Australian Government

Australian Radiation Protection and Nuclear Safety Agency

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Regulatory Assessment Report
Facility Licence Application A0339

Applicant: Australian Nuclear Science and Technology Organisation

Nuclear Installation, Intermediate Level Waste Capacity Increase (ILWCI) Facility

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Executive Summary

On the 23 July 2021, the Chief Executive Officer (CEO) of Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) received an application (A0339) from the CEO of the Australian Nuclear Science and Technology Organisation (ANSTO), for authorisation to prepare a site for a controlled facility, namely the Intermediate Level Waste Capacity Increase (ILWCI) Facility.

The proposed facility will provide additional temporary storage of intermediate level solid waste generated from existing processes at ANSTO including predominantly from the production of radiopharmaceuticals. The existing ANSTO storage facilities for this waste are predicted to be at capacity by 2027. The proposed new ILWCI Facility will provide conservatively an additional 10 years of temporary storage for waste to facilitate the continued production of radiopharmaceuticals until 2037.

This regulatory assessment report presents a review of the application for compliance with relevant matters prescribed in the ARPANS Act 1998, the Regulations and relevant international best practice for radioactive waste storage. This report recommends the CEO of ARPANSA issue a facility licence to ANSTO authorising the preparation of a site for the ILWCI Facility since the application contained sufficient information to provide assurance that the facility can be managed safely throughout the whole life cycle (including decommissioning). This will be confirmed at the next licensing stage where a construction licence application will be made to the CEO of ARPANSA with further detailed design information and refined safety analysis.

The decision to recommend issuing the licence to prepare a site for the ILWCI Facility was predominantly based on the following findings:

- All relevant matters specified in the Act and Regulations have been complied with.
- International best practice for the storage of radioactive waste has been followed as appropriate.
- The plans and arrangements for managing safety are adequate to provide assurance that safe and secure operation of the facility can be undertaken.
- The content of public submissions has been addressed and included in the decision making.
- Analysis of postulated radiological scenarios demonstrates that there is reasonable assurance there will be no radiological consequences outside of the facility or to the public or environment given the design and proposed operations in the facility.
- In addition, for workers, analysis provides reasonable assurance that the magnitude of the individual doses to operators, the number of people exposed and the likelihood that exposure from operation and future decommissioning of the facility will be as low as reasonably practical.
- The worst-case radiological scenario involves an operator falling into a storage pit which has been demonstrated to be mitigated adequately in the existing intermediate solid waste store at ANSTO predominantly through the use of physical barriers.
- The reference accident assessment demonstrates that the facility will fall into Emergency Preparedness Category III for planning purposes and as such a bounding scenario event could be managed under the existing ANSTO emergency preparedness procedures.
- There is reasonable assurance that the licence holder has the capacity to comply with the regulations and relevant licence conditions and applicant has demonstrated that there is net benefit from the proposed conduct, that is, the benefit outweighs the detriment of exposure to radiation.

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1. Introduction

The applicant, the Australian Nuclear Science and Technology Organisation (ANSTO), has applied for a facility licence under section 32 of the Australian Radiation Protection and Nuclear Safety Act (the Act) [1] to prepare a site for the nuclear installation known as the Intermediate Level Waste Capacity Increase (ILWCI) Facility. The ILWCI Facility is a nuclear installation as defined in section 10 of the Australian Radiation Protection and Nuclear Safety Regulations 2018 (the Regulations) [2].

1.1 Purpose

The purpose of this report is to document the assessment of information contained in the application against the criteria in the Act and Regulations. Consideration is given to the matters to be taken into account by the CEO under subsection 32(3) of the Act, that is, international best practice in radiation protection and nuclear safety, and those matters set out in section 53 of the Regulations.

Assessors have relied on the following documents and information in making recommendations to the CEO:

- The information contained in the initial application and subsequent information obtained from the applicant.
- The ARPANSA Radiation Protection Series[1] (RPS) and regulatory guides[2] as applicable to the facility type and licensing stage. See section 1.2 below for more information.
- International best practice including relevant information from the International Atomic Energy Agency[3] (IAEA) and the International Commission on Radiation Protection[4] (ICRP). See section 1.2 below for more information.
- Content of public submissions. See section 5.8 below for more information.
- Meetings and discussions with the applicant.

1.2 Assessment

The ARPANSA review and assessment process is laid out in ARPANSA's *Review and Assessment Manual* ARPANSA-GDE-1118 [3] and is based on applicable parts of the IAEA *Governmental, Legal and Regulatory Framework for Safety, General Safety Requirement Part 1* (IAEA GSR Part 1) [4]. The key objective of the assessment process is to identify the requirements for the facility, summarise information provided in the licence application and conclude whether the requirements have been met.

Given that the licence application is to prepare a site for a waste store, the assessment has been conducted against the key documents in Table 1 in Appendix 1. The table shows how the regulatory guides used

[1] See https://www.arpansa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series

[2] See https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/regulatory-guides

[3] See https://www.iaea.org/

[4] See https://www.icrp.org/

primarily in the assessment have been developed based on RPS documents which in turn have been adapted from relevant international best practice.

1.3 Receipt of application

In accordance with the requirements of the Act, ANSTO submitted an application for a facility licence on 23 July 2021. The application was in an acceptable form and the prescribed application fee was received.

