Charles Sturt University

Chemical Safety Manual

Booklet 4 - Substances

IN THIS BOOKLET

1. Nanomaterials

1.1. Terminology

Nano-objects are defined as materials with one (nanoplate), two (nanorod) or three (nanoparticle) external dimensions in the nanoscale (i.e. between approximately 1 and 100 nm). Nano-objects can form agglomerates and aggregates. For the purpose of this document, the term nanomaterials shall apply as a collective term for the above materials.

1.2. Legislation

There is currently no NSW legislation dealing specifically with nanomaterials. However, legislation covering chemicals is applicable to nanomaterials. The Work Health and Safety Regulations 2017 (NSW) have specific requirements for workplace hazardous chemicals, this covers nanomaterials in the same way as other hazardous chemicals.

1.3. Types of Engineered Nanomaterials

While some occur naturally, many nanomaterials are engineered with specific properties in mind. Table 7 on the following page provides details on some of the more common types of engineered nanomaterials to which this guide might be applied.

Table 7 - Common types of engineered nanomaterials

Type	Description	Characteristics
Fullerenes	Fullerenes comprise one of four types of naturally-occurring forms of carbon. Their molecules are composed entirely of carbon and take the form of a hollow sphere. One of the most commonly described fullerenes is C60, known as a Buckminster fullerene or a buckyball. Fullerenes are chemically stable materials and insoluble in aqueous solutions. Potential applications include drug delivery, coatings and hydrogen storage.	carbon-only molecules (hollow sphere, ellipsoid, tube, or plane)
Carbon nanotubes	Carbon nanotubes (CNT) are allotropes of carbon with cylindrical structure, high-aspect ratio different tube diameters and lengths as well as tube structures principally consisting of one to many layers of tubular graphene-like sheets. The principal types are usually grouped into SW (single-walled), DW (double walled), and MW (multi-walled) CNT. Diameters may vary from around 1 nm for SWCNT to more than 100 nm for MWCNT. Their lengths can exceed several hundred µm. Commercial CNT can often contain a significant amount of other carbon allotropes and inorganic nanoparticle catalysts.	cylindrical fullerene (single or multi-walled, capped or uncapped)
Nanowires	Nanowires are small conducting or semi-conducting nanofibers with a single crystal structure, a typical diameter of a few 10s of nm and a large aspect ratio. Various metals have been used to manufacture nanowires, including cobalt, gold and copper. Silicon nanowires have also been produced. Potential applications include inter-connectors in Nano-electronic devices, photovoltaics and sensors.	large aspect ratio
Quantum dots	Quantum dots are small (2 nm to 10 nm) assemblies of semiconductor materials with novel electronic, optical, magnetic and catalytic properties. Typically containing 1,000 to 100,000 atoms, quantum dots are considered to be something between an extended solid structure and a single molecular entity. Semiconductor quantum dots exhibit distinct photo-electronic properties which relate directly to their size. For example, by altering the particle size, the light emitted by the particle on excitation can be tuned to a specific desired wavelength. Applications include catalysis, medical imaging, optical devices and sensors.	semi-conducting crystal core (e.g. CdSe, CdS core, ZnS coat)
Metals and metal oxides, ceramics	This category includes a wide range of compact forms of nanoparticles, including ultrafine titanium dioxide and fumed silica. Such nanoparticles can be formed from many materials, including metals, oxides and ceramics. Although the primary particles have compact form, these materials are often available only in agglomerated or aggregated form. They can be composites having, for example, a metal core with an oxide shell, or alloys in which mixtures of metals are present. This group of nanoparticles is generally less well defined in terms of size and shape, and likely to be produced in larger bulk quantities than other forms of nanoparticles. Applications include coatings and pigments, catalysis, personal care products, cosmetics and composites.	ultrafine powders (e.g. Ag, Au, ZnO, TiO2, CeO)

Carbon black	Carbon black is virtually pure elemental carbon in the form of particles that are produced by incomplete combustion or thermal decomposition of gaseous or liquid hydrocarbons under controlled conditions. Its physical appearance is that of a black, finely divided powder or pellet. Its use in tyres, rubber and plastic products, printing inks and coatings is related to properties of specific surface area, particle size and structure, conductivity and colour. The primary particle size of carbon black is most commonly less than 100 nm, but commercial forms are aggregated, typically with dimensions greater than 100 nm. Carbon black is one of the top 50 industrial chemicals manufactured worldwide, based on annual tonnage.	
Dendrimers	Dendrimers are polymer particles in which the atoms are arranged in a branching structure, usually symmetrically about a core. Dendrimers are typically monodisperse with a large number of functionalizable peripheral groups. They are currently being evaluated as drug delivery vehicles.	
Nanoclays	Nanoclays are ceramic nanoparticles of layered mineral silicates. Nanoclays can be naturally occurring or engineered to have specific properties. Naturally occurring forms include several classes such as: montmorillonite, bentonite, kaolinite, hectorite, and halloysite. Nanoclays also include organo-clays, i.e. clays that have been subjected to cation exchange, typically with large organic molecules, which partially or completely de-laminates the primary sheets.	

