are lined with two autoclave bags and fitted with tight fitting lids. When full the internal bags are loosely taped closed and labelled. For transport lids are fitted and the receptacles and contents transported to the waste autoclaves where the contents are deposited into 200L white bins ready for autoclaving

PC2 Tissue Culture rooms

Waste directly contaminated with Genetically Modified material will be deposited in 30L white autoclave bins. These bins are lined with two autoclave bags and fitted with tight fitting lids. When full the internal bags are loosely taped closed and labelled and deposited into local 200L white bins (with lids) . For transport lids are fitted and the receptacles and contents transported to the waste autoclaves where the contents are deposited into 200L white bins ready for autoclaving

PC3 Laboratory

All waste will be deposited in 30L white autoclave bins. These bins are lined with two autoclave bags and fitted with tight fitting lids. When full the internal bags are loosely taped closed and then autoclaved via a “pass through” autoclave. Once autoclaved the waste is deposited into a clinical waste SULO type bin which is removed to the level1 contaminated waste bin storage area.

Biohazard waste is not to be generated in offices or public areas

Cytotoxic Waste

Laboratories and Laboratory Service Rooms

Cytotoxic waste is to be deposited at point of use into approved cytotoxic (purple) receptacles. These will either be cytotoxic sharps containers or receptacles lined with two cytotoxic waste bags. Bags are to be sealed before being transported to the 240L

cytotoxic waste bins in bin bays by staff. When SULO bins are full they will be transported to the Level 1 bin storage area and replaced with clean/empty bins on an as required basis by cleaning staff.

Cytotoxic waste is not to be generated in offices or public areas

Sharps

Sharps are to be directly deposited into disposable sharps containers at point of use. When full, the sharps containers are to be sealed and deposited in 240L clinical waste bins. If the Sharps that are contaminated with genetically modified material the full containers are to be deposited into cytotoxic waste bins for destruction (as cytotoxic waste is incinerated).

Sharps waste is not to be generated in offices or public areas.

Chemical Waste

All chemical waste (solid and liquid) awaiting disposal will be stored locally and logged online by laboratory staff for tracking. All waste is to be appropriately contained. Labels indicating the name and class of substance (where the waste is classified as being a dangerous good) will be provided prior to collection by technical staff and removal to the chemical waste holding area. All chemical waste will be segregated by being placed in an appropriate dangerous goods storage cabinet, or in some other approved storage location. Wastes will be consigned at least bi-monthly, to be transported to a licensed waste disposal facility in accordance with all EPA guidelines and procedures.

Chemical waste will be held in a dedicated secured area built adjacent to the loading dock. This space will accommodate the following facilities.

- 1 x 250L Flammable Liquids Storage (Class 3) Cabinet,
- 1 x 30L Oxidising Agent (Class 5.1) Storage Cabinet
- 1 x 30L Organic Peroxide (Class 5.2) Storage Cabinet
- 1 x 30L Toxic Substance (Class 6.1) Storage Cabinet
- 1 x 30L Corrosive Substance (Class 8) Storage Cabinet
- shelving/racking for up to 20 x 20L drums of X-ray developer/fixer classified as non-hazardous

Chemical waste will be collected by contractors at least bi-monthly.

Radioactive waste

A very small quantity of low-level radioactive waste may be generated (the isotope usage being both small and sporadic). Any waste stream that is of significant activity will be stored in a lead lined container for safe disposal. WMI/WRH have included within the commitments section of the Part 3A application to engage a qualified specialist consultant to prepare separate advice in these matters.

Fluorescent Light Globes & Tubes

Luminaires will be selected so that as far as is possible, environmentally responsible design choices are made. It is still expected that there will be a future requirement to dispose of used globes and tubes that may contain mercury (known to be hazardous to the environment). Fluorescent light bulbs will be collected and placed into receptacles supplied by the relevant waste contractor. These will be collected with the chemical waste and disposed of in accordance with best waste disposal practice.

Proposed on-site accumulation area for keeping wastes

A secure storage area is to be provided on Level 1 housing clinical and cytotoxic waste bins near the loading dock. It is anticipated that this space will accommodate more than 100 x 240L SULO bins [57 per day - 27 Clinical, 16 General, 14 recycling) plus an equivalent number of empties].

This assumes an operation model in which there is a pick up of all full bins on a daily basis, as occurs currently in the WMI building.

