

Australian Government Australian Submarine Agency



# **Radioactive Waste Management**

Controlled Industrial Facility (HMAS *Stirling*) ARPANSA Construction Licence Technical Overview



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## List of Acronyms

ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASA	Australian Submarine Agency
AUKUS	The trilateral security partnership between Australia, United Kingdom and the United States of America
CIF	Controlled Industrial Facility
HMAS	His Majesty's Australian Ship
IAEA	International Atomic Energy Agency
SRF-West	Submarine Rotational Force - West





## **Radioactive Waste Management**

## Section 1 – Introduction

- 1.1 This Technical Overview provides general information on radioactive waste management for construction of the Controlled Industrial Facility (CIF).
- 1.2 The content of this Technical Overview addresses Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) requirements detailed in Section F of the ARPANSA – Form -1797 v11.1 dated November 2022.
- 1.3 This Technical Overview contains information submitted to ARPANSA developed using the Regulatory Guide - Plans and arrangements for managing safety (ARPANSA-GDE-1735) and the ASA's internal guidance set out in Best Practice Guidance for Managing Nuclear Safety and Radiation Protection.
- 1.4 This Technical Overview is to be read in conjunction with the other ASA technical overviews, including the Safety Analysis Report, Safety Management, Radiation Protection, Emergency Management and Environment Protection.

#### **Radioactive Waste**

1.5 Radioactive waste is material that no longer has any foreseeable use and contains radioactive materials with activities or activity concentrations at levels requiring ongoing management. ARPANSA's Australian classification scheme for disposal of radioactive waste is based on the international scheme issued by the International Atomic Energy Agency (IAEA). Australia's radioactive waste classification system and the intended pathway for storage and disposal of Commonwealth government waste is consistent with international best practice.

#### **IAEA Waste Hierarchy**

1.6 The ASA will take the IAEA's waste management hierarchy<sup>1</sup> into account to guide the design and construction of the CIF, its operations and decommissioning. The hierarchy ranks strategies in order of preference, from avoiding the creation of waste as the most desired outcome, and disposal as the least desired outcome.

<sup>&</sup>lt;sup>1</sup> Further explanation on the IAEA's waste management hierarchy can be found here: https://www.iaea.org/sites/default/files/23/05/managing\_radioactive\_waste.pdf





## Section 2 – Scope and assumptions

- 2.1 To be clear, there will be no radioactive waste arising from the construction stage of the Submarine Rotational Force West (SRF-West) CIF.
- 2.2 The CIF is one of the core support facilities for nuclear-powered submarines, and when operational will deliver:
- a. <u>Radiological repair function</u>: the management of the acceptance, clearance, calibration, repair and return of submarine components that may contain contaminated or activated components
- b. <u>Waste management function</u>: the acceptance, categorisation, treatment, packaging, and temporary storage of low-level radioactive waste from submarine operations
- c. <u>Facility upkeep function</u>: the repair, maintenance, storage and disposal of non-radioactive facility equipment
- d. <u>Facility operations function</u>: storage of equipment, workforce office space.

#### Scope

- 2.3 This Technical Overview:
- a. Confirms that there will be no intermediate-level radioactive waste, or spent fuel at the CIF, and
- b. Outlines processes for the management of solid and liquid low-level radioactive waste during the routine operations of nuclear-powered submarines for waste that will be offloaded as a part of SRF-West operations at HMAS *Stirling*.
- 2.4 This Technical Overview will not consider:
- a. Management of the decommissioned reactor and spent nuclear fuel
- b. Conditioning processes to prepare low-level radioactive waste for disposal
- c. Transport of low-level radioactive waste from HMAS *Stirling* to a disposal or other interim storage site.

### Section 3 – Management of radioactive waste

#### **Radiological Controls Goals**

- 3.1 The goals and objectives of the radioactive waste management function acknowledge and apply the overarching Radiological Controls Principles as follows:
- a. Control the radioactive exposure and monitor the whole body and extremity radiation doses to people
- b. Keep doses as low as reasonably achievable
- c. Prevent contamination of our people and the work environment
- d. Prevent internal contamination of our people
- e. Control radioactive material from cradle to grave
- f. Protect the public





- g. Prevent adverse impacts to the environment
- h. Ensure our people have the training, supervision and resources necessary to execute their work to achieve the mission.

