Osborne Submarine Construction Yard (SCY) EIS

HR4: Dangerous Substances

Prepared for:

Australian Naval Infrastructure (ANI) & URPS

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Executive Summary

This report presents information and advice to support the Environmental Impact Statement (EIS) for planning approval of the proposed nuclear powered submarine construction yard (SCY) project at Osborne, Adelaide:

- ***To ensure risk of and adverse impacts from dangerous substances associated with the development are avoided, minimised, or mitigated to protect people, property, and the environment.***

It includes:

1. A preliminary inventory identifying the potentially dangerous substances and hazardous materials or wastes that may be used or produced by the SCY project during its:
    a. Construction phase (for construction of SCY infrastructure at Osborne), and
    b. Operational phase (for construction of submarines at the SCY).
2. Description of methods to ensure that use, handling, storage, bunding, transport and/or disposal of these hazardous substances or wastes during project construction and operation (including storage, bunding and /or any associated fire protection facilities) can be successfully provided for, to achieve safety and minimise hazard risks to workers, property, the environment, emergency services personnel, neighbouring communities, and the public.
3. Early assessment of potential risks involving these hazardous substances or wastes for SCY site personnel, project and/or public infrastructure, and the environment and public health in the vicinity of the site – which can guide future project design to mitigate these potential risks.

The report outlines steps that can be undertaken by the SCY project to ensure potential risks of dangerous substances are appropriately managed to protect people, property, and the environment.

– An overview of these steps is illustrated in Figure E-1 overleaf.
– It includes:
    - Main classification criteria that would need to be applied (per relevant regulatory requirements applying in South Australian and nationally).
    - Key stakeholders to be engaged to confirm relevant dangerous goods or hazardous substance management requirements and expectations for design, construction, and operation of SCY.
    - Potential approvals and licenses that may be required for dangerous goods &/or hazardous substances' management.
    - For each project phase (construction and operational), key elements for dangerous goods or hazardous substances' management that would be developed.

The SCY will be developed across multiple areas at its proposed Osborne site.

– These areas may be designed and built and then operated by different parties, and each area could have individual dangerous goods or hazardous substances' management requirements and approvals / licenses applicable.
– Consequently, there may be a hierarchy of licensing or approvals put in place, e.g.,
    - There may be some site-wide licenses or approvals put in place, with
    - Other individual licenses or approvals for specific areas where certain activities only happen or are confined to, e.g., where radiation materials or waste may be present.

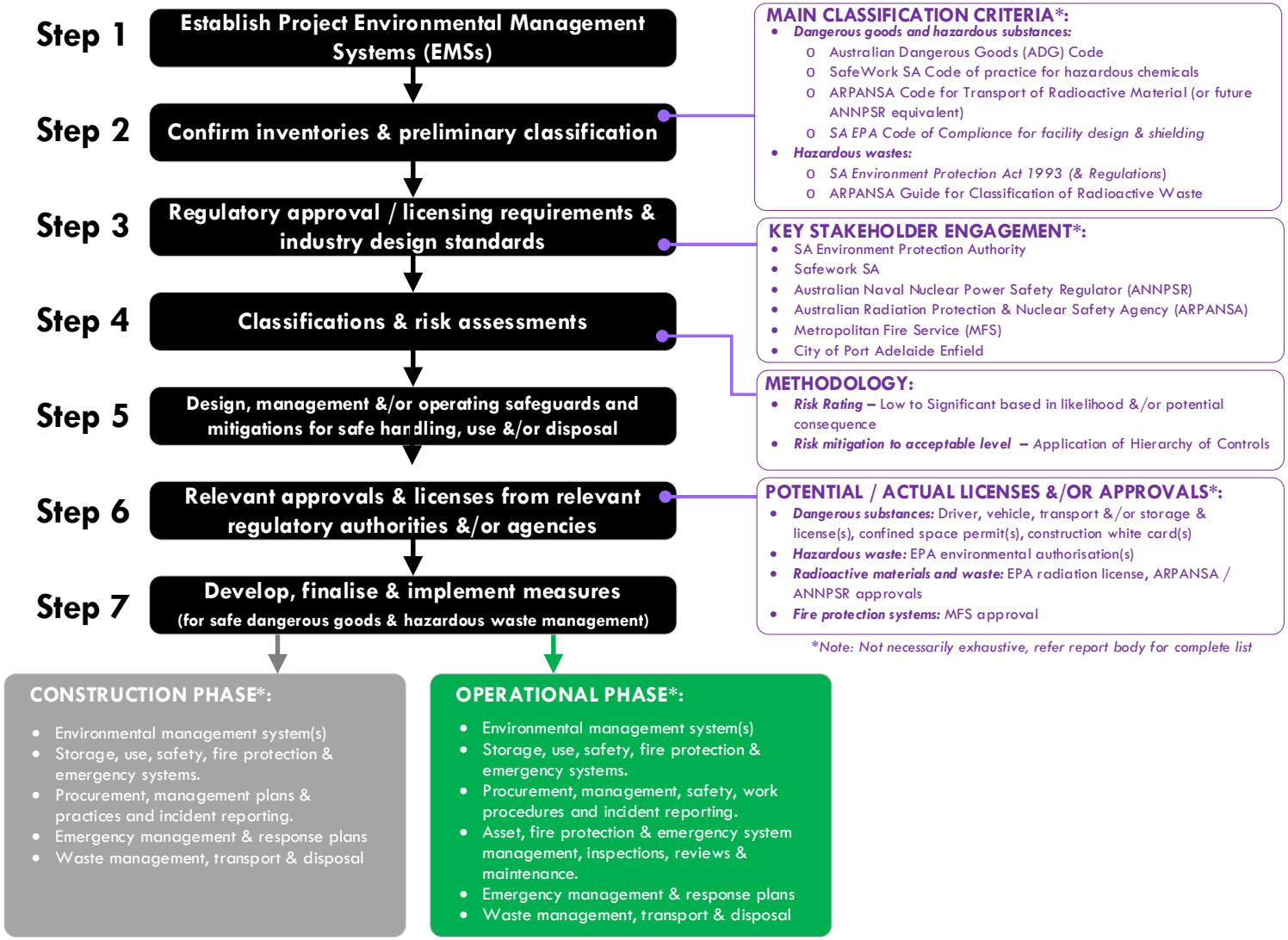

Figure E-1 – Overview of steps outlined in this report for the SCY project to successfully ensure potential risks of dangerous substances are appropriately managed to protect people, property, and the environment

Contents

1 Introduction

1.1 Context

Australian Naval Infrastructure (ANI) is planning a nuclear-powered submarine construction yard (or SCY) at Osborne, Adelaide, for the Australian Government's SSN-AUKUS submarine project.

The Minister for Planning has declared the SCY as an impact assessed development under section 108 (1)(c) of the *Planning, Development, and Infrastructure Act 2016* (PDI Act), which requires the preparation of an Environmental Impact Statement (EIS).

To support the EIS, information has been sought on dangerous substances generated by the project and how these can be managed to avoid, minimise, or mitigate their impacts to protect people, property, and the environment.

This report provides this information based on the project data available.

1.2 Scope of assessment

Table 1-1 overleaf outlines the dangerous substances information requested to support the project EIS. In summary, this information sought includes:

- Identification of potentially dangerous substances and hazardous materials to be used, transported, stored, processed, or produced during the project,
- Advice on how these would or should be stored and managed at the development site including their off-site disposal.
- Potential risks from these dangerous substances and hazardous materials to environment and public health in the vicinity of the site.

1.3 Presentation

This report is presented as follows.

Section 2 – Project information & assumptions	Summarises available project information or assumptions made to support this advice.
Section 3 – Inventory of dangerous substances and hazardous materials	Identifies potentially dangerous substances and hazardous material that may be used during the construction and operational phases of the project.
Section 4 – Recommended site management & disposal	Advice on how these potentially dangerous substances and hazardous materials would or should be stored and managed at the development site including fire protection and their off-site disposal.
Section 5 – Potential risk review & mitigation	Review of potential risks from these dangerous substances and hazardous materials to environment and public health in the vicinity of the site

Table 1-1 – Scope of Assessment requested to support the EIS

HR4	**Dangerous Substances**	**Ensure risk of and adverse impacts from dangerous substances associated with the development are avoided, minimised or mitigated to protect people, property and the environment**	Dangerous substances and hazardous materials: – Identify all dangerous and hazardous substances and any explosives to be used, transported, stored, bunded, processed or produced and the rate of usage. – Describe the expected use, handling, and disposal of these materials during construction and operation, with reference to storage (including any associated fire protection facilities). – Describe how hazardous contaminants and waste substances produced by the development may or should be treated, contained or bunded until their disposal at an approved facility. – Evaluate the potential effects of any accidents involving dangerous substances on the environment and public health in the vicinity of the site.

2 Available project information

2.1 Project status

Design development for the SCY project has commenced.

- There is not yet a full description available of activities that will be undertaken during the project, nor types and/or quantities of potential hazardous materials and substances that might be used.
- Consequently, it is necessary to review project information available and consider what these project activities would or might be, to identify what potentially hazardous substances could be used during construction and/or operational phases.
- This high-level information is presented in following sections and was used to hypothecate a preliminary inventory of potentially hazardous substances that could be used by the project.

2.2 Project overview

Based on currently available information, the following gives an overview of the SCY project at Osborne.

- The project would cover a substantial site area on the Northeastern corner of the Lefevre Peninsula.
- There would be at multiple buildings or structures built for the project across this site.
- At high level, these buildings and structures would or could be expected to include (but may not be limited to):
    - Single or multi-level office buildings,
    - On-site accommodation facilities (including leisure and catering),
    - Manufacturing buildings and workshops,
    - Storage Warehouses,
    - Docks,
    - Covered submarine assembly area including launch area,
    - Car Park areas – External open and/or multi-level covered structures (for personnel parking and fleet vehicles),
    - Utility Buildings – For plant including back-up generators, communication, and data systems.
    - Ancillary facilities (e.g., health)
    - Fuel storage tanks,
    - External yards for storage (including materials and waste),
    - Specialised buildings, yards and storage areas for hazardous materials and activities,
    - Security fencing and gates,
    - Landscaped and recreational areas for personnel, and
    - Roads and transport infrastructure (including for public transport access).
- There would be tens of thousands of square metres of built area constructed and then operated and maintained after.
- Some of these structures would or could have specialised design needs or house activities to meet specific defence, security, and submarine construction requirements.

2.3 Expected or potential project activities

2.3.1 Construction Phase

The construction phase of the SCY is expected to involve the following activities at the site. It should be noted that these activities would not happen across the entire site at once and may occur progressively in different parts of the site over a multi-year construction program.

Demolition	Clear site ready so construction can safely commence, which may include (but not be limited to): • Set up access points and security (i.e., fencing, gates, etc.), • Clear vegetation, • Remove existing structures and previous utility infrastructure (e.g., old transformers, gas pipes, water piping, above or underground tanks, etc.), • Identify and dispose of any hazardous materials still located or stored on site from past industrial activities, • Identify, excavate, and manage of any previously contaminated soils, and • Reprocess suitable demolished materials at site to be recycled in future construction.
Preliminary works *(or site preparation)*	Prepare the site for access and construction of buildings and other facilities and structures, which may include (but not be limited to): • Site grading to main levels, • Services installation including trenching, poles, laying conduits or pipes (which may include relocation of any existing services, conduits and/or corridors across the site), • Road base construction and construction phase paving, • Cut and fill (with soil, rock and/or aggregate) to prepare final levels for buildings and/or (above or below ground) structures, and • Excavations for footings / piers and foundation installation for buildings and other structures.
Construction	Of buildings and other facilities and structures including (but not limited to): • Final site service excavations and conduits or pipework installed for supply into buildings and other facilities and structures (electricity, water, gas, sewer, comms), • Piles / Footings / piers and foundations laid / installed, • Building and other structure frames erected (steel frame / concrete slab, steel frame concrete tilt-up, timber) • Roofing, internal structural, and internal services installed (e.g., switchboards, conduits, piping &/or connections for electricity, water, gas, sewer, comms), • Utility and/or service plant and equipment &/or storages installed (e.g., HVAC, ventilation ducting, boilers, hot water, gas storage, water pumping & storage, etc.) • External windows, walls, facades installed, • Internal insulation, walls, ceilings, doors, glass and other partitions, and electrical and comms and access points installed, • Surface treatments / finishes (water proofing, painting, tiling, wood panelling, other), • Base fit-out (cabinetry, kitchens, toilets), • Floors / coverings (e.g., timber, laminate, tiling, carpets, etc.), • Final fit-out (furniture, curtains, drapes, other furnishings), • Specialised workshop &/or laboratory fit outs (if industrial), • Manufacturing, laboratory, R&D plant, equipment & storages delivered and installed (if industrial) • Disposal of waste and recycling generated by the above.

2.3.2 Operational phase

The operational phase of the SCY is expected include the following activities at the site. Each of these activities could have their own range of potentially dangerous materials or hazardous substances, with some being the same or shared (e.g., cleaning and water treatment chemicals, fuels, pesticides, etc.) across these activities. *Note: These are potential activities based on hypothecation by Colby Phillips Advisory based on preliminary project information available, and there may be some differences once the final submarine manufacturing activity scope for the SCY site is confirmed.*

Submarine manufacturing	Would involve a range of on-site manufacturing activities, much of general industrial nature, but other specialised for submarine manufacturing and associated defence work and could include areas for (but not limited to) the following. The presence of these activities could vary from building to building across the site. • Offices – Which would be similar those in office-only buildings. • Warehousing and storage – High-level security and low-level security. • Dangerous goods storage(s) – Which may be in multiple areas inside and outside buildings and of different scales ranging from safety cabinets with small containers, rooms with larger containers and/or drums, and open, bunded or enclosed areas with tanks or larger bulk storages (including for gasses, liquids, solids, hazardous waste materials). • Metal shop – For forming / pressing, cutting, welding, of metals. • Other Surface coatings – Including other specialised methods like powder coating, vapor deposition and /or thermal spraying. • Paint shop – For painting of materials and/or components. • Plastics production / moulding area – For specialised production of plastic polymers and/or their casting, extrusion and/or 3D printing into components. • Electrical equipment manufacturing / assembly & testing. • Combat systems manufacturing / assembly & testing including secure storage of these materials as needed. • Communications, sonar & radar systems manufacturing / assembly & testing. • Submarine battery storage & testing. • Lead storage and shaping facilities. • Nuclear Steam Raising Plant (NSRP) fabrication, assembly, integration, testing and commissioning. • Other specialised manufacturing areas. • Specialised R&D areas & testing / analytical laboratories. • General workshop operations areas – which may include lathes, CNC, cutting, grinding machines and pre-assembly areas. • Secure area for storing, preparation and/or testing the submarine nuclear reactor before installation in the submarine. • Main submarine assembly & fit out area – where manufactured and/or prefabricated components would finally be assembled to form the submarine and fit it out. • Main submarine launch area – From where the submarine would be launched. • Vehicle, plant & equipment maintenance workshops – For maintaining and servicing vehicles and mobile plant. • Staff support areas – which could include: o Refectory(ies) and/or lunchrooms, o Toilets & changerooms, o On-site first-aid and medical facilities, o Training / simulation facilities / areas, and o Human resources support and/or guidance areas.