On occasions when the WRH auditorium area is utilised for conferences etc, there will be a larger requirement for general waste bins, so the capacity to carry additional “empties” is to be incorporated into the plan.

The tabulation on the following pages describes the nature and quantity of each of these waste streams, along with the measures to be implemented to minimise, reuse, recycle and safely dispose of these waste streams (including, as appropriate, the measures to responsibly manage the disposal of hazardous and/or contaminated waste).

Waste type	Description	Quantity per month			Maximum inventory held on site @ WMI	Comment
		Wet Laboratories	WRH (including office/admin) activities	Animal House		
General waste	General waste collected from specific departments daily by WMI/WRH cleaning services.	5,280 kg	1,320 kg	1,320 kg	1,080 kg	<ul style="list-style-type: none"> • Stored at Level 1 – normal pick up daily but assume maximum inventory will accumulate over a 3 day period – collected by a reputable waste transport/collection company who will transport the waste to landfill.
Recyclable Waste	Paper, cardboard,	88 x 240 L bins	198 x 240 L bins	22 x 240 L bins	42 x 240 L bins	<ul style="list-style-type: none"> • WMI will promote recycling of all waste by public and staff where possible throughout the facility. Appropriately colour coded bins will be located in departments - recyclable glass, paper and plastic will then be collected by cleaners and relocated to the Level 01 storage area near the loading dock for collection and appropriate disposal by a contracted company.

Waste type	Description	Quantity per month			Maximum inventory held on site @ WMI	Comment
		Wet Laboratories	WRH (including office/admin) activities	Animal House		
Recyclable Waste	Co-mingled plastic, glass and aluminium cans and bottles	88 x 240 L bins	66 x 240 L bins	22 x 240 L bins	33 x 240 L bins	<ul style="list-style-type: none"> As for paper/cardboard
Confidential waste	Lockable bins of confidential records		6 x 240 L bins		3 x 240 L bins	<ul style="list-style-type: none"> These bins will be located in each department generating confidential waste. As bins are filled they will be conveyed to the Level 01 Lower Ground for pick up by a contracted company that then shreds and recycles this waste.
Contaminated waste including sharps and Clinical Waste	Contaminated (clinical) waste collected in colour coded bins (yellow with an orange lid) held in the departments	5,280 kg	3,960 kg	1,320 kg	1,440 kg	<ul style="list-style-type: none"> Maximum stored inventory based on accumulating 3 days waste
	Infectious waste (Class 6.2) (yellow with a red lid)	528 kg	396 kg	Nil	270 kg	<ul style="list-style-type: none"> Maximum stored inventory based on accumulating 3 days waste
	Sharps containers (yellow)	16 x 20 L	12 x 20 L	8 x 20 L	8 x 20 L	<ul style="list-style-type: none"> To be disposed of as clinical waste
	PC2/PC3 Bio-hazardous waste	44 x 200 L bins to Autoclave room	44 x 200 L bins	nil	12 x 200 L bins	<ul style="list-style-type: none"> Contents autoclaved and rendered non-infectious

Waste type	Description	Quantity per month			Maximum inventory held on site @ WMI	Comment
		Wet Laboratories	WRH (including office/admin) activities	Animal House		
Cytotoxic Waste	Waste material including sharps contaminated with a cytotoxic drug	8 x 240 L bins	2 x 240 L bins	2 x 240 L bins	4 x 240 L bins	<ul style="list-style-type: none"> Cytotoxic waste will be collected in colour coded bins (purple bins with purple screw top lids) held in the departments generating the waste. These will be collected daily and stored in a separate enclosure in the Level 01 Lower Ground Floor for collection. This waste is then collected (also daily) by a contracted company for incineration
Chemical Waste	Flammable liquids, oxidising substances, organic peroxides, toxic substances, corrosive substances	250 L Class 3 60 L Class 5.1 40 kg Class 5.2 600 L Class 6.1 60 L Class 8 440 L of fixers (NCADG			250 L Class 3 30 L Class 5.1 20 kg Class 5.2 30 L Class 6.1 30 L Class 8 440 L of fixers (NCADG	<ul style="list-style-type: none"> Assumes that storage facilities are filled to maximum nominal capacity twice per month (for bi-monthly pick up