1.4. Potential Hazards

There are specific issues associated that should be considered as part of the planning and risk assessment of work involving nanomaterials. Nanomaterials are generally considered more hazardous than their larger form counterparts because of the potential for nanomaterials to express property changes such as increased flammability and reactivity, from their larger counterparts and the potential of some nanomaterials to form explosive dust clouds. In addition to this, increased particle number and combined surface area, other particle characteristics might influence the biological response, including solubility, shape, charge and surface chemistry, catalytic properties, adsorbed pollutants (e.g. heavy metals or endotoxins), as well as degree of agglomeration.

1.5. SDS's and Control Banding for risk assessment.

As nanotechnology is an emerging field and the reasons described above, SDS's for nanomaterials may not adequately cover all the hazards of these materials. Due to this, research has been undertaken into what standard controls would be suitable for working with nanomaterials to reduce exposure. It has been shown that existing controls utilised for dusty processes are effective controls for use with nanomaterials. From this research a principle of control banding has been developed, which is based on an evaluation of the known health risks of the nanomaterial product and the potential exposure identify an appropriate control band. When undertaking a risk assessment for work involving nanomaterials, specialist advice may be required to identify the appropriate control band.

Conceptually, the five control band levels detailed in the ISO Standard consist of:

- CB 1: Natural or mechanical general ventilation
- CB 2: Local ventilation: extractor hood, slot hood, arm hood, table hood, etc.
- CB 3: Enclosed ventilation: ventilated booth, fume hood, closed reactor with regular opening
- CB 4: Full containment: glove box/bags, continuously closed systems
- CB 5: Full containment and review by a specialist: seek expert advice

1.6. Labelling

Manufacturers/importers have a duty to correctly classify chemicals and include information on known hazards on the label in accordance with Work Health and Safety Regulations.

Where the hazards associated with engineered nanoparticles have not been fully characterised the manufacturer/supplier should include an interim statement on the label such as:

a. Contains engineered/manufactured nanomaterials. Caution: Hazards unknown; or

b. Contains engineered/manufactured nanomaterials. Caution: Hazards not fully characterised.

Where engineered nanomaterials are labelled with the above phrases, they should be included on the label of any container to which the nanomaterial is decanted.

1.7. Spills

Methods to control spill and accidental release of nanomaterials should be identified in pre-planning activities. Where on-site personnel might reasonably be expected to deal with a spillage of nanomaterials, consideration may be given to the use of wet wipe cleaning methods, barriers to minimise air currents across areas affected by a spillage and tested and certified HEPA filters, for dry materials or dried spills. Dry sweeping should be avoided.

1.8. Nano waste Management

The properties of a nanomaterial must be considered when determining the appropriate method of waste disposal. Consideration needs to be given to the following characteristics:

- Type of nanomaterial or nano-product from which nanowaste is derived can effect waste characteristics. These characteristics include flammability, corrosivity, reactivity ,toxicity, physical form (e.g. material size can affect waste characteristics)
- The sources of nanomaterial waste may include the manufactured nanomaterials themselves (e.g. carbon nanotubes), Nano By-products - organic or inorganic, liquid suspensions containing nanomaterials, items contaminated with nanomaterials (e.g. wipes/PPE), the waste of animals to which nanomaterials have been administered, solid matrices with nanomaterials
- Due to the above, waste containing nanomaterials may require, separation from other waste streams, to be bagged and sealed, to be labelled as per clinical waste protocols and ADG Code, storage on site, to be recycled where possible. For the time being, disposal of waste via incineration plants should be avoided where little is known about the behaviour or there is high concentrations of nanoparticles.

2. Security Risk Substances (SRS)

2.1. Ammonium Nitrate

The term Security Risk Substances (SRS) has been given to dangerous goods of particular security concern because their misuse may lead to mass casualties and/or destruction.

The requirements of the SRS Regulations are in addition to the requirements of the other dangerous goods safety regulations and any other legislation that may apply.

Security Risk Substances are substances containing more than 45% Ammonium Nitrate, which is not an explosive or an aqueous solution consisting of a homogeneous mixture of 2 or more components in a single phase. The above substances will collectively be referred to as Security Sensitive Ammonium Nitrate (SSAN)

2.2. Licencing and Exemption

In general, the manufacture, import, export, supply, transport possession, access or use of Security Risk Substances requires a license, issued by SafeWork NSW. An exemption to the licencing requirements for the possession of SRS exists for educational institutions (persons employed by and students of educational institutions).

This exemption is conditional on a legitimate research, teaching or analysis requirement for the SRS that do not involve the manufacture of an illegal product and a limit of 3kg of SRS held in any laboratory/building. This is to be recorded and managed on ChemWatch Gold FFX. Should more than of 3kg of SRS be required, contact the Facility Manager to discuss.

SRS's are considered to be a Chemical of Security Concern. Please see section 3 below for recommendations on management of Chemicals of Security Concern.