	• Utility areas and operations – which could include:
	  o Switchboards and Grid electricity supply, plus on-site Solar PV and/or batteries,
	  o Information Technology (IT) rooms / data centres,
	  o HVAC, which may include cooling towers and chemical dosing systems,
	  o Boiler / hot water plant,
	  o Steam generation / boiler,
	  o Water supply pump room, storage tanks, which may include chemical dosing,
	  o High purity de-ionised water production,
	  o Air compressors,
	  o Fuel storage and bowsers and/or charging stations (for vehicles, mobile plant &/or equipment), and/or
	  o Back-up gensets and their fuel storage tanks (for energy security).
	• Emergency Response facilities: Emergency Control Centre, Emergency Response Group, Fire Fighting Water Tanks etc.
	• Standard industrial waste and recycling disposal and storage areas – Secure and unsecure, including for:
	  o Non-hazardous waste and recycling, e.g., rubbish, metals, cardboard, glass, food waste, hard waste, etc.,
	  o Medical / clinical waste,
	  o Low level nuclear waste materials waste, and
	  o Other hazardous waste – from use of dangerous or hazardous gas, liquids and/or solids.
	• Nuclear waste management and storage areas for low level-radioactive waste: collection, sorting, categorisation and temporary storage of low-level liquid and solid waste, prior to being transported off-site for disposal in accordance with relevant legislation and Regulatory guidance.

Offices	Which would largely be like those occurring in standard commercial or government offices elsewhere, including (but not limited to):
	• Computer and other electrical and electronic equipment,
	• Use of paper and stationery and digital media,
	• Staff facilities including kitchens, lunch / tea rooms, toilets, and End-of-Trip areas,
	• First-aid or medical treatment areas,
	• Cleaning – including:
	  o Chemical storage, and
	  o Waste and recycling disposal areas
	• Utilities –
	  o Switchboards and Grid electricity supply, plus on-site Solar PV and/or batteries,
	  o Information Technology (IT) rooms / data centres,
	  o HVAC, which may include cooling towers and chemical dosing
	  o Boiler /hot water plant,
	  o Water supply pump room, storage tanks, which may include chemical dosing, and
	  o Back-up genset(s) and fuel storage (for energy security).

Accommodation *(on-site)*	For workers and/or defence personnel, including (but not limited to): • Serviced and unserviced accommodation – some of which may include kitchens, • Utilities (to support this accommodation) – which may be like those needed by offices and outlined above,

	• Cleaning – which would may include chemical storage, waste, and recycling disposal areas, and even laundry facilities, and • Shared areas – which may include gyms, common eating and/or other recreational areas, landscaped gardens, etc.
Retail / commercial	To support the workforce and SCY operations, which may include (but not be limited to): • Hospitality (i.e., café), • Childcare centre, • Medical care, and • Leisure (e.g., gym, spa / sauna).
Car parking	For workforce and /or SCY, security and/or defence fleet vehicles, which would include (but not be limited to): • Car parking in paved ground-level areas, basements and/or multi-storey buildings, and • Fuel storage and bowsers and/or charging stations (for security, SCY fleet and defence vehicles).
Security	Which would or could include: • Specialized offices in buildings across the site or stand-alone buildings at key access points or for main security administration, • Gates at access points, • Fencing and other structures or barriers to control site and/or secure building access, and • Electronic active and passive monitoring and/or surveillance systems for the above.
Gardens & Landscaping	Across the site, which would or could include: • Lawns and gardens, • Water features, • Outside recreational / leisure areas for sport, playgrounds and / or BBQs / eating, • Walkways or running / cycling tracks (for access to and from and around the site), and • Garden maintenance shed and storage.

3 Inventory of hazardous substances (preliminary)

3.1 Purpose

This section gives a preliminary list or inventory of potentially dangerous substances and hazardous materials that could be used during construction and operational phases of the project.

3.2 Classification methodology

3.2.1 Dangerous substances and hazardous materials

This preliminary inventory is presented by dangerous goods classifications *per* the Australian Code for Transport of Dangerous Goods by Road & Rail or the ADG Code (National Transport Commission, 2024).

- These ADG Code classifications are used in South Australia to define dangerous substances and hazardous materials for the purposes of storage and transport, *viz. South Australia Dangerous Substances Act 1979* (2021) and sub-ordinate legislation (i.e., regulations).
    - These ADG Code classifications are also analogous to, referenced by, and aligned with hazardous substance classification in South Australia and nationally under relevant worker, health & safety legislation (as identified later in this advice).
- Figure 3-1 overleaf (right side) gives an overview of these ADG Code classifications and Appendix 1 to this report provides more details describing each classification.
    - There are 9 ADG Code dangerous goods classifications – from 1. Explosives to 9. Miscellaneous substances and articles (that fall outside the other 8 classifications).
    - Some ADG Code classifications then sub-divide the substance or material into:
        - ***Divisions*** – To reflect differing physical, chemical and/or biological properties, and
        - ***Packing / Compatibility Group*** – Which can reflect an expected or assessed hazard level (from low to high), packing configuration, and/or reactivity potential or type.
- For Class 7 – Radiation, the ADG Code has no Divisions with classification of individual items / packages based on the Australian Radiation Protection and Nuclear Safety Authority (ARPANSA) Code for Safe Transport of Radioactive Material (2019).
    - This ARPANSA classification framework is included in Figure 3-1
    - Figure 3-1 acknowledges other codes or standards may be relevant to classifying radioactive dangerous goods and substances in this Class.
        - ARPANSA Code of Radiation Protection Requirements for Industrial Radiography (2018) – for industrial devices that use and/or generate ionising radiation (e.g., X-ray machines, X-ray diffractometry, etc.) and may be used during the project operational phase for manufacturing and material testing and analysis.
        - The South Australian Environment Protection Authority's (SA EPA's) Code of Compliance (COC)–2, for facility design and shielding (SA EPA, 2023).
            - This SA EPA Code classifies premises that store or handle radioactive materials into three types (Types A, B or C) based on the radioactivity of materials being stored and/or ionizing radiation devices present.
            - Consequently, it can reflect an aggregated or consolidated dangerous goods classification based on these materials and/or devices being stored or used in a location, even if these items have a lesser hazard individually.
            - There may also be future additional or ARPANSA equivalent codes or standards issued by new Australian Naval Nuclear Power Safety Regulator (ANNPSR) that become relevant.

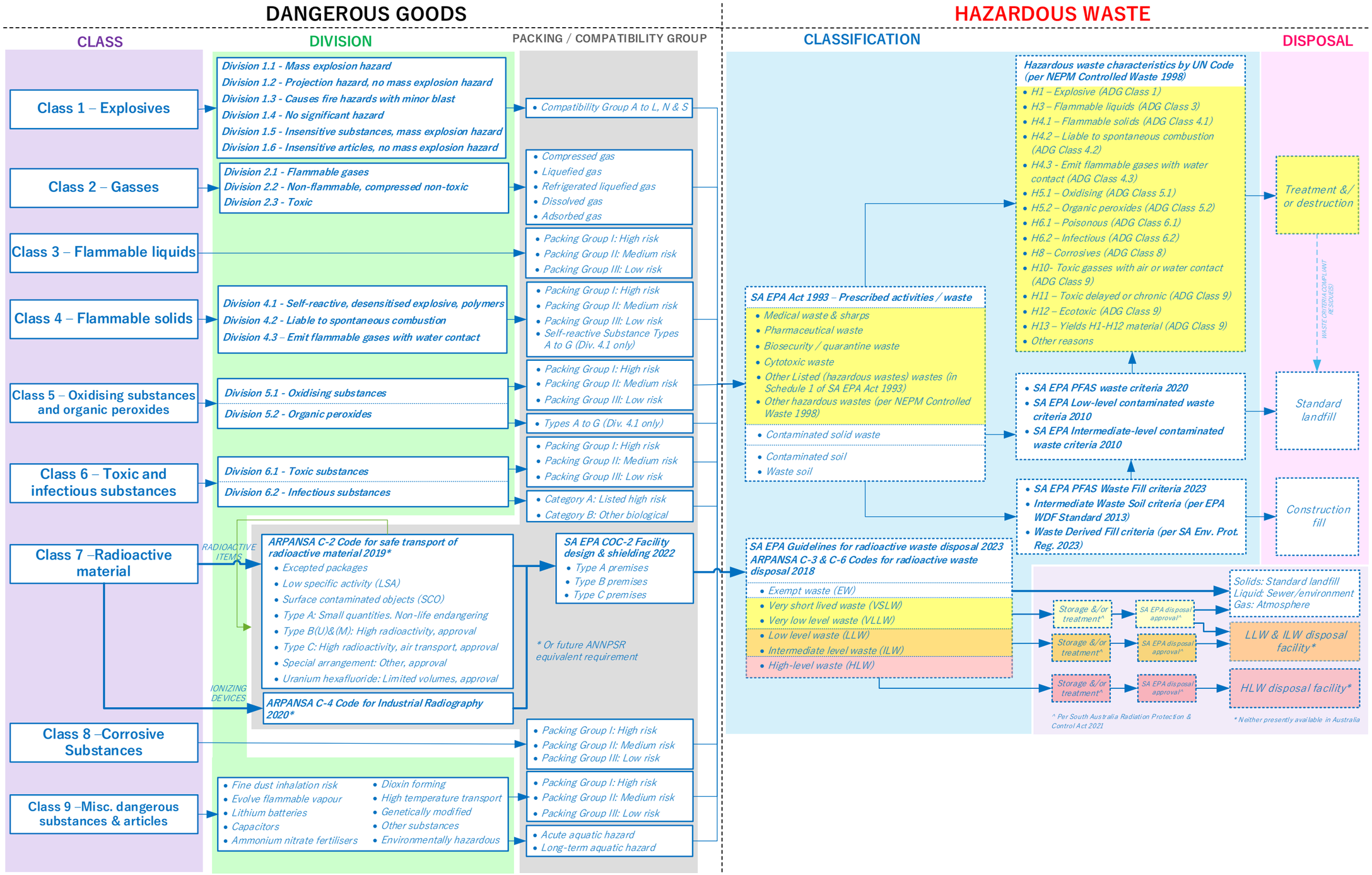

Figure 3-1 – Overview of ADG Code classification framework for dangerous goods (right side) and South Australian Environment Protection Authority (EPA) hazardous materials classification framework (left side). *Refer Appendix 1 for more details on the ADG Code definitions (with examples). Note: This overview in some places simplifies these frameworks to aid concise presentation, it is a complex subject, and there may be or is more detail that needs to be considered when classifying dangerous materials and hazardous substances as the project proceeds. Citations for relevant documents referenced in this figure as follows. SA EPA Act 1993 (South Australian Government, 2024). NEPM Controlled Waste 1998 (Australian Government, 2012). W2REPP 2010 (South Australian Government, 2021) SA EPA Low-level contaminated waste criteria 2010 (SA EPA, 2010). SA EPA Intermediate-level contaminated waste criteria (SA EPA, 2010). EPA WDF Standard 2013 (SA EPA, 2013). SA Env. Prot. Reg. 2023 (South Australian Government, 2024). ARPANSA C-2 Code for safe transport of radioactive material 2019 (ARPANSA, 2019). SA EPA COC-2 Facility design & shielding 2022 (SA EPA, 2023). SA EPA Guidelines for radioactive waste disposal 2023 (SA EPA, 2024). ARPANSA C-3 Code for (Disposal facilities for solid) radioactive waste disposal 2018 (ARPANSA, 2018a). ARPANSA C-6 Code radioactive waste disposal (by the user) 2018 (ARPANSA, 2018b). SA EPA PFAS waste criteria 2020 (SA EPA, 2020). South Australia Radiation Protection & Control Act 2021 (South Australian Government, 2021). *Note: Current ARPANSA codes may be supplemented and/or substituted by future ANNPSR requirements.*

3.2.2 Hazardous wastes

In addition to hazardous substances used during the project, there would be hazardous wastes produced (during both the construction and operational phases), many originating from these hazardous substances when and/or after they are used. Consequently, a second list or preliminary inventory was developed for these hazardous waste materials.

- Figure 3-1 (left side) also includes (at high-level) an overview of the classification framework in South Australia for hazardous wastes.
- This classification framework is based on the South Australian *Environment Protection Act 1993* (South Australian Government, 2024), its sub-ordinate legislation (i.e., regulations, environmental protection policies), and/or other regulatory mechanisms and/or tools (e.g. codes of practice, criteria, guidelines, etc.) developed by the SA EPA to support it.
- In broad terms, this framework classifies hazardous wastes into four main categories:
    - ***Hazardous chemical and/or biological wastes*** – Which may need to be treated, sterilised and/or destroyed before landfill disposal[1] and are sub-classified to reflect the dangerous substances and hazardous materials these wastes originate from and that would remain present in them (at some level and potentially mixed with other substances),
    - ***Contaminated solid wastes*** – Which might still be able to be (directly) disposed to a landfill if they meet certain safety criteria (as noted in Figure 3-1),
    - ***Waste soils*** – Which includes:
        - *Contaminated soils* – which require treatment or remediation before reuse if they do not meet certain safety criteria (as noted Figure 3-1), and
        - *Waste Fill* – which can be used for construction fill (and/or landfill cover too) if they do meet certain safety criteria, and
    - ***Radioactive waste*** – That contain radionuclides and require special consideration to ensure safe disposal depending on their radioactive hazard risk and availability of suitable with disposal facility or option.
- For radioactive waste, the SA EPA has issued codes of practice and guidelines for radioactive waste management disposal under the *Radiation Protection and Control Act 2021* (South Australian Government, 2021) and its sub-ordinate legislation.
    - These guidelines reference the ARPANSA Code for the disposal of radioactive waste by the user (2018b), which applies to lower- level radioactive waste suitable for disposal to landfill, sewer and/or atmosphere.
    - In addition, another ARPANSA Code for disposal facilities for solid radioactive waste (2018a), applies to other (or higher-level) radioactive waste that may not be immediately suitable for disposal by this means.
    - Classifications of radioactive waste in these codes is illustrated in Figure 3-1 and further explained in the ARPANSA Guide for classification of radioactive waste (2020).
    - Figure 3-1 also signals some of the regulatory requirements that may apply to managing (i.e., transporting, storing, and disposing of) these radioactive wastes.
    - Radiation waste is strictly regulated in Australia and requires regulatory approvals for its storage and/or disposal, and there are limited disposal options for some types of radioactive waste (as will be noted later in this advice).