#### Waste Management Goals

- 3.2 The overarching goals of the ASA's radioactive waste management activities are to:
- a. Ensure all activities are undertaken in accordance with the relevant regulatory requirements and international best practice, particularly practices of the UK and the US partners
- b. Ensure radioactive waste is characterised, packaged, stored and recorded appropriately ready for disposal at authorised landfill facilities
- c. Minimise the amount of radioactive waste created while balancing the need to provide protection to personnel through the appropriate use of personal protective equipment
- d. Ensure accurate, accessible and complete records of all waste activities are maintained for the lifetime of the AUKUS program
- e. Ensure transparency and public engagement.

#### Properties of the waste

- 3.3 This document adopts the broad definitions of radioactive waste described by ARPANSA in *Radioactive waste in Australia.*
- 3.4 Low-level waste constitutes waste that is above exemption levels, but with limited amounts of long-lived radionuclides.
- 3.5 CIF operations will include the management of the following low-level radioactive waste streams, including:
- a. Solid low-level radioactive waste, both compressible, i.e. soft, (e.g. personal protective equipment, filter material) and non-compressible, i.e. hard, (e.g. a pipe)
- b. Solid mixed (hazardous) low-level radioactive waste (e.g. a valve with mechanical grease)
- c. Radioactive liquid waste.
- 3.6 Solid waste may include components such as pumps, pipes, and valves. Handling these items may require the use of disposable personal protective equipment, plastic bags, tape and wipes which will also require management as a secondary solid waste stream.
- 3.7 Solid radioactive waste will also include mixed hazardous waste. Mixed hazardous waste contains both radioactive and other hazards.
- 3.8 Liquid waste will be transferred to the CIF for treatment via handheld bottles and via hose to transfer tanks.
- 3.9 Characterisation of solid, solid/mixed (hazardous), and liquid (small volume and bulk) waste will occur as part of the radiological clearances. Identified radionuclides will be recorded and accounted for through the life of the waste storage repository.



#### **Effective Control**

3.10 The technical overview for *Effective Control Arrangements* outlines the approach to managing effective control of radioactive material requiring regulatory control, including waste. This document includes the effective control arrangements between key organisations such as the ASA, the Department of Defence, and AUKUS partners' Navy nuclear-powered submarine operators and maintenance workers that may be operating at HMAS *Stirling*.

#### Waste Management Program

- 3.11 In accordance with best international practice, the ASA will operate a waste management program where material is characterised such that:
- a. Waste that is not radioactive, and does not need to be stored under regulatory control, is treated as 'Potential Free Release' waste and can be released from regulatory control and disposed of at authorised landfill facilities.
- b. Waste that is currently radioactive but contains short-lived radionuclides to be considered 'delay and decay' waste and will be assessed as to whether the waste can be released from regulatory control after a period of interim storage and disposed of at authorised landfill facilities.

#### **Overview of Waste Collection**

3.12 The procedures for the collection of low-level radioactive waste from a nuclear-powered submarine and movement to the CIF will be consistent with current operations at existing Australian sites.

#### Waste Collection Supporting Information

3.13 The management of waste from foreign vessels falls under the control of the ARPANSA Radioactive Material Import Permit process. Compliance with this process will enable customs clearance of radioactive materials and for such items to be transferred to an Australian licence. This process is normally used for the planned import of radioactive sources and nuclear medicines all over Australia.

#### Characterisation

3.14 Characterisation of the waste will occur as part of the radiological clearances by health physics surveyors to inform their handling of the items.

#### Storage, not disposal

- 3.15 There will be no disposal of low-level radioactive waste at HMAS Stirling.
- 3.16 The CIF will provide temporary onsite storage, before disposal at a national waste repository.



#### Safe handling of waste

- 3.17 The movement of low-level radioactive waste consignments from the point of transfer at Diamantina Pier to the CIF will be conducted in a controlled manner using authorised shipping/transport containers in a dedicated waste transfer vehicle (e.g. for solid/mixed waste) with enclosed flat floored authorised conveyance with side and rear door access. A partition (and potentially shielding) will separate the crew from the cargo compartment.
- 3.18 Within the CIF there will be a suite of manual handling equipment available to include: forklift jacks, forklifts and a gantry crane for heavy/bulk items. This will also facilitate remote handling for items that may pose a contact dose hazard for operators.
- 3.19 Detailed operating procedures, equipment, instructions and associate training requirements are to be developed to support all waste management operations.