3. Chemicals of Security Concern

3.1. Introduction

Chemicals are legitimately used by individuals and organisations every day throughout Australia. However, a small percentage of these chemicals have been diverted and used for unlawful purposes, including facilitating terrorist attacks. The Council of Australian Governments (COAG) have identified 96 chemicals as chemicals of security concern, due to their potential to produce explosive or toxic weapons.

A voluntary National Code of Practice for Chemicals of Security Concern applies to 11 of the 96 Chemicals of Security Concern that are precursors to homemade explosives. Ideally the code should be applied to the additional 84 toxic chemicals of security concern as security risk management is part of good business practise. The remaining Chemical of Security Concern is Ammonium Nitrate as covered by the Dangerous Goods Safety (Security Risk Substance) regulations 2007 (see Section 18). The National Code of Practice for Chemicals of Security Concern outlines measures to increase responsibility, security, monitoring of inventory and the reporting of suspicious behaviour.

3.2. Chemicals covered by the code

Table 8: Chemicals covered by the National Code of Practice for Chemicals of Security Concern.

Chemicals of Security Concern		
Security Risk Substances **Ammonium Nitrate (Section 18)**	> 45% Ammonium Nitrate, which is not an explosive or an aqueous solution consisting of a homogeneous mixture of 2 or more components in a single phase.	
11 precursor chemicals **Ammonium perchlorate** **Hydrogen peroxide** **Nitric acid** **Nitromethane** **Potassium chlorate** **Potassium nitrate** **Potassium perchlorate** **Sodium azide** **Sodium chlorate** **Sodium nitrate** **Sodium perchlorate**	≥ 65% or pure aqueous solution ≥ 10% All pure aqueous solutions, mixtures with other chemicals ≥15% ≥ 30% ≥ 10% ≥ 65% or pure aqueous solution ≥ 10% ≥ 65% or pure aqueous solution ≥ 10% ≥ 65% or pure aqueous solution ≥ 10% ≥ 95% ≥ 65% or pure aqueous solution ≥ 10% ≥ 65% or pure aqueous solution ≥ 10% ≥ 65% or pure aqueous solution ≥ 10%	
84 toxic chemicals **Aldicarb**	Endosulfan	Perchloric acid

Aluminium phosphide	Ethion	Phorate
Ammonia (anhydrous)	Ethyl mercury chloride	Phosgene
Arsenic pentoxide	Ethyldiethanolamine	Phosphine
Arsenic trioxide	Hydrochloric acid	Phosphorus
Arsine	Hydrogen chloride	Phosphorus oxychloride
Azinphos methyl	Hydrogen cyanide	Phosphorus pentachloride
Bendiocarb	Hydrogen sulphide	Phosphorus trichloride
Beryllium sulfate	Magnesium phosphide	Potassium cyanide
Bromine	Mercuric chloride	Propoxur
Cadusafos	Mercuric nitrate	Sodium cyanide
Calcium cyanide	Mercuric oxide	Sodium fluoroacetate
Carbofuran	Mercurous nitrate	Strychnine
Carbon disulphide	Mercury cyanide	Sulfur dichloride
Carbon monoxide	Methamidophos	Sulfur monochloride
Chloropicrin	Methidathion	Sulphuric acid
Chlorfenvinphos	Methiocarb	Terbufos
Chlorine	Methomyl	Thallium sulfate
Cyanogen bromide	Methyl fluoroacetate	Thionyl chloride
Cyanogen chloride	Methyldiethanolamine	Thiophosphoryl chloride
Diazinon	Mevinphos	Triethanolamine
Dichlorvos	Nitric oxide	Triethyl phosphite
Diethyl phosphite	Omethoate	Trimethyl phosphite
Dimethyl phosphite	Osmium tetroxide	Zinc cyanide
Dimethyl mercury	Oxamyl	Zinc phosphide
Dimethyl sulfate	Paraquat	
Disulfoton	Parathion methyl	

3.3. Application of the Code in Universities

Universities Australia developed a National Code of Practice for Chemicals of Security Concern - guidance note for laboratories - in universities, health or industry. The guidance outlines advice for implementing the code in laboratory based workplaces. The advice is separated into 3 sections. The importance of the National Code of Practice for Chemicals of Security Concern and the controls in place should form part of your training & induction programme.

1. The overarching responsibility for integrating the Code of Practice for Chemicals of Security Concern sits with someone in a position to implement and promote the code. As part of organisational risk assessment the assessment of security risk and implementation of security measures should be considered together with ensuring that personnel who are able to order chemicals are verified as trustworthy people, making laboratory mangers & supervisors aware of the code, the importance of reporting suspicious behaviour and reviewing waste disposal procedures. At Charles Sturt University this is the DVC (Research and Engagement).

2. Technical Managers and Supervisors can implement the Code of Practice by a risk assessment approach that may include the following controls. Reviewing security measures, ensuring that chemicals are stored in a secured area, restricting access arrangements to those who have a legitimate need, maintaining an accurate inventory, being familiar with and encouraging supervisors to be familiar with the chemicals and volumes being used by students and technicians & limiting the number of people authorised to purchase chemicals.