[1] In South Australia, most hazardous wastes are banned from disposal to landfill under the *Environment Protection (Waste to Resources) Policy 2010* (South Australian Government, 2021)

3.3 Preliminary inventory

3.3.1 Dangerous substances and hazardous materials

Table 3-1 overleaf gives an inventory of potentially hazardous substances hypothecated as possible for the SCY project over its construction and/or operational phases.

- At this time, it is only a preliminary inventory until the activities for the project are fully defined so that all hazardous substances that will be used can be specifically identified.
    - At this early stage, there is not enough project information to exactly know exactly what types and quantities of hazardous substances would be used.
    - This preliminary inventory will therefore need to be reviewed, amended and/or expanded as the project develops and proceeds and this information comes to hand.
- It identifies a range of potentially dangerous goods and hazardous materials that could be used (or generated) during the project across the ADG Code classifications, especially in the operational phase, e.g.,
    - ***Gasses, flammable liquids and solids, oxidising substances, toxic compounds, corrosive substances, and other miscellaneous materials*** – Of diverse types and possible hazard risks that may be needed for a range of on-site submarine manufacturing activities, e.g., metal and plastics material and components manufacturing, electroplating, other surface coatings, electrical and weapons systems assembly, R&D, laboratory testing and analysis, etc.
    - ***Radioactive materials*** – Including (but not limited to) from radiation gauges, check detectors, laboratory testing equipment and radionuclides, etc.
- As outlined later in Section 4 of this advice, these potentially dangerous substances and hazardous materials in each project phase will need to:
    - Be confirmed, characterised, and formally classified during further site and project design development,
    - Be subjected to formal risk assessment processes to identify and quantify potential risks and hazards from their storage, transport, handling and use at the site, and identify appropriate mitigation measures to eliminate or minimise their risks or hazards to people, environment, plant and equipment and the site
    - Have appropriate site facilities designed, and safety management processes and systems developed for their storage, containment including bunding, transport, handling and use at the site to eliminate or minimise their risks or hazards to people, environment, plant and equipment and the site, and

{Cont. five pages overleaf on page 20}

Table 3-1 – SCY preliminary inventory of dangerous substances and hazardous materials. *Note: This list is not exhaustive and is only preliminary by hypothecation based on expected project activities per Section 2.3 of this report. Project phase inventory identifier: ● = Likely / expected, ○ = Possible*

Class		Material description / example	Division	Packing Group / Compatibility	Site activity(ies) / use(s) examples	Project Phase		
						Construction phase		Operational phase
						Demolition	Construction	
1	**Explosives**	*Use and storage of explosives at the site are not anticipated by ANI at the SCY during the project.*						
2	**Gasses**	Acetylene	2.1 - Flammable gases	Compressed gas	Welding gas		●	●
		LPG		Liquefied gas	Energy source, fuel source		●	○
		Natural gas		Compressed gas	Energy source		●	○
		Propane / butane		Compressed &/or liquefied gas	Welding gas, energy source		●	●
		Hydrogen		Compressed &/or refrigerated liquefied gas	Welding gas, energy source, fuel source		○	●
		Hydrocarbon refrigerants		Refrigerated liquefied gas	Refrigeration		●	●
		Other flammable gasses			Submarine manufacturing			○
		Argon	2.2 - Non-flammable, compressed non-toxic	Compressed gas	Welding gas		●	●
		Helium		Compressed gas	Welding gas		●	●
		Nitrogen		Compressed &/or liquefied gas	Welding gas, atmospheric modifier (submarine manufacturing)		○	●
		Oxygen		Compressed &/or liquefied gas			○	●
		Carbon dioxide		Compressed &/or liquefied gas	Welding gas, atmospheric modifier (submarine manufacturing), refrigeration, fire extinguishers	●	●	●
		Hydrofluorocarbons (HFCs)		Refrigerated liquefied gas	Refrigeration	○	○	●
		Other non-flammable, compressed non-toxic			Submarine manufacturing			○
		Chlorine	2.3 - Toxic	Compressed gas	Water treatment chemical			●
		Ammonia		Compressed &/or dissolved gas	Refrigeration			●
3	**Flammable liquids**	Diesel		III	Fuel source, energy source	●	●	●
		Petrol		II		●	●	●

Class		Material description / example	Division	Packing Group / Compatibility	Site activity(ies) / use(s) examples	Project Phase		
						Construction phase		Operational phase
						Demolition	*Construction*	
		Adhesives (flammable types)		I to III (depending on flash and boiling points)	Some construction application(s), reagents for laboratory use, R&D, specialised various submarine components and/or manufacturing applications, utility applications, site maintenance &/or various retail and / or commercial uses		●	●
		Paints / lacquers / varnishes					●	●
		Alcohols (pure, in solution or mixed with other chemicals)					○	●
		Liquid hydrocarbons / other organic solvents (e.g., acetone, benzene, toluene, methyl ethyl ketone)					○	●
		Other flammable liquids					○	●
4	**Flammable solids**	Alkali metals (various salts) (e.g., sodium, potassium, calcium, lithium, other, etc.)	4.1 - Self-reactive, desensitised explosive, polymers	I to III (depending on burning response)				●
		Metal powders (e.g., iron, aluminium, titanium, chromium, cobalt, metal carbides, etc.)					○	●
		Some granulated or powdered plastics					○	●
		Other flammable solid chemicals (e.g., phosphorus, sulphur, firelighters, camphor)					○	●
		Metal hydrides	4.2 - Liable to spontaneous combustion	I to III (depending on test response)				●
		Alkali earth elements						●
		Finely divided metal powders					○	●
		Nitrides						●
		Hydrazines						●
		Cyanate compounds						●
		Other spontaneously combustible compounds					○	●
		Calcium Carbide	4.3 - Emit flammable gases with water contact	I to III (depending on water reactivity response)				○
		Reactive metals (e.g., sodium, magnesium, potassium, zinc, etc.)						○
		Other substances that emit flammable gas on contact with water					○	●
5	**Oxidising substances**	Ammonium nitrate (fertiliser)	5.1 - Oxidising substances	I to III (depending on ignition and burning response)			○	●
		Peroxide chemicals (e.g., hydrogen peroxide)					○	●

Class		Material description / example	Division	Packing Group / Compatibility	Site activity(ies) / use(s) examples	Project Phase		
						Construction phase		Operational phase
						Demolition	*Construction*	
	and organic peroxides	Potassium chlorate						●
		Sodium nitrate & nitrate						●
		Other (non-organic) oxidising substances						●
		Dibenzoyl peroxide	5.2 - Organic peroxides	A to G (depending on explosive risk / response)				●
		Methyl ethyl ketone peroxide						●
		Peroxyacetic acid						●
		Other organic peroxides						●
6	**Toxic and infectious substances**	Cyanide solution	6.1 - Toxic substances	I to III (depending on toxicity risk)				
		Heavy metals and their solutions						●
		Organochlorine compounds (e.g., trichloroethylene, dichloromethane, etc.)						●
		Other toxic organic compounds (e.g., toluene diisocyanate, formaldehyde, isocyanates, etc.)						●
		Pesticides				●	●	●
		Cytotoxic compounds						○
		Wet chemical fire extinguishers				●	●	●
		Foam fire extinguishers				●	●	●
		Other toxic chemicals					○	●
		Mould (toxic)	6.2 - Infectious substances	B	Demolition materials	○		
		Legionella		B	Cooling towers			○
		Medical and/or clinical patient specimens, microbial surface swabs, vaccines		A or B (depending in whether listed or not)	Workforce medical use, first-aid kits			○
7	**Radioactive material**	Smoke detectors		Excepted package	Fire protection	○	●	●
		Laboratory radiochemicals		Type A, B or C package + SA EPA Type A, B &/or C non-laboratory radioactive material registered premises	Medical use, laboratory testing			○
		Material testing radiation gauges		Type A, B or C package + ARPANSA Code of practice and safety guide for safe use of fixed radiation gauges 2007	Laboratory and field testing			
		Laboratory & material ionising radiation testing equipment		ARPANSA Code of radiation protection requirements for industrial radiography 2018	Laboratory testing			●
		Radiation detector check sources		Type A or B package	Radiation safety detector performance testing and verification			●

Class		Material description / example	Division	Packing Group / Compatibility	Site activity(ies) / use(s) examples	Project Phase		
						Construction phase		Operational phase
						Demolition	*Construction*	
		Submarine nuclear propulsion source/reactor		Special arrangement	Submarine manufacturing			●
8	**Corrosive substances**	Chromic acid		I to III (depending on skin damage or corrosion rate)	Some specialised construction-phase uses, reagents for laboratory use, R&D, specialised submarine components and/or manufacturing applications, utility applications, site maintenance &/or limited retail and commercial uses			
		Hydrochloric acid					○	●
		Hydrofluoric acidic acid						●
		Sulphuric acid						
		Nitric acid						●
		Phosphoric acid						●
		Sodium hydroxide (caustic soda)					○	●
		Ammonium solution					○	○
		Ferric chloride						○
		Sodium hypochlorite					○	○
		Other corrosive compounds (e.g., acids, alkalis)					○	●
9	**Miscellaneous dangerous substances and articles**	Asbestos	Depending on relevant Division for components from Classifications 1 to 8	Depending on relevant Packing Group / Compatibility for components from Classifications 1 to 8	Demolition waste only (if present)	○		
		Electrical transformers &/or capacitors (e.g., containing PCBs)			Demolition (if present), construction, submarine manufacturing, energy utility applications, vehicle, laboratory, office &/or workforce uses	○	●	●
		E-waste				○	●	●
		Lithium batteries				○	○	●
		Other electrical equipment					○	●
		Battery powered vehicles & equipment					●	●
		Dry ice			Laboratory use(s), R&D, some specialised submarine manufacturing applications			●
		Life-saving devices (e.g., self-inflating, flares)			Various site use(s) during all project phases, specialised submarine manufacturing &/or use(s)	○	●	●
		First-aid & chemical kits				●	●	●
		Engines & generators				●	●	●
		Magnetised materials				○	○	●
		Other dangerous substances and articles				○	○	●

- Ensure that all future project personnel are:
  - Advised of these potentially dangerous and hazardous substances and relevant regulatory and site hazard and risk management requirements that apply,
  - Informed of the safety management processes and systems developed for these materials (including for procurement, handling, use, disposal, and reporting of dangerous situations and/or incidents involving them),
  - Routinely trained to properly and safely use the storage, transport, and handling facilities provided at site for them, and
  - Equipped with necessary personal protection and other equipment for this purpose, e.g., protective clothing, detectors, transfer trolleys or containers, guards, etc.

3.3.2 Hazardous wastes

Table 3-2 overleaf hypothecates a potential inventory of hazardous wastes that could be produced by the SCY project.

- Like hazardous substances, it is at this time only a preliminary inventory until project activities are fully defined and hazardous wastes to be generated can be identified.
  - In this regard, Table 3-2 does not reproduce all the potential waste by-products from hazardous substances identified in Table 3-1, and just notes that there could be waste products from these substances (to be identified and confirmed in detail later).
  - This hazardous wastes' inventory will therefore need to be reviewed and expanded as the project develops and proceeds and this information comes to hand, including more precise information on waste types, quantities and/or levels of contamination.
- The non-radioactive hazardous wastes from the SCY project would not be substantially different to what one might see from other similar industrial manufacturing activities (e.g., automotive, battery) or submarine and shipbuilding projects that already operate (or have operated in the past) in South Australia.
- Some (but not all) radioactive wastes during the operational phase, however, can be considered a distinctive (albeit not unique[2]) feature of this project for South Australia.
  - These radioactive wastes could include:
    - End-of-life (EOL) radiation gauges – Sealed radiation sources that may be used during submarine manufacturing (to measure material properties).
    - EOL radioactive contaminated clothing, personal protection equipment (PPE) and personal radiation monitoring devices – Used by site personnel during submarine manufacturing activities and exposed to potential radiation sources.
    - EOL radiation detector check sources – Used to confirm functioning or calibrate site or personal monitoring radiation monitoring devices.
    - EOL (or maintenance and/or testing) radiation exposed site and/or submarine materials or components.

{Cont. three pages over}

[2] Some South Australian industrial businesses that support uranium mining activities already handle these types of radioactive waste.

Table 3-2 – SCY preliminary inventory of dangerous and hazardous materials. *Note: This list is not exhaustive and is only preliminary. Project phase inventory identifier: ● = Likely / expected, ○ = Possible. Citations for relevant documents referenced in this figure as follows. ARPANSA Guide for classification of radioactive waste 2020 (ARPANSA, 2020). SA EPA PFAS waste criteria 2020 (SA EPA, 2020). SA EPA Low-level contaminated waste criteria 2010 (SA EPA, 2010). SA EPA Intermediate-level contaminated waste criteria (SA EPA, 2010). EPA WDF Standard 2013 (SA EPA, 2013). SA Env. Prot. Reg. 2023 (South Australian Government, 2024)*

Classification		Materials	Site activity(ies) / use(s) examples	Project Phase		
				Construction phase		*Operational phase*
				Demolition	*Construction*	
Medical waste &/or sharps			From on-site medical areas (or other laboratory testing areas if relevant)		○	●
Pharmaceutical waste						○
Biosecurity / quarantine waste				○		○
Cytotoxic waste						○
Listed or other hazardous wastes	***H1 – Explosive (ADG Class 1)***	*Use and storage of explosives, and thus generation of waste by products from these at the site are not anticipated by ANI at the SCY during the project.*				
	H3 – Flammable liquids (ADG Class 3)	Wastes containing by-products / materials in Table 3-1 for ADG Class 3	Waste fuels, waste paints and materials from construction, waste materials and components from submarine manufacturing activities &/or other operational phase activities	●	●	●
	H4.1 – Flammable solids (ADG Class 4.1)	Wastes containing by-products from materials in Table 3-1 for ADG Class 4.1	Waste materials, by-products and/or components from site construction, submarine manufacturing activities &/or other operational phase activities	○	○	●
	H4.2 – Liable to spontaneous combustion (ADG Class 4.2)	Wastes containing by-products from materials in Table 3-1 for ADG Class 4.2			○	●
	H4.3 - Emit flammable gases with water contact (ADG Class 4.3)	Wastes containing by-products from materials in Table 3-1 for ADG Class 4.3			○	●
	H5.1 – Oxidising (ADG Class 5.1)	Wastes containing by-products from materials in Table 3-1 for ADG Class 5.1			○	●
	H5.2 – Organic peroxides (ADG Class 5.2)	Wastes containing by-products from materials in Table 3-1 for ADG Class 5.2			○	●
	H6.1 – Poisonous (ADG Class 6.1)	Wastes containing by-products from materials in Table 3-1 for ADG Class 6.1		●	●	●
	H6.2 – Infectious (ADG Class 6.2)	Wastes containing by-products from materials in Table 3-1 for ADG Class 6.2	Waste from workforce medical activities, site first-aid kits			○
	H8 – Corrosives (ADG Class 8)	Wastes containing by-products from materials in Table 3-1 for ADG Class 8	Specialised construction uses, submarine manufacturing activities, site maintenance &/or other operational-phase site uses		○	●
	H10- Toxic gasses with air or water contact (ADG Class 9)	Wastes containing by-products from materials with these properties in Table 3-1 for ADG Class 9		○	●	●
	H11 – Toxic delayed or chronic (ADG Class 9)					
	H12 – Ecotoxic (ADG Class 9)					
	H13 – Yields H1-H12 material (ADG Class 9)					
	Other reasons:					
	Asbestos	From demolition activities		○		
	Compressed gas cylinders	Containing residues or gasses in Table 3-1 for ADG Class 2		○	●	●