#### **Fissile material**

3.20 Fissile material will not be transferred from any nuclear-powered submarine to the CIF.

#### Compliance with statutory authorities and local regulations

- 3.21 The ASA acknowledges that waste management operations will need to meet the Commonwealth regulatory frameworks including:
- a. Australian Radiation Protection and Nuclear Safety Act 1998
- b. Australian Radiation Protection and Nuclear Safety Regulations 2018
- c. Environment Protection and Biodiversity Conservation Act 1999
- d. Work Health and Safety Act 2011
- e. Nuclear Non-Proliferation (Safeguards) Act 1987
- f. National Radioactive Waste Management Act 2012
- g. Australian Naval Nuclear Power Safety Bill 2024
- h. Customs Regulations 1956
- i. Hazardous Waste Act 1989

### Section 4 – Limiting ionising radiation exposure

#### Exposure pathways

- 4.1 The technical overview for *Safety Analysis Report* and associated hazard identification assessments have been completed. The outcomes of these assessments and studies informed the identification of credible exposure pathways for all radioactive waste.
- 4.2 The ASA gives an undertaking to provide further description of the above aspects in its documentation for the operational stage for the CIF as the detailed design matures.



#### Limiting of exposure

4.3 Refer to the technical overview for *Radiation Protection*.

#### Monitoring and assessing discharges

- 4.4 During the construction phase there are no routes of discharge of radioactive material into the environment or exposure pathways to wildlife in their natural habitats.
- 4.5 Refer to the technical overview for *Radiation Protection*.

## Section 5 – Packaging and containment of radioactive waste

#### Packages

- 5.1 Determining the appropriate package to use will consider factors including how long will the waste be stored; thickness; durability; size; shape; cost; robustness; sealing capabilities; air tightness; liquid tightness; onsite movements of containers; material compatibility; use of liners; compatibility with labels etc.
- 5.2 The labelling of waste packages, including their re-labelling with updated information, is a key component of long-term waste management. The use of labels with QR codes, barcodes or RFID tags will be considered.

#### **Containment systems**

- 5.3 The ASA will design and implement containment systems and spill response plans for liquid waste processing and will address air quality control and ventilation systems to mitigate airborne contamination risks. This will include the development of procedures for environmental monitoring and reporting, especially in sensitive marine environments. The ASA gives an undertaking to provide further description of this in its documentation for the operational stage for the CIF.
- 5.4 Containers holding radioactive liquids are to be marked as such and must be kept in a bund. Protection of the environment in regards to spills will require design features that allow for the collection of contaminated liquids and their management through pumps and decay tanks. This is a core design requirement for the CIF.
- 5.5 The facility will be designed in such a way as to minimise, if not mitigate entirely, the risk of spills reaching the groundwater.
- 5.6 The location of fire control systems, especially sprinklers has been considered and bunding installed in areas where sprinklers may operate.



## Section 6 – Storage of radioactive waste

- 6.1 Low-level radioactive waste resulting from nuclear-powered submarine activities will be managed and temporarily stored at the CIF ready for a permanent disposal solution. The CIF has been designed to safely and securely accommodate of around 2,600 drums of low-level radioactive waste<sup>2</sup> through the planned life of the facility.
- 6.2 Low-level radioactive waste will be permanently disposed of at an authorised national waste management repository.

#### **Shielding and Ventilation**

- 6.3 Engineering controls will be installed at the CIF. Examples include the provision of active particulate monitoring to provide indication to CIF personnel of a release or breach within the facility.
- 6.4 Areas where waste will be stored for extended periods of time may require fixed shielding to be installed. This will be influenced by the occupation levels of the various parts of the facility and any dose rate constraints set for areas inside and outside of the facility. The use of temporary shielding could also be considered if it is known that wastes will only be present for a short period of time and/or if the wastes are likely to decay rapidly. Areas where this might apply include in areas for radiological characterisation and/or decontamination.
- 6.5 Active ventilation systems, including HEPA filters, charcoal filters, and negative pressure areas etc. are only likely to be required in the decontamination areas of the CIF with the extent of the measures to be determined via risk assessment and further analysis.

#### Monitoring

- 6.6 Waste within the CIF will be both visually and radiologically monitored. Radiological monitoring will be risk informed and will focus on the Radiological Control Goals described in Section 3.1. The selection of monitoring methods and technologies employed will be based on the level of hazard, the nature of the equipment involved and, the planned work activities occurring within any given part of the facility.
- 6.7 The ASA gives an undertaking to provide further description of the above aspects in its documentation for the operations stage of the CIF.