3. Technical Managers and Supervisors can implement the Code of Practice using a risk assessment approach and may include strategies around reviewing inventory recording systems to enable regular interactive and accurate monitoring, Appointing people with appropriate responsibility to regularly reconcile inventory and report any unexplained discrepancies.

3.4. Reporting

Report any suspicious activity or unexplained discrepancies to Security. They will then contact the National Security Hotline.

4. Scheduled Poisons

4.1. Scheduled Poisons, Medicines and Drugs

The NSW Poisons and Therapeutic Goods Act 1966 No 31 regulates and controls the possession, sale and use of poisons, medicines and drugs to protect the public from harm associated with the misuse of these substances.

Poisons, medicines and drugs controlled under the Poisons and Therapeutic Goods Act 1966 are classified into Schedules (listed below) based on their toxicity, use and potential for misuse. The Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) is the legislative instrument that has been adopted as the list of poisons classified into each schedule. Many poisons by their nature are also hazardous or dangerous and as such the requirements of the Poisons and Therapeutic Goods Act 1966 are in addition to those of other applicable legislation unless specifically stated. The Schedules of a poison can also be found on the SDS, where available.

For specific details relating to the handling of Schedules substances, refer to Faculty of Science & Health

Scheduled Substance Management Procedure.

4.2. Definition of Schedules

The Schedules as defined in the Poisons and Therapeutic Goods Act 1966 are:

Schedule 1	**Currently not used**
Schedule 2	Pharmacy Medicine; medicines available to the public from pharmacies or where there is no pharmacy service available, from persons licensed to sell Schedule 2 poisons
Schedule 3	Pharmacist Only Medicine; medicines sold by retail under the supervision of a pharmacist or supplied by medical practitioners, dentists or veterinary surgeons
Schedule 4	Prescription Only Medicine OR Prescription Animal Remedy; medicines that are supplied on prescription from a pharmacy or by a medical practitioner, dentist, veterinary surgeon, or nurse practitioner
Schedule 5	Caution poisons of a hazardous nature that must be readily available to the public, but require caution in handling, storage and use
Schedule 6	Poison poisons that must be available to the public, but are of a more hazardous or poisonous nature than those included in Schedule 5
Schedule 7	Dangerous Poison; poisons that require special precautions in manufacture, handling, storage or use, or special individual regulations regarding labelling or availability
Schedule 8	Controlled Drug; prescription medicines which require restriction of manufacture, supply, distribution, possession and use to reduce abuse, misuse and physical or psychological dependence

Schedule 9	Prohibited Substances; poisons that are drugs of abuse, the manufacture, possession, sale or use of which should be prohibited by law except for amounts which may be necessary for educational, experimental or research purposes conducted with the approval of Commonwealth and/or State or Territory Health Authorities.
Schedule 10	Substances of such danger to health as to warrant prohibition of supply and use. Substances which are prohibited for the purpose or purposes listed for each poison

4.3. Poisons Permit

To purchase, use and hold poisons in schedules 2, 3, 4, 7, 8, or 9, Charles Sturt University must hold an appropriate permit for either research, educational, or industrial purposes. The purchase, use or holding of Schedule 5 and 6 Poisons do not require a permit.

The permit must be held by a person (nominated by the School/Department) with sufficient education or experience in the handling of Poisons (generally this is a tertiary qualification or 5 years' experience, relevant to the poisons listed on the permit). Permit holders are responsible for ensuring that all permit conditions are met. Staff who require the purchase, access and use scheduled poisons must be authorised to do so by the permit holder

Permits are only valid for the named poisons/schedules and locations. Manufacture, distribution, sale or supply of Scheduled Poisons is prohibited under these permits. Schedule 9 substances may only be used with the gazetted approval of the Department of Health CEO for certain research and teaching purposes. Applications for Schedule 9 substances are separate authority.

Permits may outline additional conditions for use, storage, and record keeping for individual poisons or entire schedules. Permits may also detail any limitations on the size or quantity allowed under the permit. Poisons covered under a Poisons Permit cannot be used for purposes other than those for which the permit has been granted.

This section does not include the legal requirements and obligations for prescribing and administering drugs/medications to people (including authorised personnel and labelling). The use of scheduled poisons in human or animal research must be approved by the corresponding ethics committee.

4.4. Purchase

It is a requirement for a permit to be in place prior to the purchase of the scheduled poisons above. Permits must either list the chemicals being used on the permit or list the relevant schedule for them to be compliant. Suppliers are required to ensure the appropriate permit is held by Charles Sturt University prior to the supply of scheduled poisons requiring a permit.

All purchases of Scheduled poisons must follow Charles Sturt University's purchasing procedure. The purchase should be made by the Permit holder or as a minimum the permit holder must provide authorisation for the purchase.

4.5. Storage & Access Arrangements

All Scheduled Poisons must be stored securely. Additional conditions for storage may be stipulated in Individual Permit conditions.

As a minimum Schedule 4 Poisons must be stored within a locked room or dedicated locked cupboard/cabinet, with authorised access only.