Contaminated commercial & industrial waste	***SA EPA Low-level contaminated waste***	This waste from the site that complies with: • *SA EPA PFAS waste criteria 2020* • *SA EPA Low-level contaminated waste criteria 2010* • *SA EPA Intermediate-level contaminated waste criteria 2010*	Identified during demolition or construction activities or produced during operational phase activities, where these hazardous substances may contact and contaminate regular waste and recycling materials.	○	○	○
	SA EPA Intermediate-level contaminated waste			○	○	○
Waste soil	***Intermediate Waste Soil***	This waste from site demolition and/or construction activities that complies with: • *SA EPA PFAS Waste Fill criteria 2023 Intermediate Waste Soil criteria (per EPA WDF Standard 2013)* • *Waste Derived Fill criteria (per SA Env. Prot. Reg. 2009)*	Identified during demolition or construction activities	○	○	
	Waste Derived Fill			●	●	
Radiation (or radioactive) waste	***Exempt waste (EW)***	Radioactive waste from by-products of materials in Table 3-1 for ADG Class 7 with radioactivity and classified per the ARPANSA Guide for classification of radioactive waste 2020	*Which may include End of life (EOL) detectors, Personal Protective Equipment (PPE), monitoring devices and radiation gauges, sealed sources for radiography, solid and liquid low-level waste from testing and commissioning activities'*			●
	Very short-lived waste (VSLW)					●
	Very low-level waste (VLLW)					●
	Low level waste (LLW)					●
	Note: Storage and handling of Intermediate level (ILW) and high-level radioactive waste (HLW) is not anticipated by ANI at SCY.					

- EOL submarine nuclear reactors (in 30+ years)– Where we have been advised are expected to be removed and handled elsewhere (i.e., not at the SCY) before return overseas to the supplier or manufacturer or other approved party for disposal.

o Hazard classification of these radioactive wastes could range from:

- Exempt wastes (EW)– which (if approved) may be disposed of direct to landfill (or sewer if liquid waste or atmosphere if gaseous).
- Very short-lived (VSLW) and very low-level waste (VLLW) – which would require (on-site or off-site) storage and/or treatment before (an approved) disposal.
- Low level (LLW) – which presently can only be stored as no Australian disposal facility exists (but one is being planned for this material[3]).
- *Note: Intermediate level (ILW) and high-level waste (HLW) are not expected by ANI at the SCY.*

[3] The Australian Government is planning a National Radioactive Waste Management Facility (NRWMF) for disposal of Low Level Waste (LLW) and Intermediate Level Waste (ILW), see: Radioactive waste disposal and storage | ARPANSA.

4 Recommended site management & disposal

4.1 Introduction

As already noted, design of the SCY is still at initial stages and preliminary inventories developed in this advice for hazardous substances (per Table 3-1) and wastes (Table 3-2) should presently be considered indicative.

- Once the SCY project is developed further and more information comes to hand, Table 4-1 overleaf outlines the recommended process to confirm these inventories and identify how potentially hazardous substances and/or wastes would or should be stored and managed at the site including fire protection needed and their off-site disposal.
    - A graphical summary of these steps is illustrated in Figure 4-1 two pages over.
- The following section gives advice for how each of these next steps would be undertaken and how relevant planning and regulatory requirements would be clarified, considered, and complied with.
- It does not specify at present time how future site management and disposal should happen but outlines how these matters would be successfully resolved through this recommended process to meet all project planning, regulatory compliance, and environmental requirements and/or match expectations of planning and regulatory authorities (e.g., plan SA, SA EPA, SafeWork SA, etc.) and other important stakeholders (Metropolitan Fire Service, City of Port Adelaide Enfield, etc.).
- A short separate section, however, is provided on hazardous and radioactive waste disposal, where many disposal pathways available to the SCY project are already reasonably well defined.

If this recommended process is followed, it will successfully:

- ***Identify and evaluate the potential risks for the SCY project.***
- ***Establish the design measures needed to mitigate these risks for the project, so***
- ***Ensure that risks of hazardous substances and wastes are prevented or minimised, so the project is safe to workers, emergency services, the environment, neighbouring communities, and the public.***

4.2 Overview of recommended steps

4.2.1 Step 1 - Project Environmental Management System (EMS)

The SCY project Environmental Management Systems (EMS) for each project phase would include separate consideration of and dedicated sections for management of hazardous substances and/or waste (including fire protection requirements).

- These EMSs would developed to and certified to ISO 14000 series of standards for environmental management systems (see: AS/NZS ISO 14001:2016 - Standards Australia)
- Dedicated sections for dangerous goods, hazardous substances and/or hazardous waste (including fire protection requirements) would ensure a consistent project-wide and systematic approach for developing procedures, policies, and systems to assess, manage and minimise safety and environmental risks from these materials for the SCY project, public, environment and site.
- For design development of any part of the project site, Steps 2 to 5 in Table 4-1 for the operational phase would be undertaken before construction commences as some site design decisions made may later impact on ability to achieve successful hazardous substance and/or waste risk mitigation for operational phase activities (e.g., siting of hazardous storage at the site and access for emergency services, design of stormwater systems to prevent run-off containing potential environmental contamination from hazardous material storages). *{Cont. three pages over}*

Table 4-1 – Recommended process for developing how dangerous substances and hazardous material should be stored and managed including fire protection and their off-site disposal

Step 1 - Project Environmental Management System	A formal Environmental Management System (EMS) is developed and established to provide a consistent project-wide and life-cycle approach to developing procedures, policies, and systems to assess, manage and minimise environmental risks from dangerous or hazardous substances and/or hazardous wastes for the project through its construction and operational phases.
Step 2 - Confirm inventories & preliminary classification	Confirm, characterise, and formally all known or expected dangerous or hazardous substances to be used (in line with ADG Code) and/or hazardous wastes (per SA EPA requirements &/or ARPANSA Codes / Future ANNPSR requirements) to be generated during further site and project design development.
Step 3 - Regulatory approval / licensing requirements & industry design standards	• Identify and review all relevant regulatory requirements for approval and licensing and industry (design) standards for transport, storage, handling and/or disposal of these dangerous or hazardous substances and/or hazardous wastes, including fire protection requirements. • Meet with relevant approval, licensing and/or other stakeholders to clarify and confirm these requirements for this site context / situation.
Step 4- Risk / hazard assessment	Conduct formal risk assessment processes to identify and quantify potential risks and hazards from these dangerous or hazardous substances to be used and/or hazardous waste during: • Procurement and/or transport to site, • On-site storage, handling &/or use, • For hazardous wastes, their transport and off-site disposal, and • Fire protection.
Step 5 - Facility design & management systems	Develop site management processes and design appropriate site facilities to safely transport, store, handle, use and/or dispose of dangerous or hazardous substances to be used and/or hazardous wastes, including fire protection, required PPE and site monitoring systems - to: • Mitigate risks to acceptable levels, • Meet relevant industry standards, and • Comply with relevant approvals and licenses.
Step 6 - Approvals and licenses	Apply for and obtain relevant approvals and licenses as needed for each stage or phase of the project.
Step 7 – Finalise & implement EMS	Finalise & implement EMS to ensure that: • Procedures, policies, and systems to safely manage dangerous or hazardous substances and/or hazardous wastes are implemented, monitored, and reviewed and improved as needed (including to address any future regulatory changes), • Site facilities to safely transport, store, handle, use and/or dispose of dangerous or hazardous substances and/or for fire protection are properly maintained and operated, • All relevant approvals and licenses are monitored and complied with, • Relevant regulatory authorities are routinely engaged with as needed to review performance and identify any improvements that may be needed.

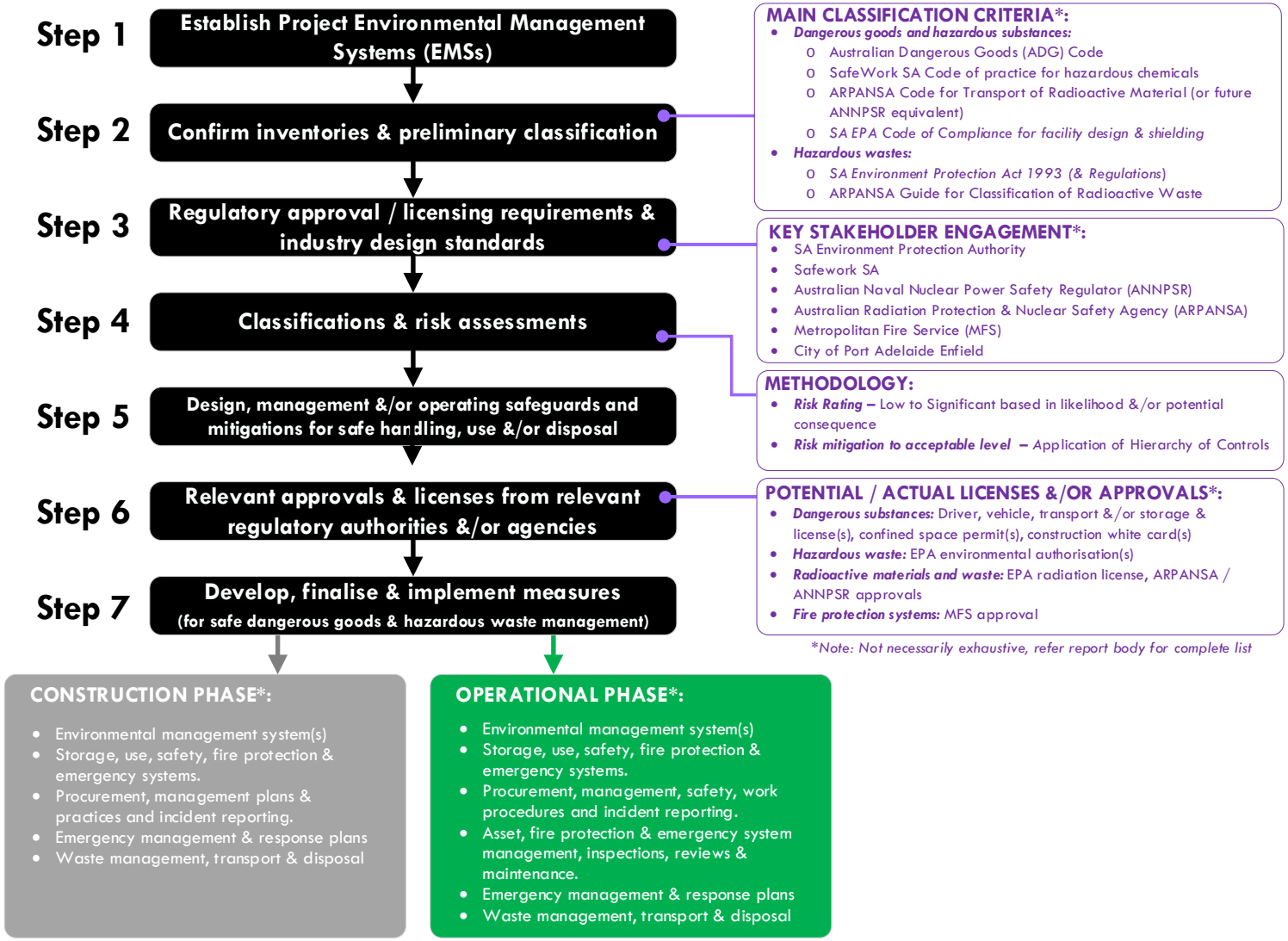

Figure 4-1 – Overview of steps outlined in this report for the SCY project to successfully ensure potential risks of dangerous substances are appropriately managed to protect people, property, and the environment

- For hazardous substances and wastes the EMSs would include (but may not be limited to):
    - Inventory of hazardous substances or wastes at the site including Material Safety Data Sheets (MSDSs) and their project hazard risk assessment / classification (per Step 2), and
    - Relevant regulatory requirements and approvals or licenses applying to these hazardous substances and/or wastes for the project and site, including for fire protection (per Step 3).
    - Names and contact details of the suppliers of these substances and/or disposal services for wastes (per Step 4) including:
        - Origin or disposal fate of these substances and/or wastes,
        - Transport and security requirements, transporter approval and/or licensing requirements, and supplier compliance with these requirements,
        - Systems or methods for identification and measurement (of quantity or volume and / or quality or contamination) and chain of custody management and collection and reporting of this data,
        - Suppliers' emergency response management plans (EMPs) in event of spillage and/or accident during transport, including relevant authority notification, security access clearances required, specialised training needed for site personnel and first responders, and protection of the environment and public.
    - Locations where these substances and/or wastes would be stored, handled, used and/or disposed of at site.
    - Identification and reference to relevant management systems, procedures and /or site facilities needed to ensure that these materials or wastes are safely stored, handled, used and/or disposed of at the site.
    - Design standards and/or site-specific approvals or licenses for these management systems, procedures and/or site facilities and/or equipment, including bunding needed and fire protection and incident response requirements.
    - Individual personnel training, approvals / licensing and PPE needed for site personnel to access these site facilities and/or handle, use and/or dispose of these materials or wastes during the project.
    - Safety incident reporting and investigation requirements and processes.
    - EMPs and equipment required for responding to safety incidents involving these materials at the site, including for fire protection and protection of environment, public and neighbouring communities.
    - Review and improvement processes and condition / compliance inspections required.
    - Site management responsibilities, including up-to-date register or contact details
    - Emergency response notification processes to follow, including contact details of relevant emergency responders and local authorities.

4.2.2 Step 2 – Confirm Inventories & preliminary classification

This step would confirm, characterise, and formally classify all known or expected dangerous goods or hazardous substances to be used and/or hazardous wastes generated from site activities, including their potential fire risks, to be used during construction and/or operational phases of the project.