Waste type	Description	Quantity per month	Comment
Trade Waste Plumbing and Drainage	Waste from fixtures and equipment that generate non domestic waste (sewage) are considered Trade Waste discharges.	Not quantified	<ul style="list-style-type: none"> • WMI/WRH will discharge trade waste and sewage to a Sydney Water asset pipeline. Discharge will be subject to quality standards that will be the subject of a trade waste agreement to be entered into by WMI <p>In order to comply with discharge conditions:</p> <ul style="list-style-type: none"> • A trade wastes accumulation/dilution pit with a retention capacity of 4,000 L is to be provided to provide buffering capability and avoid short term instantaneous peaks • pH adjustment is to be incorporated into the pre-treatment measures and grease and/or high temperature discharges will be treated on site to the meet requirements of Sydney Water Corporation before discharging to the Authority Sewer. • Kitchen trade waste from retail or food outlets – trade waste generated in retail food outlets will be collected by a special system of arrestor basket floor drainage, which discharges to a grease arrestor. Grease waste will be separated in the grease arrestor before being discharged into the sewer system • Laundry waste products – hot waste from dirty utilities will be cooled to comply with Sydney Water sewer discharge regulations. Additional pipe support and additional allowance for thermal expansion will be considered in the immediate vicinity of very hot discharges. Pipe materials will be selected on their ability to handle the high discharge temperatures. • Arrestor basket traps will be provided in the loading dock garbage rooms and all floor drains and service areas that may be contaminated with solid materials

Sewage discharge quality

WMI, like the clinical activities of the various hospitals at the Westmead Campus, discharges sewage to the Sydney Water Corporation system. Clinical operations are known to discharge *E. coli* and other microbial pathogens present in any animal excrement, but at potentially higher levels than domestic sewage.

Notwithstanding this, Sydney Water do not call for the treatment of pathogens in the Hospital's sewage effluent, in that any *E. coli* or other dangerous pathogens are already contained within all human waste as a normal event, and that Public Health safeguards already incorporated within the design rules for sanitary drainage systems are sufficient to manage this hazard.

There are some exceptions to the above; for

- 1) Viral haemorrhaging diseases which have a high mortality rate and can be spread by water, require patient isolation and heat sterilisation of all waste matter from infected patients. Such installations are not common. There is a unit on standby at Westmead Hospital and there may be similar units at other Hospitals.
- 2) The presence of any highly infectious water borne disease would be drawn to the attention of Sydney Water - *it is noted that neither AS/NZS 3500 Plumbing and Drainage set and NSW Engineering Services & Sustainable Development Guidelines - Technical Series TS11 calls for any specific precautions in respect to pathogen treatment.*
- 3) Where radioactive isotope Iodine 131 is used such that isolation is required, wastes may need to be contained for the half life of the isotope in suitable plant – this will be addressed in the specialist report to be prepared by the consultant engaged for that purpose.
- 4) Laboratories - The waste water products from all laboratories requires approval of appropriate trade waste treatment, in the case of infectious material this may require chlorine, ozone or ultra violet irradiation as is appropriate.

Statutory dangerous goods signage

The inventory of dangerous goods for the WMI building facility exceeds both the placarding threshold limit and manifest level as described in Part 6A of the *Occupational Health and Safety Regulation 2001*.

As a consequence of exceeding the placard quantity there is a requirement for a HAZCHEM sign and storage location placarding at building entry points, and for individual depot signage (dangerous goods class labels) to be displayed.

As a consequence of exceeding the manifest limit, WMI has specific obligations to

- compile and maintain a manifest that contains the information and plans listed in Schedule 7 of the *Occupational Health and Safety Regulation 2001* (and to keep it in an accessible location near the main entrance for use by the NSW Fire Brigades)
- Notify WorkCover that dangerous goods in excess of manifest quantities are kept at the premises, and
- Prepare a draft emergency plan for the premises, submit it for comment by the NSW Fire Brigades and produce a final plan having regard to any written advice received by the NSW Fire Brigades

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 WMI development.

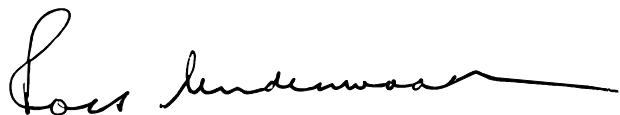
Further, the proposed facilities for the storage, handling and use of dangerous goods and hazardous substances, will be designed and constructed in compliance with all relevant legislative requirements. This is consistent with best practice principles for the management of risk to health and safety posed 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 clinical facilities, thereby meeting deemed compliance with relevant statutory instruments and obligations.

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

I thank you for the opportunity of providing advice in these matters.