Where a Scheduled poison requiring a permit is also a dangerous goods (i.e. Schedule 7 Poisons) it must also be stored securely in addition to the Dangerous Goods Safety storage requirements.

Schedule 8 and 9 substances these must be located within an approved safe. (The safe must meet the requirements of Poisons and Therapeutic Goods Act 1966).

4.6. Record Keeping Poisons

Schedule 4 poisons require purchase and usage records to be kept. The records should be detailed enough so that discrepancy of use, lost or stolen poisons would be reasonably detected.

Schedule 8 and 9 poisons require records of purchase and usage and destruction to be kept in a dedicated record book obtained from the supplier. Inventory records must be entered at least monthly.

4.7. Labelling

Schedule poisons when packaged and sold solely for dispensary, industrial, laboratory or manufacturing purposes should be labelled according to the requirements of Booklet 2 Section 6.

When packaged for consumer usage (i.e. prescribed medicines), scheduled poisons must be labelled according to the labelling requirements of the SUSMP – Standard for the Uniform Scheduling of Medicines and Poisons

The labelling requirements for decanted drugs, poisons and controlled substances must follow the decanted labelling requirements outlined in Booklet 2 Section 6.

4.8. Disposal

Poisons must be disposed of without creating risk to the public. Schedule 8 poisons can only be destroyed by or under the supervision of a person authorised by the Poisons Regulations.

5. Concessional Spirits

Undenatured ethanol (alcohol) can attract an excise under the Excise Act.

Charles Sturt University currently has an exemption from holding a permit, records must still be kept for a minimum of 5 years.

The following form may be used as a spirit register.

A spirit register which sets out the spirit received, used and a running balance must be maintained. The records must include:

a. invoice number
b. date, type and strength of spirit received
c. opening stock quantity
d. date, type, quantity, spirit and what the spirit was used for
e. closing stock quantity
f. details of any stocktakes carried out
g. any losses of spirit including the volume and reason.
h. more information on concessional spirits is available from the Australian Taxation Office website.

6. Health Surveillance

The Work Health and Safety Regulations list some specific hazardous substances under Schedule 14 that require health surveillance where there is a risk to health from exposure to any of the listed substances. The type of surveillance for each substance is outlined in the regulations.

Schedule 14 substances:

- Acrylonitrile
- Inorganic Arsenic
- Asbestos
- Benzene
- Cadmium
- Inorganic Chromium

- Creosote
- Isocyanates
- Inorganic Mercury
- 4,4'methylene bis(2-chloroaniline) (MOCA)
- Organophosphate pesticides
- Pentachlorophenol (PCP)
- Polycyclic aromatic hydrocarbons (PAH)
- Crystalline silica
- Thallium
- Vinyl chloride

This is not an exhaustive list of the hazardous substances for which health surveillance should be considered. Health surveillance should be provided when risk assessment indicates that exposure to a chemical presents a reasonable likelihood that adverse health conditions could occur under particular conditions and there is a scientifically validated method available to monitor it.

The initial surveillance must occur prior to the commencement of work and further surveillance during and/or after the period of work involving the substance. Health surveillance records are treated as confidential and must be kept for 30 years. The employer must cover the cost of health surveillance. If health surveillance is required, contact Work Health and Safety Unit.

7. Scheduled Carcinogens

7.1. Chemical Carcinogens

Carcinogenic chemicals are hazardous substances that may cause cancer. Three schedules of carcinogenic chemicals have been declared under Work Health and Safety Regulations. If the use of a scheduled carcinogen is required, contact chemicalsafety@csu.edu.au prior to application to the Commissioner of WorkSafe. Applications will require a justification of the use of the substance and a detailed risk assessment of the proposed work. The Commissioner may stipulate further conditions or restrictions on the use of the carcinogenic substance.

The scheduled substances below are not an exhaustive list of carcinogens. If a chemical is classified as carcinogenic, a thorough risk assessment should be performed.

The listed carcinogenic substances are subject to the scheduled restrictions as a pure substance; or in a mixture containing 0.1% or more of that substance determined as a weight/weight (w/w) concentration for solids or liquids, or a volume/volume (v/v) concentration for gases. They must not be used without the approval of the Commissioner of Worksafe.

7.2. Carcinogenic substances only to be used for bona fide research

The listed Schedule 10 substances have been identified as Carcinogenic substances to be used only for bona fide research under the Work Health and Safety Regulations. The Commissioner must be notified of the intention to use a Schedule 10 carcinogenic substance in the workplace prior to the commencement of work.

Schedule 10 Substances

- 2-Acetylaminofluorene
- Alfatoxins
- 4-Aminodiphenyl
- Benzidine and its salts
- Bis(chloromethyl) ether
- Chloromethyl methyl ether (technical grade)
- 4-Diaminoazobenzene

- 2-Napthylamine and its salts
- 4-Nitrodiphenyl

7.3. Carcinogenic substances only to be used for purposes approved by the commissioner

The listed Schedule 10 substances have been identified as requiring approval by the Commissioner of Worksafe under the Work Health and Safety Regulations. This approval must be obtained prior to the commencement of work.