- ***Dangerous goods and hazardous substances*** – would be identified and classified in line with:
    - *Non-radioactive goods and substances* –
        - The ADG Code (National Transport Commission, 2024),

- SafeWork SA Code of practice for managing risks of hazardous chemicals in the workplace (2024) (which references the ADG Code but applies a similar and slightly different system of chemical hazard classification criteria based on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)), and
- *If applicable, South Australia Explosives Act 1936* (South Australian Government, 2020) and *Regulations 2011* (South Australian Govenment, 2020) (which references the ADG Code too). *Note: Use and storage of explosives at the site are not anticipated by ANI at the SCY during the project.*

o *Potential and/or actual Radioactive goods and substances* –

- ARPANSA Code for Safe Transport of Radioactive Material (2019) for individual items or packages.
- ARPANSA Code of Radiation Protection Requirements for Industrial Radiography (2018) for devices that use or generate ionising radiation.
- Future ARPANSA equivalent and/or additional requirements established by the by a future Australian Naval Nuclear Power Safety Regulator (ANNPSR) established under the recently enacted *Australian Naval Nuclear Power Safety Act 2024*[4].
- SA EPA Code of Compliance (COC-2) for facility design and shielding 2022 (2023) where items or devices may be stored and/or used together.

– ***Hazardous wastes*** – would be identified and classified based on:

o *Non-radioactive hazardous wastes* – Per the South Australia *Environment Protection Act 1993* (South Australian Government, 2024), its subordinate legislation, and other relevant codes and guides issues by the SA EPA:

- By prescribed activity of if a listed waste in Schedule 1 of this Act, and
- For listed or other hazardous wastes by their UN code per the National Environment Protection Measure (Movement of Controlled Waste between States and Territories) 1998 (Australian Government, 2012),
- For contaminated industrial and commercial wastes for landfill disposal, by SA EPA criteria for classification of this waste (2010) and landfill disposal criteria for PFAS-contaminated waste (2020), and
- For waste soil (from demolition and/or construction activities), SA EPA criteria for classifying this waste (2010) and landfill disposal criteria for PFAS-contaminated waste (2020).

o *Radioactive wastes* – Per the South Australia *Radiation Protection and Control Act 2021*, its subordinate legislation, and other relevant codes and guides issues by the SA EPA, ARPANSA and/or future ANNPSR:

- SA EPA Guidelines for radioactive waste disposal (2024),
- ARPANSA Codes for transport and disposal of radioactive waste (2019) (2018a) (2018b),
- ARPANSA Guidelines for classification of radioactive waste (2020), and/or
- Any relevant future ANNPSR requirement(s).

[4] This act was passed by the Australian Parliament on the 10 October 2024 and assented on the 24 October 2024.

4.2.3 Step 3 – Regulatory approval / licensing requirements & relevant standards

This step would involve the following.

A. Identify and review regulatory and approval or licensing requirements

- Identifying and reviewing all relevant regulatory requirements for approval and licensing of or hazardous substances and/or hazardous wastes for:
  - Transport,
  - Storage,
  - Containment and bunding,
  - Handling or use,
  - Disposal,
  - Fire protection requirements, and
  - Potential (direct and/or indirect) environmental impacts from the above activities.
- Much of the relevant regulatory legislation and requirements have already been identified and/or alluded to earlier in this advice, but a wider list (by jurisdiction) is given in Table 4-2 overleaf.
  - Some South Australian legislation and requirements will or may intersect or reference national legislation and /or regulatory requirements, e.g., ARPANSA Codes and/or future ANNPSR requirements for radioactive materials of wastes, ADG Code for dangerous goods, etc.
  - Some regulatory requirements will depend on whether State or Government jurisdiction applies to the SCY project and/or site.
  - This list includes the relevant South Australian legislation that supports and helps to protect the existing dolphin population in the Port River:
    - *Adelaide Dolphin Sanctuary Act 2005*, and
    - *Environment Protection (Water Quality) Policy 2016*
- As part of this review, the project team would meet with relevant approval and licensing authorities and/or other stakeholders to clarify and confirm these requirements for the SCY project site context / situation.
  - These clarifications may include identifying requirements around site specific and/or sensitive issues, e.g.,
    - Potential stormwater run-off contamination into and environmental impacts on the Port River (or other water bodies) in event of spillages or emergency events related to for hazardous substances and/or hazardous wastes (at site or during transport).
    - Proximity and potential risks or hazards to residential neighbourhoods on Lefevre Peninsula, local infrastructure, and/or public facilities or access near the site (including setbacks for hazardous substance and/or waste storages).
    - On-site storage and containment or bunding provision / requirements (if different to or above that of relevant Australian Standards for storage and handling).

{Cont. two pages over}

Table 4-2 – List of relevant legislation and regulatory requirements in South Australia and /or nationally (including where under Commonwealth jurisdiction) that govern dangerous goods, hazardous substances and/or hazardous wastes including radioactive materials. *Note: List is not necessarily exhaustive and does not include other associated or referenced guidance documents, standards &/or codes that may be applied or used by regulatory authorities to interpret compliance with these relevant regulatory requirements or arrangements. Includes the Australian Naval Nuclear Power Safety Act 2024 enacted on 24 October 2024.*

South Australia	Commonwealth
• ***Work health and safety*** o *Work Health and Safety Act 2012* (SA) o *Work Health and Safety Regulations 2012* (SA) o Approved Codes of Practice in South Australia (see: Codes of Practice | SafeWork SA) • ***Dangerous goods*** o *Dangerous Substances Act 1979* o *Dangerous Substances (General) Regulations 2017* o *Dangerous Substances (Dangerous Goods Transport) Regulations 2023* • ***Hazardous wastes (non-radioactive)*** o *Environment Protection Act 1993* o *Environment Protection Regulations 2009* o *Environment Protection (Wastes to Resources) Policy 2010* o *Environment Protection (Movement of Controlled Waste) Policy 2014* o *National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998* o *National Environment Protection (Assessment of Site Contamination) Measure 1999* o *Environment Protection (Air Quality) Policy 2015* o *Environment Protection (Water Quality) Policy 2016* o *Code of Practice for stormwater pollution prevention by the building and construction industry* o *Code of Practice for stormwater pollution prevention by the local, state, and federal government* o *National Environment Protection (Assessment of Site Contamination) Measure 1999* o *Adelaide Dolphin Sanctuary Act 2005* • ***Radioactive materials & wastes*** o *Radiation Protection & Control Act 2021* o *Radiation Protection & Control Regulations 2022* o SA EPA Radiation Codes of Compliance (see: Codes of Compliance | EPA) o *Nuclear Waste Storage Facility (Prohibition) Act 2000* • ***Fire safety & protection*** o *Fire and Emergency Services Act 2005* o *Fire and Emergency Services Regulations 2021* o Building Code of Australia • ***All above areas*** o *Planning, Development, and Infrastructure Act 2016* o *Planning, Development, and Infrastructure (General) Regulations 2017* o South Australia Planning & Design Code (see: Planning and Design Code)1 • ***Explosives (if applicable).*** *Note: Use and storage of explosives at the site are not anticipated by ANI at the SCY during the project.* o *Explosives Act 1936* o *Explosives (Security Sensitive Substances) Regulations 2021* o *Explosives Regulations 2011*	• ***Worker health & safety, dangerous goods & hazardous wastes*** o *Work Health and Safety Act 2011** o *Work Health and Safety Regulations 2011** o Codes of Practice under the WHS Act (see: Codes of Practice under the WHS Act | Comcare)* **If under Comcare's jurisdiction* o ADG Code, Edition 7.9 o *Hazardous Waste (Regulation of Exports and Imports) Act 1989* o *Environment Protection and Biodiversity Conservation Act 1999* • ***Radioactive materials & wastes*** o *Australian Naval Nuclear Power Safety Act 2024* o *Australian Radiation Protection and Nuclear Safety Act 1998* o *Australian Radiation Protection and Nuclear Safety Regulations 2018* o ARPANSA Codes and standards (see: Codes and standards | ARPANSA) o *National Radioactive Waste Management Act 2012* • ***Explosives (if applicable).*** *Note: Use and storage of explosives at the site are not anticipated by ANI at the SCY during the project.* o *Explosives Act 1961* o *Explosives Transport Regulations 2002* o *Explosives Areas Regulation 2003* o Australian Code for transport of explosives by road and rail. Edition 3

- Maintenance of local air quality from site use and/or manufacturing activities, or in event of spillages or emergencies.
- Transport routes to and from the site in proximity to these neighbourhoods and through Port Adelaide and Metropolitan Adelaide.
- Fire control and/or firefighting support systems at site and/or for transport vehicles carrying these hazardous substances and/or wastes (at or to and from site).
- Fire and emergency service access to and around the site in event of emergencies or incidents.

- It may identify how site approvals and licenses should be structured over the construction and/or operating phases and/or demarcated by site area and activities being undertaken in that area, i.e., certain areas handling radioactive materials &/or wastes may only need to be licensed for this purpose instead of whole site.
- Relevant approval and licensing authorities and/or other stakeholders that would be engaged as part of this review would include (but not be limited to):
  - SA EPA
  - City of Port Adelaide Enfield
  - SafeWork SA and/or Safe Work Australia
  - South Australian Metropolitan Fire Service
  - South Australian Department for Environment and Water,
  - PlanSA,
  - Australian Government Department of Defence,
  - ARPANSA and/or ANNPSR, and
  - Australian Government Department of Climate Change, Energy, the Environment & Water (DCCEEW).
- Even where Commonwealth jurisdiction may apply (to certain matters), relevant State Government stakeholders would still be engaged to capture their views and/or expectations on these matters.

B. Identify relevant industry (design) requirements, Australian & international standards and / or best practices

- Designated and/or best practice industry design requirements, Australian &/or international standards, and/or codes of practice and/or guidelines would be identified and itemised.
- Many of these standards, codes of practice and/or guidelines are referenced in relevant regulatory and approval or licensing documents, but others may be necessary to ensure best Australian and international design practice in safe management of these hazardous substances and wastes, e.g.,
  - SafeWork SA has published a Code of Practice for assessing and managing risks of hazardous chemicals in the workplace (SafeWork SA, 2024)
  - The ADG Code (National Transport Commission, 2024) references multiple Australian and/or international Standards, which provide requirements and/or guidance when designing facilities for storage and handling of different types of dangerous codes.
    - Table 1 in the ADG Code gives a complete list of standards it refers to.

- These standards include detailed requirements for storage and containment including bunding of hazardous substances which would be followed and complied with.

- The SA EPA provides its own guidance documents on regulation of hazardous waste, waste classification and licensing requirements for storage at sites including bunding and transportation for disposal.
  - These guidance documents refer to the same standards that the ADG Code references for storage and containment requirements of hazardous substances including bunding.
- ARPANSA publishes a range of guides to complement of codes of practice for managing risks, storing, handling and disposing of radioactive materials and / or wastes (see : Guides and recommendations | ARPANSA)
- The establishment of the ANNPSR under recently passed *Australian Naval Nuclear Power Safety Act 2024* may see new or equivalent requirements bring developed that could substitute or add to ARPANSA requirements.
- Additional International Atomic Energy (IAEA) safety standards (Safety standards | IAEA) can be used to supplement ARPANSA codes and guides and/or future ANNPSR requirements and provide guidance on radiological environmental impact assessment, management systems and occupational protection practices.

o It is not feasible (in this initial advice) to itemise all these design requirements / standards / codes / guides, but they cover and would be used for the following matters.

- Risk assessment methods for hazardous substances and/or waste during:
  - Transport (to and from the site),
  - Workers during storage, handling, and use,
  - Site equipment &/or infrastructure,
  - Disposal,
  - Actual or potential public health and safety and environmental impacts in event of:
    - Leaks or spillages (to air, water, and/or land), and
    - During fire, extreme weather and / or other emergency / disaster events during the above activities.
- Design of site and/or plant, equipment, infrastructure and/or work practices to mitigate or prevent above risks during:
  - Transport of dangerous goods and hazardous substance, including:
    - Vehicle and container types,
    - Labelling,
    - Licensing and approvals,
    - Transport route selection and logistics management,
    - Security requirements, and
    - Spillage and/or emergency procedures and response management.
  - On-site storage dangerous goods and hazardous substances and/or wastes, including:
    - Location selection, and

  - Segregation – to keep certain hazardous substances and/or wastes (e.g., in different safety cabinets, rooms, or bunded areas),
  - Setbacks (from other hazardous substances and/or waste, other site activities or facilities, and/or sensitive receptors),
  - Containment measures, e.g., enclosure design, shielding and/or barrier requirements, bunding, evacuation or venting, and /or any volume limits,
  - Fire incident prevention and / or mitigation systems, and
  - Licensing and approvals.
- On-site use and handling of dangerous goods and hazardous substances and/or hazardous wastes during submarine manufacturing or other site activities, including (if the hazard cannot be eliminated or substituted for):
  - Isolation measures (to isolate the hazard from workers),
  - Engineering controls (place a barrier between hazard and worker),
  - Administrative controls (through permits, standard operating procedures, safe work practices and training),
  - Personal protective equipment (PPE) required for workers,
  - Fire incident prevention and / or mitigation systems, and
  - Licensing and approvals.
- Leaks or spillage prevention and incident response & mitigation – to protect workers, emergency service personnel and public, and minimise impacts on environment, site and plant and equipment.
- Fire, extreme weather and / or other emergency / disaster event / incident response notifications, systems, management & mitigation – again for the same purpose.

4.2.4 Step 4 – Risk / hazard assessment

This step would conduct the formal risk assessment process of dangerous goods or hazardous substances and/or hazardous waste in the project inventories developed in Step 2 for each phase of the project. This risk assessment process would involve the following.