Yours sincerely

Safety Engineering & Technical Services Pty Ltd



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

DISCLAIMER

This opinion in relation to the compliance of the facilities to be provided at the Westmead Millennium Institute 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. However, any use that any party makes of the documentation 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 Westmead Millennium Institute

Level/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments
<u>Level B1 (Basement)</u> Reserve diesel tank for emergency generating set	C1	-	Diesel fuel	10,000 L	<ul style="list-style-type: none"> In-ground tank installed in a tank chamber below floor of Basement Level
<u>Level 01 Lower Ground</u> Liquid Nitrogen Supply Tank	Class 2, Division 2.2 Cryogen	-	Liquefied refrigerated nitrogen	2,000 L	<ul style="list-style-type: none"> Bulk liquefied nitrogen supply tank located on Ground Level, external to the building to the north of the loading dock
<u>Level 01 Lower Ground</u> Liquid Carbon Dioxide Bulk Supply	Class 2, Division 2.2 Cryogen	-	Liquefied carbon dioxide	1.120 L	<ul style="list-style-type: none"> 2 x 600 lb (270 kg) Gasmatic® low-pressure liquefied carbon dioxide supply units - each unit has a maximum liquefied gas capacity of 560 L (water capacity) – the storage units to be located external to the building to the north of the Loading Dock
<u>Level 01 Lower Ground</u> Dry ice container	9	III	Carbon dioxide, solid	100 kg	<ul style="list-style-type: none"> Kept in an insulated storage box at the Loading Dock
<u>Level 01 Lower Ground</u> Clinical Waste Storage Room	NCADG + Class 6.2		Non-hazardous clinical waste with < 50 kg Class 6.2 infectious waste (maximum 2 x 240 L SULO bins)	< 50 kg	<ul style="list-style-type: none"> Infectious wastes (mostly from blood products) are to be segregated from other clinical waste streams for separate transport and disposal
<u>Level 01 Lower Ground</u> Biological wastes	NCADG	-	Non-hazardous clinical wastes		<ul style="list-style-type: none"> Wastes are autoclaved and are non-infectious (i.e do not meet the classification criteria for Class 6.2)
<u>Level 01 Lower Ground</u> Chemical	3	II/III	Flammable liquids	250 L	<ul style="list-style-type: none"> Kept in an approved cabinet awaiting bi-monthly disposal
	5.1	III	Oxidising substances	30 L	<ul style="list-style-type: none"> Kept in an approved safety cabinet awaiting bi-monthly disposal

Level/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments
wastes storage space	5.2	II	Organic peroxides	20 kg	• Kept in an approved safety cabinet awaiting bi-monthly disposal
	6.1	II	Toxic wastes	30 L	• Kept in an approved safety cabinet awaiting bi-monthly disposal
	8	II/III	Corrosive substances	30 L	• Kept in an approved safety cabinet awaiting bi-monthly disposal
	NCADG	-	Developer/fixer	400 L	• 20 x 20 L drums of developer/fixer – not classified as being dangerous goods
<u>Level 01 Lower Ground</u> Cytotoxic wastes storage room	6.1	II	Toxic wastes	120 kg	• Maximum of 6 x 240 SULO bins - the active cytotoxic ingredient content will be less than 100 mgm, the bulk of materials will be discarded consumables that may be contaminated with trace quantities
<u>Level 01 Lower Ground</u> Tissue Bank	Class 2, Division 2.2 Cryogen	-	Liquefied refrigerated nitrogen	2,900 L	• Up to 10 vapour phase freezers each containing about 290 L of liquefied nitrogen – each freezer consumes about 10 L of liquid nitrogen per day and is connected to automatic top up facilities from liquid bulk tank – storage arrangement in accordance with AS 1894-1997
<u>Level 01 Lower Ground</u> Gas cylinder store	Class 2, Division 2.2 & 2.2/5.1	-	Compressed non-flammable and oxidising gases	2,000 L	• Gas cylinder store – Minor Storage quantities as per AS 4332-2004 – gases include carbon dioxide, medical air carbogen, nitrous oxide
<u>Level 01 Lower Ground Floor</u> Flammable liquid package store	3	II/III	Flammable liquids	500 L	• Store to accommodate decant facilities
<u>Level 01 Lower Ground Floor</u> WM Hub Labs (3) PC2, PC3, Human	3	II/III	Flammable liquids	90 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
	6.1	II/III	Toxic substances	90 L	• Each Hub lab to have an approved cabinet of 30 L max capacity