Schedule 10 Substances

- Acrylonitrile
- Benzene (when used as a feedstock and containing more than 50% benzene by volume)
- Cyclophosphamide [(a cytotoxic drug) when used in preparation for therapeutic use in hospitals and oncology treatment facilities and in manufacturing operations]
- 3,3-Dichlorobenzidine and its salts (including 3,3-dichlorobenzidine dichloride)
- Diethyl sulphate
- Dimethyl sulphate
- Ethylene dibromide (when used as a fumigant)
- 4-4'-Methylene bis(2-chloroaniline) – (MOCA)
- Beta-Propiolactone (2-propiolactone)
- O-Toluidine and O-Toluidine hydrochloride
- Vinyl Chloride Monomer

7.4. Carcinogenic substances – Asbestos

The listed Schedule 8 substances have been identified as requiring approval by the Commissioner of Worksafe under the Work Health and Safety Regulations. This approval must be obtained prior to the commencement of work.

Schedule 8 Substances

- Actinolite asbestos
- Amosite (brown asbestos)
- Anthophyllite asbestos
- Crocidolite (blue asbestos)
- Chrysotile (white asbestos)
- Tremolite asbestos

7.5. Access, Health Surveillance & Records

Access to scheduled carcinogens should be restricted to staff or students who:

a. work directly with the scheduled carcinogens;

b. have received chemical training; and

c. have been fully briefed on the chemical risk assessment.

Restricted areas should display appropriate signage (check SDS).

Health surveillance is required for scheduled carcinogens and an SDS will provide some initial advice on the types and frequency of health tests required. Additional advice should be sought from the University's Health Surveillance and Monitoring Procedure.

Records must be maintained and kept for each person who works with a scheduled carcinogenic substance. The records must contain:

- the person's full name;
- the person's date of birth;
- the person's residential address during the period that the person worked with the scheduled carcinogenic substance;
- the name of each scheduled carcinogenic substance that the person worked with; and
- the period of time over which the person worked with each of the scheduled carcinogenic substances. A written copy outlining the above details must be given to each person who works with a scheduled carcinogenic substance on leaving Charles Sturt University.

8. Agricultural and Veterinary Chemicals

8.1. Introduction

In addition to the general chemical management requirements, there are additional legislative requirements for agricultural and veterinary chemicals under the Agricultural and Veterinary Chemicals Act 1994 & Regulations 2015. The government departments that control the use of agricultural and veterinarian chemicals regulation Australian Pesticides and Veterinary Medicines Authority.

All agricultural and veterinary products or their active constituent sold in Australia must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) which provides approval for a product for the purpose and use as stated on the label.

8.2. Purchase

All chemical purchases must be completed through Unimarket and have a current ChemCert certificate. Due to the nature of the products, many agricultural & veterinary products are also scheduled poisons. Please refer to (section 4 above) for more information about the requirements for poisons.

8.3. APVMA Research Permits for off label use

Use of an agricultural or veterinary chemical other than as directed by the label is termed 'off label' use and requires an APVMA research permit. A Public chemical Registration Information System Search (PubCRIS) is maintained on the APVMA website. https://portal.apvma.gov.au/pubcris.

8.4. Usage Restrictions for Agricultural or Veterinary purposes.

There are controls on the use of agricultural & veterinary chemicals for Agricultural and Veterinary practices to protect people, animals, crops, and the environment. They cover aspects such as spray drift, overuse and maximum residue levels and withholding periods for agricultural produce. If an agricultural & veterinary chemical is required for research into agricultural or veterinary practices or produce, additional licensing or permit requirements may apply.

Permits to use agricultural chemicals including herbicides, fungicides, baits and poisons, and insecticides are regulated by the Australian Pesticides and Veterinary Medicines Authority.

8.4.1. Veterinary Drugs and Poisons Permits

Veterinary practitioners are authorised to obtain, possess, use or supply most drugs and poisons for the lawful practice of their profession, i.e. for the veterinary treatment of animals under their care. You will need to provide proof that you are a registered veterinarian and that you hold the required poisons permits to purchase many veterinarian pharmaceuticals.

8.5. Labelling

Manufactures must ensure that agricultural and veterinary chemicals have a label in English that complies with the requirements of the Australian Pesticides and Veterinary Medicines Authority and also includes the following:

a. any hazard statement that is consistent with the correct classification of the chemical, and

b. any precautionary statement that is consistent with the correct classification of the chemical.

8.6. Health Surveillance

The use of certain agricultural chemicals may require health surveillance. This is particularly relevant to pesticides that contain organophosphates and or benzenes. For information about health surveillance see section 6 above.