1. ***Identify and assess risks*** – Elucidate and quantify (i.e., including likelihood and potential consequence top develop a risk rating, e.g., see Figure 4-2 overleaf) the potential project risks of the hazardous materials and/or waste for the project, including for the following areas, at the site during use or handling, storage, and/or transport to and from.
   - Occupational or worker safety
   - Environmental (water, air, land)
   - Fire (events)
   - Public or community
   - Site infrastructure and equipment

{Cont. two pages over}

			Potential Consequences				
			Minor injuries or discomfort, no medical treatment or measureable side effects	Injuries or illness requiring medical treatement, temporary impairment only	Injuries or illness requiring hospital admission, no permanent impairment	Injury or illness resulting in permanent impairment	Fatality
			Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Likelihood	Expected to occur regularly under normal circumstances	**Almost Certain**	**High**	**High**	**Catastrophic**	**Catastrophic**	**Catastrophic**
	Expected to occur at some time	**Likely**	**Medium**	**High**	**High**	**Catastrophic**	**Catastrophic**
	May occur at some time	**Possible**	**Medium**	**Medium**	**High**	**Catastrophic**	**Catastrophic**
	Not likely to occur in normal circumstances	**Unlikely**	**Low**	**Low**	**Low**	**High**	**Catastrophic**
	Could happen, but probably never will	**Rare**	**Low**	**Low**	**Low**	**High**	**Catastrophic**

Figure 4-2 – Example of a risk assessment matrix. *The objective of risk assessment is to assign a risk rating to an activity or event (from Low to Catastrophic) based on likelihood of happening and potential consequence. The project design or management is then changed to reduce this risk rating to lowest possible level. Source: Colby Phillips Advisory*

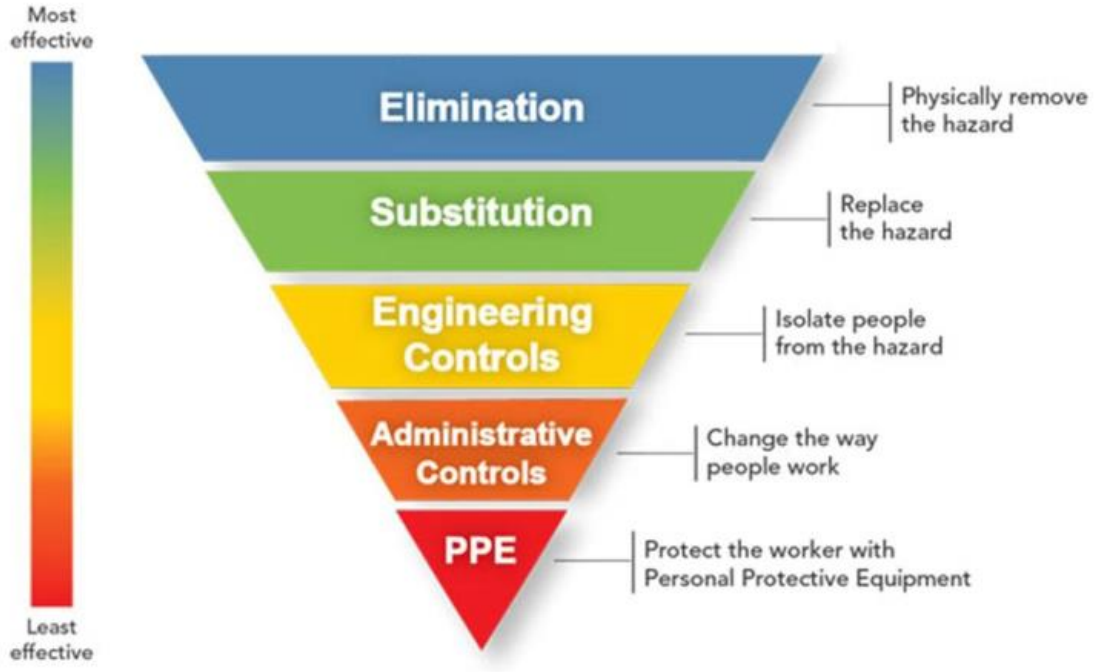

Figure 4-3 – Example of hierarchy of control approach to minimizing safety risks or hazards. *The best approach is to eliminate the risk altogether and the least used option should be to rely on PPE. Image source: About Hierarchy of Controls | Hierarchy of Controls | CDC*

2. ***Risk mitigation actions to minimise identified risks*** – Identify design and/or site management responses or methods that would mitigate these risks to a lowest acceptable level (or rating), in line with relevant regulatory requirements and industry design standards and/or best practices, which may include:
    - Site re-design (i.e., arrangement / layout, setbacks, activity separation / segregation, safety corridors, emergency access paths),
    - Site infrastructure design changes (e.g., building material, barriers, bunding, ventilation / evacuation systems, fire protection systems, access roads, spillage interception and holding systems, alarms, etc.),
    - Site activity restrictions or changes (e.g., to eliminate risks from certain activities or make them inherently safer),
    - Design and selection of plant &/or equipment (e.g., for risk elimination, substitution to remove risks, isolation controls or interlocks, and / or engineering controls – see Figure 4-3 on previous page),
    - Site management and/or operational changes (i.e., administrative controls, work restrictions and permits, training and use of PPE), etc.

This formal risk assessment process may be staggered, and issue-prioritised during planning, design development and construction phases of the project to help expedite the project and/or where early project design decisions and/or activities may influence later project outcomes that may impede mitigation of (identified) risks. It would also be undertaken as part of the wider hazard and risk assessment for the project (addressing and integrating other design hazard / risk issues too).

4.2.5 Step 5 – Facility design & management systems

Step 5 would implement the outcomes of Step 4 to:

1. ***Develop project management processes*** – which would include setting up the project EMSs for hazardous materials and wastes management at the SCY site (as itemized earlier in Step 1).
2. ***Design site facilities*** – to safely transport, store, handle, use and/or dispose of dangerous or hazardous substances and/or hazardous wastes identified in the project inventories, including fire protection.
    - There would be multiple locations, types, and scales of storage across the site depending on the activity being undertaken and types and risks or dangerous goods or hazardous substances may be being used and hazardous waste being generated, including:
        - Central storages – to consolidate safe and efficient management for some of these hazardous substances and wastes.
        - Multiple smaller distributed storages – across the site:
            - At points-of-use for convenience,
            - Where needed to minimise transport or transfer distances or exposure,
            - Keep volumes below high-risk thresholds or at safer levels more easily managed,
            - For segregation of certain hazardous materials or wastes from each other, and/or
            - Specialized security or hazard systems are needed for certain hazardous substances and / or hazardous wastes.
    - Transport arrangements, storages, containment and bunding provisions, and other equipment for hazardous substances would be designed to meet requirements of the ADG

Code, SafeWork South Australia Code of Practice (SafeWork SA, 2024) (or Safe Work Australia codes) and SA EPA licensing requirements, including (but not limited to):

- Segregation requirements (including barriers if needed)
- Storage devices (e.g., tanks, cylinders, storage cabinets, cupboards) including protections (against leaks, fires, spills, emissions)
- Labelling
- Decanting, piping and/or mobile transfer systems (including for bulk storages)
- Fire protection
- Safety or hazard monitoring
- Local safety equipment (e.g., safety showers, eye wash, PPE)
- Permits, procedures and training for personnel involved in transport, transfer, access or use of these hazardous substances
- Warning / risk notifications and emergency information

- Transport arrangements, storages, bunding and other equipment for radioactive materials (or devices) would be designed to follow similar requirements as outlined in the South Australia *Radiation Protection and Control Act 2021* and *Regulations 2022*, SA EPA Codes of compliance under this legislation and relevant ARPANSA codes of practice.
- Transport arrangements, storages, and other equipment for hazardous wastes would be designed to follow the requirements of SA EPA licensing, which would follow similar above requirements for the source hazardous and/or radioactive substances including contaminated industrial and commercial waste or waste fill / soil.

3. ***Select and procure plant and equipment*** – to safely construct or operate the SCY site and prevent and/or minimise the hazards and/or risks including from storage, containment and bunding measures, and on-site use of hazardous substances and/or production or hazardous wastes.
4. ***Develop site management and operational processes*** –for safely constructing or operating the SCY site, including:
    - Relevant administrative controls,
    - Work procedures to mitigate risks of these hazardous waste and materials during the project,
    - Incident / emergency response plans, and monitoring and reporting systems
    - Advice, materials and/or training to be developed and provided (as required) to all future project personnel, contractors and/or other stakeholders so they are:
        - Fully informed of:
            - These potentially dangerous materials and/or hazardous wastes at the SCY site,
            - Relevant regulatory and site hazard and risk management requirements that apply,
            - Safety management processes and systems developed for them (including for any dangerous situations and/or incidents involving them),
        - Equipped with or can supply their own PPE or other safety equipment to be used, and
        - Trained to properly and safely use these systems and storage and handling facilities provided at site for them.

The above items are not necessarily linear, and many would be considered together to collectively act to reduce hazards from these materials to acceptable risk levels that can be safely managed at the SCY.

4.2.6 Step 6 – Approvals and licenses

The above would support relevant approvals and licenses for on-site use of hazardous substances and/or storage and disposal of hazardous wastes for the project to be secured. Some of these approvals and licenses may be obtained progressively during the project as each phase commences and/or is completed, e.g., an approval maybe needed for some demolition activities or to commence construction, some licenses may not be provided until the construction is complete and commissioning and/or inspections can happen. As noted earlier, there may be a hierarchy of licensing or approvals put in place, e.g.,

- There may be some site-wide licenses or approvals put in place, with
- Other individual licenses or approvals for specific areas where certain activities only happen or are confined to, e.g., where radiation materials or waste may be present.

4.2.7 Step 7 – Develop, finalize, and implement project EMS

The project EMSs integrating the requirements for management of hazardous substances and wastes would be developed and implemented in time for each project phase to ensure:

1. Procedures, policies, and systems to safely manage dangerous or hazardous substances and/or hazardous wastes are implemented, monitored, and reviewed and improved as needed (including to address any future regulatory changes),
2. Site facilities to safely transport, store, contain and/or bund, handle, use and/or dispose of dangerous or hazardous substances and/or for fire protection are properly maintained and operated,
3. All relevant approvals and licenses are monitored and complied with, and
4. Relevant regulatory authorities and other project stakeholders are routinely engaged with as needed to review performance and identify any improvements that may be needed.

4.3 Hazardous waste disposal

4.3.1 Hazardous waste (non-radioactive)

Transport and disposal arrangements required for hazardous waste produced by the SCY project would be readily available in Metropolitan Adelaide, which has existing industrial activities that already require similar services.

- ***Disposal of hazardous waste***
    - ***Landfill disposal is banned*** – Most hazardous waste is banned from landfill disposal per the South Australia *Environment Protection (Waste to Resources) Policy 2010* (South Australian Government, 2021), with the following potential exceptions.
        - Asbestos – so long as wrapped and sealed, can be disposed of to a landfill licensed to receive this material (with SA EPA approval).
        - Contaminated commercial and industrial waste and/or soil –if below SA EPA threshold criteria for contamination (2010) and PFAS (2020)
        - Clinical or medical waste – that has been sterilised or autoclaved and if it too below SA EPA threshold criteria for contamination (2010) and PFAS (2020).
    - ***Disposal must happen at a hazardous &/or listed waste disposal facility licensed (by the SA EPA) to take this material*** – Most hazardous waste would therefore be sent for disposal to a licensed hazardous waste disposal and treatment facility able to accept that material, e.g. (but not limited to),
        - Cleanaway Wingfield Treatment Plant at Wingfield – Oils, acids, alkalis, inorganic chemicals, organic solvents (including liquids and some solid forms) –
        - Veolia South Australia Thermal Treatment facility at Dry Creek – Medical, quarantine, confidential and pharmaceutical waste, inks, paints, dyes, some organic solvents
        - Southern Waste ResourceCo at Maslin Beach – Contaminated soils, residues from industrial waste treatment
        - E-waste – Variety of e-waste recyclers and/or drop-off stations exist in Adelaide
- ***Transport of hazardous waste***
    - ***Licensing requirements*** – Transport of hazardous waste in South Australia would require (except where a low volume or risk exemption applies) a service provider with a Category A (waste transport license) license *per* the South Australia *Environment Protection Act 1993* (South Australian Government, 2024).

- ***Service availability*** – There are multiple service providers with Category A waste transporter license in in Metropolitan Adelaide.

4.3.2 Radioactive waste

Transport and disposal arrangements for radioactive waste produced by the SCY project in Metropolitan Adelaide would be limited and more challenging to manage as explained below.

- ***Disposal of radioactive waste –*** would depend on its classification *per* the ARPANSA Code for Disposal of Radioactive Waste (2018b):
  - ***Exempt waste*** –
    - Could be disposed of to landfill where meeting the generic criteria for exemption (and clearance) are available in Schedule I of the General Safety Requirements No. GSR Part 3 Radiation Protection (IAEA, 2014), and
    - Subject to confirmation and approval by the SA EPA under the South Australia *Radiation Protection and Control Regulations 2022* (South Australian Government, 2022), following SA EPA Guidelines for waste management application/ plan to dispose of unsealed radioactive material (SA EPA, 2024).
  - ***Very short-lived and low-level waste –***
    - Might be disposed of to landfill once able to be stored and/or treated to meet Exempt waste criteria above and same SA EPA approvals, or
    - Alternatively, would be held and stored like Low-level waste below for later disposal to a suitable radioactive disposal facility.
  - ***Low-level –***
    - Can only be held and stored in a suitable and secure facility until suitable disposal facility becomes available in Australia (as is presently being planned[5])

  Note: Intermediate (ILW) and high level (HLW) radioactive waste are not anticipated by ANI at SCY.
- ***Transport of radioactive waste***
  - ***Licensing requirements –*** Transporters require:
    - Separate licensing from the SA EPA under the *South Australia Radiation Protection and Control Act* 2021 (2021) and *Regulations 2022* (2022), and
    - Must comply with the ARPANSA Code for the Safe Transport of Radioactive Material (2019).
  - ***Service availability –***
    - Exists in Metropolitan Adelaide but there are fewer (licensed) service providers (e.g., Energy Logistix (Aust.), Remote Transport Australia).

4.3.3 Waste containing explosives

Use and storage of explosives at the site are not anticipated by ANI at the SCY during the project.

[5] The Australian Government is planning a National Radioactive Waste Management Facility (NRWMF) for disposal of Low Level Waste (LLW) and Intermediate Level Waste (ILW), see: Radioactive waste disposal and storage | ARPANSA.

5 Potential risk evaluation review

5.1 Hazardous substances (in radioactive materials)

5.1.1 Review

Table 5-1 starting two pages overleaf gives an initial evaluation of potential risks from hazardous substances identified in Table 3-1 to environmental and public health in the vicinity of the site.