Level/Facility	DG Class	PG	Hazardous contents	Q'ty	Comments
Applications	8	II/III	Corrosive substances	90 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
<u>Level 01 Upper Ground Level</u> Hub Labs (2)	3	II/III	Flammable liquids	60 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
	6.1	II/III	Toxic substances	60 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
	8	II/III	Corrosive substances	60 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
<u>Level 02</u> Hub Lab	3	II/III	Flammable liquids	30 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
	6.1	II/III	Toxic substances	30 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
	8	II/III	Corrosive substances	30 L	• Each Hub lab to have an approved cabinet of 30 L max capacity
<u>Levels 03, 04, 05 & 06</u> 48-60 researcher-module Wet Labs	3	II/III	Flammable liquids	240 L	• Each Modular Wet Lab to have 2 x approved cabinets of 30 L max capacity
	6.1	II/III	Toxic substances	120 L	• Each Modular Wet Lab to have an approved cabinet of 30 L max capacity
	8	II/III	Corrosive substances	120 L	• Each Modular Wet Lab to have an approved cabinet of 30 L maximum capacity

NOTES:

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

APPENDIX B Dangerous Goods Aggregate Inventory by Dangerous Goods Class

Dangerous Goods Class	Packing Group	Aggregate Quantity	Comments
Class 2, Division 2.2 & 2.2/5.1 compressed non-flammable and oxidising gases in cylinders	-	1,000 L w.c.	This is equivalent to 20 x G-size gas cylinders and is below the Minor Storage limit described in AS 4332-2004. It is also permissible to have up to 10 x G-size cylinders of the stated inventory of Division 2.1 (flammable) and 1 x G size Division 2.3 (toxic) gases although no requirement to keep these gases has been declared
Class 2, Division 2.2 carbon dioxide for reticulated supply	-	1,120 L w.c.	2 x Gasmatic® low-pressure cryogenic storage containers
Class 2, Division 2.2 liquefied refrigerated nitrogen	-	4,900 L	Capacity of bulk supply vessel and vapour phase freezers
Class 3 flammable liquids	II/III	1,170 L	
Class 4 flammable solids, spontaneously combustible and dangerous when wet substances	II/III	50 kg	Notional quantity allowed – not kept in quantities sufficient to warrant consideration beyond the precautions generally described in Part 10 of AS 2243 <i>Safety in Laboratories</i>

Dangerous Goods Class	Packing Group	Aggregate Quantity	Comments
Class 5.1 – oxidising substances	II/III	100 L (kg)	Notional quantity allowed – below minor storage limits as described in AS 4326-2008 <i>The storage and handling of oxidising substances</i> and not kept in quantities sufficient to warrant consideration beyond the precautions generally described in that standard and Part 10 of AS 2243 <i>Safety in Laboratories</i>
Class 5.2 – organic peroxide	II	20 L (kg)	Notional quantity allowed – below minor storage limits as described in AS 2714-2008 <i>The storage and handling of organic peroxides</i> and not kept in quantities sufficient to warrant consideration beyond the precautions generally described that standard and in Part 10 of AS 2243 <i>Safety in Laboratories</i>
Class 6.1 – toxic substances	II/III	330 L	Notional quantity allowed – below minor storage limits as described in AS/NZS 4452-1997 <i>The storage and handling of toxic substances</i> and not kept in quantities sufficient to warrant consideration beyond the precautions generally described in that standard and in Part 10 of AS 2243 <i>Safety in Laboratories</i>
Class 8 – corrosive substances	II/III	330 L	Notional quantity allowed – below minor storage limits as described in AS 3780-2008 <i>The storage and handling of corrosive substances</i> and not kept in quantities sufficient to warrant consideration beyond the precautions generally described in that standard and in Part 10 of AS 2243 <i>Safety in Laboratories</i>

Dangerous Goods Class	Packing Group	Aggregate Quantity	Comments
Class 9 – miscellaneous dangerous goods	III	250 L (Kg)	Notional quantity allowed – below minor storage limits as described in AS/NZS 4681-2008 <i>The storage and handling of Class 9 (miscellaneous) dangerous goods and articles</i> and not kept in quantities sufficient to warrant consideration beyond the precautions generally described in that standard and in Part 10 of AS 2243 <i>Safety in Laboratories</i>

APPENDIX C Who provided the advice in 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 43 years experience in industrial practice.

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; 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, and the Risk & Liability Management short course convened by Engineering Education Australia.