8.7. Legislation

8.7.1. Acts and Regulations

- Agricultural and Veterinary Chemicals Code Act 1994
- Agricultural and Veterinary Chemicals Code Regulation 1995
- Agricultural and Veterinary Chemicals NSW Act (1994)
- Agricultural and Veterinary Chemicals NSW Regulations 2015
- Poisons and Therapeutic Goods Act 1966 (NSW)
- Poisons and Therapeutic Goods Regulation 2008 (NSW)

8.7.2. Supporting Standards, Codes and Guidance Materials

- AS 2507: The storage and handling of agricultural and veterinary chemicals
- Code of Practice for the use of Agricultural and Veterinary Chemicals in NSW

9. Illicit Drug Precursors

9.1. Introduction

In addition to the general chemical management requirements, there are additional legislative requirements for precursor chemicals and ancillary equipment known to have been used for the manufacture of illicit drugs under the Misuse of Drugs Act 1981 & Regulations 1982.

Two categories of precursor substances and ancillary materials known to have been used in the manufacture of drugs are listed in the Drug Misuse and Trafficking Act 1985 & Regulations 2011. Stricter controls applied to Category 1 Items. Research & education institutions are exempt from some possession and supply restrictions, however purchase controls still apply.

9.2. Category 1 Items and purchase controls

Category 1 items (substances and things) are listed in Schedule 3 of the Drug Misuse and Trafficking Regulations 2011. Purchasers of Category 1 items will be required to hold an account with the supplier, provide a written order for the item, fill out an end user declaration and provide sufficient evidence of identity on order and receipt of the item. Suppliers will not supply a Category 1 item with 24 hours of ordering, during which time the supplier must provide a copy of the end user declaration to the Commissioner of Police.

Table 9 - Category 1 items under the Drug Misuse and Trafficking Regulations 2011, Schedule 3.

Division 1 — Substances

Chemical name	Alternate name	Quantity substance in seized sample
Acetic anhydride		50 mL
Acetyl Chloride		50 mL
4-Amino-Butanoic acid	Piperidinic acid	
Bromobenzene	Phenylbromide	
Bromo safrole		
Boron tribromide		
1, 4-Butanediol	Tetramethylene glycol	
1-Chlorophenyl-2-aminopropane		
L-Ephedrine (including salts)	Ethyl phenyl	37 g
Ethyl phenyl acetate	Benzene acetic acid, ethyl ester, methylbenzyl acetate	
Gamma butyrolactone		3.5 mL
Gamma hydroxybutanoic acid (including salts)	Gamma hydroxybutyric acid	
Hydroiodic acid	Hydrogen iodide	250 mL
4-Hydroxybutanal	4-Hydroxy butyraldehyde	
2-Hydroxytetrahydrofuran	Tetrahydro-2-furanol	
4-Hydroxy-butanoic acid lactone	Gamma-valerolactone	
4-Hydroxy-butanoic acid nitrile	4-Hydroxy butyronitrile	
4-Hydroxy pentanoic acid	Gamma valerolactone	
Hypophosphorous acid	Phosphinic acid	39 ml
Iodine (including iodide salts)		30 g
Methcathinone	Ephedrone	
3, 4-Methylenedioxyphenylpropan-2-one		
N-Methyl ephedrine		

Methyl phenyl acetate	Benzeneacetic acid, Methyl ester, Benzyl acetate	
N-Methylpseudoephedrine		
Norpseudoephedrine		
2-Pyrrolidone Gamma-butyrolactam		
Phenylacetamide		
Phenylacetic acid (including salts and esters)		33 mL
Phenylacetonitrile	Benzyl cyanide, Benzeneacetonitrile Benzyl nitrile	
Phenylacetyl chloride		
1-Phenyl-2-chloropropane		
1-Phenyl-2-nitropropene		
Phenylpropanolamine	Norephedrine	
1-Phenyl-1-Propanone	Phenylethylketone propiophenone	
1-Phenyl-2-propanone	Benzyl methyl ketone Phenylacetone	39 g
1-Phenyl-2-propanone oxime		
1-Phenyl-2-propanol		
Phosphorus red/white		19 g
Phosphorous acid	Phosphonic acid	
Pseudoephedrine (including salts)		37 g
Pyridine		

Division 2 — Things

Item	Description
1	Any storage device containing ammonia gas where the mass of the storage device is less than one tonne.

9.3. Category 2 Items and purchase controls

Category 2 items (substances and things) are listed in Schedule 4 of the Drug Misuse and Trafficking Regulations 2011. Purchasers of Category 2 items will be required to either hold an account with the supplier and provide a written order for the item or alternatively fill out an end user declaration and provide evidence of identity on order and receipt of the item. Copies of end user declarations for Category 2 items will be provided to the Commissioner of Police as soon as practicable.