- This preliminary review is a starting point for understanding the potential risks from these dangerous substances and hazardous materials.
    - Once actual dangerous substances and hazardous materials to be used by the project can be confirmed, it can be developed further with more detail and accuracy including more quantitative risk assessment / rating (e.g., per Figure 4-2 on page 34).
- It is conducted at ADG Code Classification level to identify the general potential hazard risks of these substances that may occur for the following universal types of risk events during their transport, storage, handling, use and/or use.
    - ***Physical or kinetic damage / impact*** – to the storage container (but without release of dangerous substances and hazardous materials contained therein).
        - For some dangerous goods, like oxidising agents and/or peroxides, this type of impact can potentially result in explosive or potential fire hazards from the transfer of energy to these materials.
    - ***Accidental leakage or uncontrolled release*** – of the dangerous substances and hazardous materials
    - ***Accidental ignition / reactivity*** – caused by nearby heat sources, static electricity, physical or equipment handling / processing / mixing, and / or contact with other (solid, liquid &/or gaseous) chemicals
    - ***Potential fire risks*** – for the dangerous substances and hazardous materials
    - For radioactive materials only:
        - ***Potential risk and /or uncontrolled reaction from heat build-up***: HEU nuclear reactors only (for which there would be very low likelihood but should be considered)
- Potential hazards resulting from these risk events were identified and classified as follows. *Note: Again, this classification process was not able to quantify or rate these risks and/or yet consider risk mitigations that may be put in place, which would happen later as the project design is developed.*
    - By potential type:
        - ***Explosive risk / hazard*** - *Mass, projectile &/or radiant*
        - ***Flammable / fire risk hazard*** *(if ignition source present)*
        - ***Physical projectile*** *(if propelled)*
        - ***Asphyxiant atmosphere / oxygen displacement***
        - ***Toxicity - Human or environmental*** (Direct &/or reaction by-product):
            - Chemical, e.g., cytotoxic, cancer causing, corrosive, oxidising
            - Biological, i.e., infectious
            - Physical, e.g., skin, respiratory, eyes
        - ***Environmental contamination risk / hazard:***
            - Water, e.g., if enters a water body
            - Air, e.g., if released to atmosphere

- Land e.g., if in contact with soil

- ***Damage to site equipment &/or infrastructure:***
  - Physical, e.g., cause deformation or structural failure
  - Chemical, e.g. corrosion damage, oxidation, etc.
- ***Public / neighbouring community risk / impact*** - Direct or indirect from these potential hazards, within the site vicinity:
  - Water
  - Air
  - Land
  - Person
  - Infrastructure

- Priority for future assessment:
  - ***Primary*** – where it was expected there could be higher likelihood and potential consequences,
  - ***Secondary*** – where there could be lesser likelihood and potential consequences, and
  - ***Unmarked*** – Likely to be little or no risk

5.1.2 Discussion of results

Nearly every dangerous substance and hazardous material identified for the project could have some type of potential risk to environment and public health (in addition to those on the site itself), with these risks more elevated especially in the following certain (but not necessarily limited to) circumstances:

- During the transport to and from the site in event of accidental spillage or release when the dangerous substance and hazardous material will be in the public domain.
- In unlikely event of a major uncontrolled release from on-site storage, fire and/or explosion at the SCY site, which may result in:
  - Potential transmission of dangerous substance and hazardous material outside the site boundaries into the environment and/or neighbouring communities (via land, water and/or soil), and/or
  - Potential risks and exposure of emergency personnel responding to any of these events from dangerous substances and hazardous materials at the site.

All potential risks to environment and public health would be formally reviewed and modelled during the project (including engagement with relevant regulatory authorities, environmental agencies and /or other community stakeholders) with project mitigation steps developed and put in place to prevent or minimise them to acceptable levels (as part of recommended Step 4 in Table 4-1 on page 25 of this advice).

Table 5-1 – Preliminary high-level risk review of dangerous goods / hazardous substances by ADG Code classification: Potential hazard type by possible risk event. *Note: * Use and storage of other explosives at the site are not anticipated by ANI at the SCY.*

ADG Code Class*			Risk event (during transport, storage, handling, use &/or disposal unless otherwise specified)	Potential hazard type (Primary / significant - ●, Secondary / must be considered - ○)																
				Explosive - Mass, projectile &/or radiant	Flammable / fire risk hazard	Physical projectile	Asphyxiant atmosphere / oxygen displacement	Toxicity - Human or environmental (Direct &/or reaction by-product)			Environmental contamination			Damage to site equipment &/or infrastructure		Public / neighbouring community risk / impact - Direct or indirect from these potential hazards				
								Chemical	*Biological*	*Radioactive (direct or indirect)*	*Water*	*Air*	*Land*	*Physical*	*Chemical*	*Water*	*Air*	*Land*	*Person*	*Infra-structure*
2	Gasses	2.1 – Flammable gases	Physical or kinetic damage / impact to or by cylinder carrying gas			○								○					○	○
			Accidental leakage or uncontrolled release in confined space &/or area with inadequate ventilation	○			●	○			○ (if reactive)	●	○ (if reactive)		○ (if reactive)	○ (if reactive)	●	○ (if reactive)	●	●
			Accidental ignition / reactivity caused from nearby heat source, static electricity, and / or contact with other (solid, liquid &/or gaseous) chemicals	●	●	●				○ (if material impacted)				●						
			Risk in fire from rupturing and exploding cylinders																	
		2.2 - Non-flammable, compressed non-toxic	Physical or kinetic damage / impact to or by cylinder carrying gas (but no release)			○								○					○	○
			Accidental leakage or uncontrolled release in confined space &/or area with inadequate ventilation				●													
			Risk in fire from rupturing and exploding cylinders			●				○ (if material impacted)				●					●	●
		2.3 - Toxic	Physical or kinetic damage / impact to or by cylinder carrying gas			○		○						○						
			Accidental leakage or uncontrolled release in confined space &/or area with inadequate ventilation		○						● (if reactive)	●	○ (if reactive)		● (if reactive)	● (if reactive)	●	○ (if reactive)	●	●
			Accidental ignition / reactivity caused from nearby heat source, static electricity, and / or contact with other (solid, liquid &/or gaseous) chemicals	○	○	○	○	●		○ (if material impacted)				●						
			Risk in fire from rupturing and exploding cylinders	●	●	●														
3	Flammable liquids		Physical or kinetic damage / impact to or by container or tank carrying liquid (but no release)			○								○					○	○
			Accidental leakage or uncontrolled release of liquid or its vapour	○			○													
			Accidental ignition / reactivity caused from nearby heat sources, static electricity, and / or contact with other (solid, liquid &/or gaseous) chemicals	●	●	●	●	○		○ (if material impacted)	●	○	●	●	○	●	●	●	●	●
			Risk in fire from liquid storage tank &/or container																	
4	Flammable solids		Physical or kinetic damage / impact to or by container or bags containing solids (but no release)	●	●	○								○					○	○

ADG Code Class*		Risk event (during transport, storage, handling, use &/or disposal unless otherwise specified)	Potential hazard type (Primary / significant - ●, Secondary / must be considered - ○)																
			Explosive - Mass, projectile &/or radiant	Flammable / fire risk hazard	Physical projectile	Asphyxiant atmosphere / oxygen displacement	Toxicity - Human or environmental (Direct &/or reaction by-product)			Environmental contamination			Damage to site equipment &/or infrastructure		Public / neighbouring community risk / impact - Direct or indirect from these potential hazards				
							Chemical	*Biological*	*Radioactive (direct or indirect)*	*Water*	*Air*	*Land*	*Physical*	*Chemical*	*Water*	*Air*	*Land*	*Person*	*Infra-structure*
		Accidental leakage or uncontrolled release of solids or dusts				○													
		Accidental ignition / reactivity caused by nearby heat sources, static electricity, physical or equipment handling / processing / mixing, and / or contact with other (solid, liquid &/or gaseous) chemicals			●	●	○		○ (if material impacted)	● (if reactive)	○	●	●	○	●	○	●	●	●
		Potential risk in fire from storages																	
5	**Oxidising substances and organic peroxides**	Physical or kinetic damage / impact to or by drums, tanks, other container, or bags containing these substances (but no release)			●														
		Accidental leakage or uncontrolled release of liquids, vapours, solids &/or dusts	●	●		●	●		○ (if material impacted)	●	●	●	●	●	●	●	●	●	●
		Accidental ignition / reactivity caused by nearby heat sources, static electricity, physical or equipment handling / processing / mixing, and / or contact with other (solid, liquid &/or gaseous) chemicals			●														
		Potential risk in fire from storages																	
6	**Toxic and infectious sub-stances**	Physical or kinetic damage / impact to or by drums, tanks, other container, or bags containing these substances (but no release)	○	○	○	○	○						○						
		Accidental leakage or uncontrolled release of toxic substance containing gas, liquids, vapours, solids &/or dusts		○															
	6.1 - Toxic substances	Accidental ignition / reactivity caused by nearby heat sources, static electricity, physical or equipment handling / processing / mixing, and / or contact with other (solid, liquid &/or gaseous) chemicals	○	○	○	○	●		○ (if material impacted)	● (if reactive)	●	○ (if reactive)	●	● (if reactive)	● (if reactive)	●	○ (if reactive)	●	●
		Potential risk in fire from storages	●	●	●														
	6.2 - Infectious substances (if applicable in anyway)	Accidental leakage or uncontrolled release of biological containing material as liquid, solid &/or aerosol.						●		●	●	●			●	●	●	●	●
7	**Radioactive material**	Accidental leakage or uncontrolled release of radioactive substance containing gas, liquids, vapours, solids &/or dusts							●	●	●	●			●	●	●	●	

ADG Code Class*		Risk event (during transport, storage, handling, use &/or disposal unless otherwise specified)	Potential hazard type (Primary / significant - ●, Secondary / must be considered - ○)																
			Explosive - Mass, projectile &/or radiant	Flammable / fire risk hazard	Physical projectile	Asphyxiant atmosphere / oxygen displacement	Toxicity - Human or environmental (Direct &/or reaction by-product)			Environmental contamination			Damage to site equipment &/or infrastructure		Public / neighbouring community risk / impact - Direct or indirect from these potential hazards				
							Chemical	*Biological*	*Radioactive (direct or indirect)*	*Water*	*Air*	*Land*	*Physical*	*Chemical*	*Water*	*Air*	*Land*	*Person*	*Infra-structure*
		Potential risk and /or uncontrolled reaction from heat build-up: HEU nuclear reactors only (very low likelihood)	○	○	○				●	●	●	●	○		●	●	●	●	●
8	**Corrosive substances**	Physical or kinetic damage / impact to or by drums, tanks, other container or bags containing these substances (but no release of contents)	●	●	●		●		○ (if material impacted)	●	●	●	●	●	●	●	●	●	●
		Accidental leakage or uncontrolled release of liquids, vapours, solids &/or dusts				●													
		Accidental ignition / reactivity caused by nearby heat sources, static electricity, physical or equipment handling / processing / mixing, and / or contact with other (solid, liquid &/or gaseous) chemicals			●														
		Potential risk in fire from storages																	
9	**Miscellaneous dangerous substances and articles**	Physical or kinetic damage / impact to or by items and/or drums, tanks, other container, or bags containing these substances (but no release of contents)	●	●	●	●	●	●	○ (if material impacted)	●	●	●	●	●	●	●	●	●	●
		Accidental leakage or uncontrolled release of gasses, liquids, vapours, solids &/or dusts																	
		Accidental ignition / reactivity caused by nearby heat sources, static electricity, physical or equipment handling / processing / mixing, and / or contact with other (solid, liquid &/or gaseous) chemicals																	
		Potential risk in fire from storages																	

5.2 Hazardous wastes

5.2.1 Review

Table 5-2 overleaf repeats this initial evaluation of potential risks for hazardous wastes identified in Table 3-2 to environment and public health in the vicinity of the site.

- Again, this preliminary review for hazardous wastes is a starting point for understanding their potential risks and would be expanded on during the project, including more detailed quantitative evaluation.

5.2.2 Discussion of results

The findings for the hazardous waste review are like those for dangerous substance and hazardous materials: each type of hazardous waste could have some type of potential risk to environmental and public health in vicinity of the site, especially in the following certain (but not necessarily limited to) circumstances.

- During transport from the site for disposal in event of accidental spillage or release when the hazardous waste will be in the public domain.
- In unlikely event of a major fire and/or explosion at the SCY site, which may result in:
    - Potential transmission of some types of hazardous waste outside site boundaries and into the surrounding environment and/or neighbouring communities (via land, water and/or soil), and/or
    - Potential exposure to hazardous wastes of emergency personnel responding to any of these events.

Once more, all potential risks to environment and public health would be reviewed and analysed during the project with project mitigation steps developed and put in place to prevent or minimise them to acceptable levels (per recommended Step 4 in Table 4-1 on page 25 of this advice).

Table 5-2 – Preliminary high-level risk review of hazardous wastes: Potential hazard type by possible risk event. *Note: * Use and storage of other explosives at the site are not anticipated by ANI at the SCY.*

Classification		Risk event (during transport, storage, handling, use &/or disposal unless otherwise specified)	Potential hazard type (Primary / significant - ●, Secondary / must be considered - ○)																
			Explosive - Mass, projectile &/or radiant	Flammable / fire risk hazard	Physical projectile	Asphyxiant atmosphere / oxygen displacement	Toxicity - Human or environmental (Direct &/or reaction by-product)			Environmental contamination			Damage to site equipment &/or infrastructure		Public / neighbouring community risk / impact - Direct or indirect from these potential hazards				
							Chemical	*Biological*	*Radioactive (direct or indirect)*	*Water*	*Air*	*Land*	*Physical*	*Chemical*	*Water*	*Air*	*Land*	*Person*	*Infra-structure*
Medical waste &/or sharps		Accidental leakage of waste material	○	○			●			○	○	○			○	○	○	●	
		Risk in fire event																	
Pharmaceutical waste		Accidental leakage of waste material	○	○			●			○	○	○			○	○	○	●	
		Risk in fire event																	
Biosecurity / quarantine waste		Accidental leakage of waste material						●		○	○	○			○	○	○	●	
Cytotoxic waste		Accidental leakage of waste material	○	○			●			●	●	●			○	○	○	●	
		Risk in fire event																	
Listed or hazardous wastes	*H3 – Flammable liquids (ADG Class 3)*	Refer Table 5-1 for 3. Flammable liquids																	
	H4.1 – Flammable solids (ADG Class 4.1)	Refer Table 5-1 for 4. Flammable solids																	
	H4.2 – Liable to spontaneous combustion (ADG Class 4.2)																		
	H4.3 - Emit flammable gases with water contact (ADG Class 4.3)																		
	H5.1 – Oxidising (ADG Class 5.1)	Refer Table 5-1 for 5. Oxidising substances and organic peroxides																	
	H5.2 – Organic peroxides (ADG Class 5.2)																		
	H6.1 – Poisonous (ADG Class 6.1)	Refer Table 5-1 for 6. Toxic and infectious substances																	
	H6.2 – Infectious (ADG Class 6.2)																		
	H8 – Corrosives (ADG Class 8)	Refer Table 5-1 for 8. Corrosive substances																	
	H10- Toxic gasses with air or water contact (ADG Class 9)	Refer Table 5-1 for 9. Miscellaneous dangerous substances and articles																	
	H11 – Toxic delayed or chronic (ADG Class 9)																		
	H12 – Ecotoxic (ADG Class 9)																		
	H13 – Yields H1-H12 material (ADG Class 9)																		
	Other reasons:																		
	Asbestos																		
	Compressed gas cylinders	Refer Table 5-1 for 2. Gasses																	

Classification		Risk event (during transport, storage, handling, use &/or disposal unless otherwise specified)	Potential hazard type (Primary / significant - ●, Secondary / must be considered - ○)																
			Explosive - Mass, projectile &/or radiant	Flammable / fire risk hazard	Physical projectile	Asphyxiant atmosphere / oxygen displacement	Toxicity - Human or environmental (Direct &/or reaction by-product)			Environmental contamination			Damage to site equipment &/or infrastructure		Public / neighbouring community risk / impact - Direct or indirect from these potential hazards				
							Chemical	*Biological*	*Radioactive (direct or indirect)*	*Water*	*Air*	*Land*	*Physical*	*Chemical*	*Water*	*Air*	*Land*	*Person*	*Infra-structure*
Contaminated commercial & industrial waste		Accidental leakage or uncontrolled release of solid waste					○		○	○		○			○		○	○	
		Accidental ignition / reactivity caused by nearby heat sources, static electricity and / or contact with other chemicals																	
		Potential risk in fire from storage																	
Waste soil		Accidental leakage or uncontrolled release of waste soil					○		○	○		○			○		○	○	
		Accidental ignition / reactivity caused by nearby heat sources, static electricity and / or contact with other chemicals																	
		Potential risk in fire from storage																	
Radiation waste	*Exempt waste (EW)*	Accidental leakage or uncontrolled release							○	○	○	○			○	○	○	○	
		Potential risk in fire from storage																	
	Very short-lived waste (VSLW) & Very low level waste (VLLW)	Accidental leakage or uncontrolled release							●	●	●	●			●	●	●	●	
		Potential risk in fire from storage																	
	Low level waste (LLW)	Accidental leakage or uncontrolled release	○						●	●	●	●	○	○	●	●	●	●	○
		Potential risk in fire from storage																	
	Note: It has been advised that Intermediate level waste (ILW) and High-level waste (HLW) is not anticipated at the SCY.																		