## Section 7 – Documentation of radioactive waste

#### **Records handling**

- 7.1 The management of records relating to radioactive waste is important for several reasons. This includes practical reasons such as:
- a. Being able to provide information on waste items inside sealed containers without needing to open the container and/or expose personnel to radiation hazards
- b. Assessment of compliance of a waste item against CIF waste acceptance criteria and against future criteria for offsite storage or disposal facilities

<sup>&</sup>lt;sup>2</sup> Low-level waste constitutes waste that is above exemption levels, but with limited amounts of long-lived radionuclides. The waste being managed at the CIF will be low-level waste and similar in levels to waste that is currently managed at more than 100 locations around Australia.



- c. Satisfying regulatory requirements
- d. Potential requirements of the National Archives Act 1983.
- 7.2 The ASA's waste management operations will build on the successful experience of the Australian Nuclear Science and Technology Organisation (ANSTO), and be informed by AUKUS partner experience with digital capture of information to manage records. It is likely that the records system used for radioactive waste will involve both digital (soft) and paper (hard) copy records.
- 7.3 The ASA gives an undertaking to provide further description of the above aspects in its documentation for the operational stage for the CIF.

## Section 8 – Routine discharge of radioactive waste

- 8.1 There will be no discharge from the Radioactive Liquid Processing System via a storm water/sewerage/trade waste connection. The decision to evaporate treated effluent is based on an evaluation of limitation in regards to the capacity of the sewerage waste treatment plant at HMAS *Stirling*.
- 8.2 The ASA will be required to monitor radioactive discharges to the air within, around and above the CIF.
- 8.3 The ASA will build processes based on existing technologies and procedures for site environmental monitoring for gaseous and liquid discharges used within Australia.
- 8.4 The ASA gives an undertaking to provide further description of the above aspects in its documentation for the operational stage for the CIF.

## Section 9 – Ultimate disposal or transfer of radioactive waste

#### **Expected Life of Facility**

- 9.1 Operations at HMAS Stirling are expected to continue for the life of the AUKUS program. The initial infrastructure to support this program is expected to have an operational lifetime of approximately 40 to 50 years. Prior to decommissioning the CIF replacement facilities will be established, licenced and enter into routine operations.
- 9.2 As individual pieces of plant and equipment will not have a 50-year lifetime, the CIF is being designed in such a way as to allow for the easy maintenance and/or replacement of these items during operations and decommissioning activities. This will include systems such as the electrical power supply, communications and ventilation etc.
- 9.3 This estimated lifetime is based on the design life of similar planned facilities, however the ASA will take into account local climatic issues such as high salt content in the air causing corrosion etc.
- 9.4 It is anticipated that both active and passive institutional controls, such as security access restrictions, inspections and maintenance provisions, and environmental monitoring activities, would continue for a period of time post closure.



- 9.5 Any further activities will be determined by a post-closure safety case and performance assessment that will be prepared and kept updated.
- 9.6 Prior to an application to the nuclear safety regulator for releasing the facility from regulatory control. The ASA will demonstrate that radiological and other hazards and risks to people and the environment are demonstrably safe and consistent with the statutory requirements of the regulator.

#### **Decommissioning Planning**

9.7 Decommissioning a prescribed radiological facility, such as the CIF, in Australia is a complex process and must adhere to both national and international standards. The decommissioning process aims to safely remove a facility from service, ensuring there is no residual radioactivity above original background, and ensure the site is safe for future use. This is outlined further in the technical overview for *Decommissioning*.

#### **Disposal Pathway**

9.8 Low-level radioactive wastes from decommissioning and site remediation will be permanently disposed of at a national waste management repository. ARWA is developing options for the permanent disposal of Australia's low-level radioactive waste. The ASA is supporting this work as well as exploring ancillary arrangements if required.

#### Records

- 9.9 A robust records management system will support the management of wastes from decommissioning of the CIF in due course.
- 9.10 This will include the recording of any radiological events at the CIF, especially those involving contamination of plant, equipment, and infrastructure.
- 9.11 The management of records is important for several reasons. This includes practical reasons, such as being able to provide information on waste items inside sealed containers without needing to open the container and/or expose personnel to radiation hazards, assessment of compliance of a waste item against waste acceptance criteria for a storage or disposal facility, regulatory requirements, and potential requirements from the National Archives Act 1983.