Table 10 - Category 2 items under the Drug Misuse and Trafficking Regulations 2011**, Schedule 4.**

Division 1 — Substances

Chemical name	Alternate name	Quantity of substance in seized sample
N-Acetylanthranilic acid	0-Acetamidobenzoic acid	
Allylbenzene	3-Phenyl-1-propene, 2-Propenyl Benzene	
Ammonium formate		
Anthranilic acid	2-Aminobenzoic acid	
Benzaldehyde		
Benzyl chloride	a-Chlorotoluene	
Benzyl bromide	a-Bromotoluene	
Alkali metal - Calcium		
Chromic acid (including salts)		
Chromium trioxide	Chromium (VI) oxide	
Ergometrine	Ergonovine	
Ergotamine		
Ethanamine	Monoethylamine	
N-Ethylephedrine		
N-Ethylpseudoephedrine		
Formamide		
Hydrobromic acid	Hydrogen bromide solution	
Hypophosphite salts		
Isosafrole	1, 3-Benzodioxole, 5-(1-propenyl)	
Alkali metal - Lithium		7 g
Lysergic acid		
Alkali metal - Magnesium		
Methylamine (& gas)	Aminomethane/Monomethylamine	135 mL
Methylammonium salts		
N-Methylformamide		
Palladium (including salts)		
Phenylalanine		
Piperidine		
Piperonal	3,4-Methylenedioxy-benzaldeyde, Heliotropine	50 g
Alkali metal - Potassium		

Propionic anhydride		
Raney nickel		
Safrole	5-(2-Propenyl)-1, 3-Benzodioxide	69 mL
Sassafras oil		91 mL
Sodium Borohydride		
Alkali metal - Sodium		24 g
Thionyl chloride		
Thorium (including salts)		

Division 2 — Things

Description	Details
Gas cylinder containing hydrogen sulphide gas	
Gas cylinder containing hydrogen gas	
Gas cylinder containing methylamine gas	
Round bottom reaction flask	Capacity 500 mL or greater (including the repair or modification)
Condenser	Joint size B19 or greater
Splash heads and distillation heads	
Heating mantles	Capacity 500 mL or greater (including the repair or supply of parts)
Encapsulators (capsule filling machines)	Manual or mechanical
Pill presses (including a part for a pill press)	Manual or mechanical
Rotary evaporators	

9.3.1. Legislation

- Drug Misuse and Trafficking Act 1985
- Drug Misuse and Trafficking Regulations 2011
- Code of Practice for Supple Diversion into Illicit Drug Manufacture (PACIA)

10. Radioactive Chemicals

10.1. Scope

The general chemical management requirements are relevant to the management of radioactive chemicals. Additional requirements for radioactive chemicals are identified in this section.

10.2. Introduction

Radioactive chemicals, also referred to as radionuclides or radioisotopes, spontaneously emit radiation. If they are not encapsulated they may also be referred to as open or unsealed sources. Radioactive substances are defined in clause 5 of the Radiation Control Regulations 2013 (NSW).

Radioactive chemicals are often supplied as a single chemical element isotope. For example, phosphorus has a number of radioactive isotopes including phosphorus-32 or phosphorus-33.

The acquisition and use of all radioactive substances at the university must have prior approval from the Radiation Safety Committee.

Details of radiation safety management at the university, including relevant procedures and forms, can be found on the Radiation Safety Committee website at https://research.csu.edu.au/integrity-ethics-compliance/radiation.

The website also includes links to relevant policies and procedures, as well as the university's Radiation Management Plan.

> **IMPORTANT: All** users of radiation must familiarise themselves with the contents of the Radiation Management Plan before commencing any radiation work at the university.

10.3. Legislation

10.3.1. Acts and Regulations

- Radiation Control Act 1990 (NSW)
- Radiation Control Regulations 2013 (NSW)

10.3.2. Supporting Standards, Codes and Guidance Materials

- AS/NZS 2243.4:2018 Safety in Laboratories: Part 4 Ionizing Radiation
- Radiation Protection Series (RPS) published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- NSW EPA Waste classification guidelines - Part 3: Waste containing radioactive material
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10.4. Registration and Radiation Management Licence

The Radiation Control Act 1990 requires the university to hold a radiation management licence for the possession and use of all regulated radiation material.

The university's radiation management licence is centrally controlled and maintained by Radiation Safety Committee on behalf of the organisation. The Radiation Safety Committee is responsible for instituting and maintaining a system of radiation safety at the University, which includes maintaining registration limits of all radiation sources used at the university and coordinating updates to the substances registered on the radiation management licence.

10.5. User Licenses

The Radiation Control Act 1990 requires individuals working with radioactive chemicals to hold, or work under the supervision of someone holding, a radiation user licence. Licences can be obtained from the NSW Environmental Protection Authority (EPA).

Copies of licences must be sent to the Radiation Monitoring team (radmon@csu.edu.au). When applying to the Radiation Safety Committee for approval to acquire radioactive substances, a copy of relevant user licences may also need to be attached. For further details see the Radiation Safety Committee website at https://research.csu.edu.au/integrity-ethics-compliance/radiation.

10.6. Responsibilities

The responsibility for implementation of the safe management of radioactive chemicals rests with the heads of schools, managers and supervisors. Each workplace is responsible for enforcing the relevant procedures and for ensuring that staff and students have the necessary information, instruction, training and supervision before commencing radiation work.

10.7. Radioactive Substances Project Approval

All supervisors of proposed research projects or teaching subjects involving radioactive substances must apply to the Radiation Safety Committee. Work involving radiation cannot commence without the prior written approval from the Radiation Safety Committee. Further details and application forms can be found on the Radiation Safety Committee website at https://research.csu.edu.au/integrity-ethics-compliance/radiation.