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Appendix 1 – ADG Code Classification of Dangerous Goods

Classification	Type	Hazardous descriptive feature / attribute	Example(s)	Classification Sub-division(s) or Grouping(s)	
Class 1	**Explosives**	**Explosives, devices &/or chemicals designed to, or in own right can, explode or combust, producing light, heat, sound, and pressure.**			
Division 1.1	***Mass explosion hazard***	Entire substance explodes instantaneously	Many forms of military ammunition, display fireworks, some types of detonating fuses	**Compatibility Groups A to L, N & S**	Each Compatibility Group reflects differing specified explosive material constituents / construction, condition &/or explosive hazard potential (refer ADGC (2022), Section 2.1.2.1)
Division 1.2	***Projection hazard but not a mass explosion hazard***	Propels material outwards during explosion	Some liquid and solid propellants, rocket motors		
Division 1.3	***Causes fire hazards with minor blast and/or projection hazards (but not a mass explosion hazard)***	Burns with considerable radiant heat and can produce minor blast or projection hazards or both	Solid propellants, rocket motors, some fireworks		
Division 1.4	***Present no significant hazard***	Explosive effects usually confined to body or package containing the material	Small arms ammunition, sparklers		
Division 1.5	***Very insensitive substances with mass explosion hazard***	Require initiation to explode, won't necessarily explode when exposed to fire, but still risks initiation can happen accidently	Blasting agents, fuel oil		
Division 1.6	***Extremely insensitive articles that do not have a mass explosion hazard***	Require significant initiation to explode, negligible probability of accidental initiation or propagation	Military bombs or missiles		
Class 2	**Gases**	**Substances with vapour pressure > 300 kPa (3 bar) at 50°C, or at atmospheric pressure is completely gaseous > 20°C.**		**Compressed gas**	Packaged under pressure and gaseous at -50°C
Division 2.1	***Flammable gases***	Gases that ignite (at 13% v/v) in air at 20°C and atmospheric pressure on contact with a source of ignition.	LPG, acetylene, hydrogen, propane, propylene, and methane	**Liquefied gas**	Packaged under pressure but partially liquid at > -50°C. High pressure liquefied gas if critical temperature between -50 and 65°C, low pressure liquefied gas if > 65°C
Division 2.2	***Non-flammable, compressed non-toxic gases***	May cause asphyxiation, are oxidising and/ or represent a stored energy hazard (i.e., by rapid expansion)	Carbon dioxide, helium, oxygen, nitrogen, air, argon, etc.	**Refrigerated liquefied gas**	Partially liquid when packaged under pressure because of its low temperature
Division 2.3	***Toxic***	Poisonous if inhaled by humans or LC50 ≤ 5,000mL/m3 (ppm)	Chlorine, ammonia, hydrogen chloride, fluorine, sulphur dioxide, etc.	**Dissolved gas**	Dissolved in liquid phase when packaged under pressure
				Adsorbed gas	Adsorbed on solid porous material with internal pressure < 101.3kPa at 20°C and < 300kPa & at 50°C

Classification	Type	Hazardous descriptive feature / attribute	Example(s)	Classification Sub-division(s) or Grouping(s)	
Class 3	**Flammable liquids**	**Liquid with vapours that can ignite in air on contact with a source of ignition, usually with flash point < 60° C or when being transported at temperatures > flashpoint.**	Acetone, adhesives, paints / lacquers / varnishes, alcohols, liquid fuels or oils, benzene, styrene, toluene, methyl, ethyl ketone, other liquid hydrocarbons, etc.	**Packing Group I**	Higher flammability: Initial boiling point ≤ 35°C
				Packing Group II	Moderate flammability: Initial boiling point > 35°C and Flashpoint < 23°C
				Packing Group III	Lower flammability: Initial boiling point > 35°C and 23°C < Flashpoint ≤ 60°C
Class 4	**Flammable solids**	**Substances liable to spontaneous combustion and/or which, on contact with water, emit flammable gases**			
Division 4.1	***Self-reactive substances, solid desensitised explosives, and/or polymerizing substances***	Readily combustible, thermally unstable, and/or polymerising substances liable to undergo a strongly exothermic reaction	Alkali metals, metal powders, firelighters, calcium carbide, camphor, celluloid, desensitized explosives, nitrocellulose, phosphorus, sulphur, etc.	**Packing Group I**	Substances presenting high danger: Ignites or reacts with gas flame and continues to burn material
				Packing Group II	Substances presenting medium danger: Burning time is < 45 s and flame passes a wetted zone
				Packing Group II	Substances presenting lower danger: Burning time is < 45 s but wetted zone stops flame
				Self-reactive Substance Types A to G	Progression from highest (Type A) to lowest (Type G) risk of fire &/or explosion when heated under confinement
Division 4.2	***Substances liable to spontaneous combustion***	Substances, mixtures and/or solutions which can spontaneously ignite, or self-heat up and then ignite, on contact with air.	Metal hydrides, alkali earth elements, finely divided metal powders, some gasses, nitrides, hydrazines, reactive cyanate compounds	**Packing Group I**	Substances presenting high danger: Pyrophoric liquids and solids.
				Packing Group II	Substances presenting medium danger: 25 mm cube spontaneously combusts at 140 °C
				Packing Group II	Substances presenting lower danger: 100 mm cube spontaneously combusts at elevated temperature between 100 and 140 °C
Division 4.3	***Substances which in contact with water emit flammable gases that can ignite***	Substances which are spontaneously flammable or react with water to emit flammable gases liable to form explosive mixtures with air (i.e., dangerous if wet)	Aluminium Phosphide, Calcium Carbide, Sodium	**Packing Group I**	Substances presenting high danger: Reacts vigorously with water at ambient temperatures and gas produced can ignite spontaneously or > 10L/kg material over 1 min
				Packing Group II	Substances presenting medium danger: Reacts readily with water at ambient temperatures and flammable gas produced at > 20L/kg/hr
				Packing Group II	Substances presenting lower danger: Reacts slowly with water at ambient temperatures and flammable gas produced at > 1L/kg/hr

Classification	Type	Hazardous descriptive feature / attribute	Example(s)	Classification Sub-division(s) or Grouping(s)	
Class 5	**Oxidising substances and organic peroxides**	***Solid or liquid substances which not necessarily combustible but can by yielding oxygen cause or contribute to combustion of other materials and articles containing such substances***			
Division 5.1	***Oxidising substances***	Solid or liquid substances which not necessarily combustible can by yielding oxygen cause or contribute to combustion of other materials	Ammonium nitrate (fertiliser), chlorates, nitrates, nitrites, peroxides, calcium hypochlorite, calcium nitrate, calcium peroxide, hydrogen peroxide	**Packing Group I**	Substances presenting high (or extreme) danger: Specified solid & cellulose mixture has high burning rate > than a specified test mixture, Liquid & cellulose mixture spontaneously ignites or cause high pressure rise > than a specified test mixture
				Packing Group II	Substances presenting medium danger: Specified solid & cellulose mixture has moderate burning rate > than a specified test mixture, Liquid & cellulose mixture causes moderate pressure rise > than a specified test mixture
				Packing Group III	Substances presenting lower danger: Specified solid & cellulose mixture has lower burning rate > than a specified test mixture, Liquid & cellulose mixture causes lower pressure rise > than a specified test mixture
Division 5.2	***Organic peroxides***	Organic peroxides liable to exothermic decomposition at normal or elevated temperatures.	Dibenzoyl peroxide (plastics. Fibreglass resin), methyl ethyl ketone peroxide (MOKP), peroxyacetic acid	**Types A to G**	Progression from highest (Type A) to lowest (Type G) risk of fire &/or explosion when heated under confinement
Class 6	**Toxic and infectious substances**	***Chemicals or biologicals that in small quantities can immediately or quickly cause damage to human health, or death by inhalation, absorption, or ingestion.***			
Division 6.1	***Toxic substances***	Chemical solid or liquid substances that can cause damage to human health, or death by inhalation, absorption, or ingestion.	Trichloroethylene (degreasing), dichloromethane (paint stripper), toluene diisocyanate (TDI) (foam production), formaldehyde (resins), isocyanates, paints), arsenic, chloroform, cyanide, lead, mercury substances, other heavy metals and their solutions, nicotine, pesticides (land management).	**Packing Group I**	Substances presenting high (or extreme) danger: Low (1 hr) LD50s for oral (≤5 mg/kg), dermal (≤50mg/kg) and inhalation toxicity (≤0.2mg/L)
				Packing Group II	Substances presenting medium danger: Medium (1 hr) LD50s for oral (5<x≤50 mg/kg), dermal (50<y≤200mg/kg) and inhalation toxicity (0.2<x≤2mg/L)
				Packing Group III	Substances presenting low (or minor) danger: High (1 hr) LD50s for oral (50<x≤300 mg/kg), dermal (200<y≤1000mg/kg) and inhalation toxicity (2<x≤4mg/L)
Division 6.2	***Infectious substances***	Substances with biological pathogens that cause permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.	Biological products, cultures, medical and clinical waste or patient specimens, animals, or their tissue.	**Category A**	Listed (high risk / impact) Infectious microorganisms: UN 2814 (Affecting humans), UN 2900 (Affecting animals), UN 3549 (Category A Solid Medical Waste)
				Category B	Other biological substance (may still be infectious but lower risk / impact): UN 3373 (Biological Substance), UN 3291 (Category B Medical Waste)

Classification	Type	Hazardous descriptive feature / attribute	Example(s)	Classification Sub-division(s) or Grouping(s)	
Class 7	**Radioactive material**	**Any material containing radionuclides where both activity concentration and total activity exceeds specified hazard levels**	Radiation detectors, fire suppression systems, smoke detectors, medical isotopes, x-ray machinery, etc.	**Excepted packages**	Low radioactive level and low hazard materials other than uranium or thorium where ≤ specified radioactive activity limits (per Table 3 of ARPANSA COP STORM)
				Low specific activity (LSA) radioactive material	Type I - Uranium, thorium & other radioactive compounds ≤ 10mSv/hr dose at 3m
					Type II - Water with tritium up to 0.8TBq/L or other material < specified activity limits (per 226(b) of ARPANSA COP STORM) and ≤ 10mSv/hr dose at 3m
					Type III - Solids (exc. powders) < specified activity limits (per 226(c) of ARPANSA COP STORM) and ≤ 10mSv/hr dose at 3m
				Surface contaminated objects (SCO)	Type I - Low fixed or non-fixed contamination on surfaces < specified activity limits (per 241(a) of ARPANSA COP STORM) and ≤ 10mSv/hr at 3m
					Type II - Higher surface contamination levels < specified activity limits (per 241(b) of ARPANSA COP STORM) and ≤ 10mSv/hr at 3m
				Type A packages	Small quantities of non- life endangering radioactive material < specified Type A activity limits (per 413(a) and (b) and 414 of ARPANSA COP STORM)
				Type B(U) package	High radioactivity material < Type B activity limits or on certificate of approval (per 415 and 416 of ARPANSA COP STORM). U=Unilateral approval. M=Multilateral approval
				Type B(M) package	
				Type C package	High radioactivity material for air transport < authorised package type activity limits on certificate of approval (per 417 of ARPANSA COP STORM)
				Special Arrangement	Radioactive material outside the above classifications where approved by relevant authority(ies).
				Uranium Hexafluoride	In specified form and subject to weight and volume limits and approved by relevant authority(ies).
Class 8	**Corrosive substances**	**Substances by chemical action that cause irreversible damage to the skin, or will materially damage, or even destroy, other goods or the means of transport.**	Sodium hydroxide (caustic soda), Ammonium solution, Ferric chloride (water treatment), Sodium hypochlorite (disinfectant), nitric acid, phosphoric acid, hydrochloric acid	**Packing Group I**	Substances presenting high (or extreme) danger: Irreversible skin damage after ≤ 3 min exposure, detected within 60 min
				Packing Group II	Substances presenting medium danger: Irreversible skin damage after 3 min < exposure ≤ 60 min, detected within 14 days
				Packing Group III	Substances presenting low (or minor) danger: Irreversible skin damage after 1 hr < exposure ≤ 4 hr min, detected within 14 days or > 6.25mm/year corrosion on steel or aluminium at 55°C

Classification	Type	Hazardous descriptive feature / attribute	Example(s)	Classification Sub-division(s) or Grouping(s)
Class 9	**Miscellaneous dangerous substances and articles**	**Substances and articles which present a danger or are environmentally hazardous substances but are not covered by other classes**		
	• *Fine dusts with inhalation risks: Asbestos*		• *Substances transported or offered for transport at elevated temperatures (solids & liquids)*	
	• *Lithium batteries*		• *Environmentally hazardous substances (liquids and solids)*	
	• *Capacitors*		• *Genetically modified micro-organisms and organisms*	
	• *Life-saving appliances*		• *Ammonium nitrate-based fertilisers*	
	• *Dioxin forming substances (in event of fire), e.g., PCBs*		• *Other substances (per ADGC (2022), Section 2.9.2)*	