As required by section 48 of the Regulations, the CEO published a notice in the Australian and Leader newspapers and on the ARPANSA website on 1 September 2021 acknowledging receipt of a facility application from ANSTO and his intention to make a decision on it. This notice called for public submissions with a 10-week response period. This was supplemented with a virtual public forum held on 15 October 2021[5]. Full details of the public consultation are discussed in section 5.8.

Finding - The requirements of the Act have been met in terms of submission of the application and public consultation.

2. Review of Information

This section describes the review of information provided in the application and subsequently received from the applicant following a request for more information by the ARPANSA assessors sent on 1 September 2021.

2.1 Applicant information

The application was made by the Chief Executive Officer of ANSTO. The Group Executive, ANSTO Maintenance and Engineering, is named as the nominee. The required information (name and position) was provided regarding the applicant's Radiation Safety Officer.

Finding – The licence application has been made by the Chief Executive of ANSTO (a Commonwealth entity) and therefore the requirement of section 45 of the Regulations has been met.

2.2 Address of facility

Subsection 46(1) of the Regulations requires the applicant to provide their full name, position and business address.

The facility is proposed to be located at the existing ANSTO Lucas Heights site at New Illawarra Road, Lucas Heights in NSW. The exact location and applicant's full name and position has been included (see section 2.1 above).

Finding – The applicant has provided their full name, position and business address and therefore the requirement of paragraph 46(1)(a) of the Regulations has been met.

[5] A recording of the presentations from the virtual public forum is located https://www.youtube.com/watch?v=eSb8t4pHMOw

2.3 Description of the purpose of the facility

Paragraph 46(1)(b) of the Regulations requires the applicant to provide a description of the purpose of the facility to which the licence will relate.

The applicant has stated the purpose of the facility which in summary is to provide additional temporary storage of intermediate level solid waste generated from existing processes at ANSTO, predominantly from the production of radiopharmaceuticals. The existing ANSTO storage facilities for such waste are predicted to be at capacity by 2027. The proposed new ILWCI Facility is intended to provide an additional 10 years of temporary storage for this waste.

Finding - The applicant has provided a description of the purpose of the proposed facility and has therefore met the requirements of subsection 46(1) of the Regulations.

2.4 Detailed description of the facility and the site of the facility

Paragraph 46(1)(c) of the Regulations requires the applicant to provide a detailed description of the facility and the site of the facility. The description provided has been reviewed against ARPANSA Regulatory Guide *Applying for a licence for a radioactive waste storage or disposal facility* (ARPANSA-GDE-1736) [5] with key expectations noted at the start of each section below.

2.4.1 Conceptual design characteristics of the ILWCI Facility

Design characteristics of the proposed facility and information on how the facility interacts with the site so that any introduction of unreasonable design requirements to compensate for a less favourable site can be avoided.

The facility is proposed to be located in the existing Waste Operations precinct and will comprise a single level store similar to the existing Intermediate Level Waste Store (ILWS) (licensed under Waste Operations Licence F0260) in purpose and design. A report by Jacobs Engineering, *ANSTO ILWCI Concept Design (30%) Report* (2019) Rev 3 [6] was submitted in support of the application. This report presents the results of the design consultancy for the ILWCI Facility including the concept structural design and results of optioneering. The report includes the results of geotechnical studies for suitability of the site (discussed further in section 2.5.2 below along with discussion of the full site characteristics and evaluation).

The ILWCI facility is proposed to temporarily store encapsulated Spent Uranium Filter (SUF) cups and ILSW also known as 'Remote Handled Solid Waste' (RHSW) from existing authorised operations. The SUF cups are generated from the production process of molybdenum-99 (Mo-99) at the ANM facility. These waste streams are packed elsewhere in other licensed facilities onsite and the ILWCI Facility will be used only for the temporary storage of this waste.

The proposed conceptual design is a steel portal framed structure with a braced roof, clad in steel sheeting, with end bays supported on concrete piled footings. The floors will have subfloor in-situ concrete vaults in over-excavated rock and supported directly on rock. A summary of the key features in the conceptual design has been provided in Appendix 2.

Finding - Sufficient information has been provided on concept design and proposed key features for safety at this stage to satisfy the intent of ARPANSA-GDE-1736.

Detailed design will need to be submitted as part of any future licence application to construct this facility and will be further assessed at that stage. Site characteristics and site evaluation are covered in section 2.5.2 below.

2.4.2 Waste management systems and waste to be managed in the facility

- *The waste management system should include facilities for storage; waste inventory and future waste streams destined for the facility; transport arrangements and likely paths; any ancillary facilities for predisposal management, e.g. for conditioning of waste.*
- *The waste (form, volume, radionuclide inventory, chemical composition, toxicity, stability and all other physical, chemical and radiological characteristics that are relevant for reviewing the safety of the facility) currently in store that is destined for the facility.*
- *The waste and its characteristics (see above) anticipated for the facility during its operational lifetime and whether the facility is a store or a disposal facility.*
- *The waste acceptance criteria including the characteristics of the waste (e.g. mobility), waste form and the containment system; design and construction of packages; provisions for retrievability of packages; design provisions for criticality safety where nuclear materials are present.*

See the following section 2.4.3 for information on how this has been covered in the application.

2.4.3 Interface with existing ANSTO facilities

ANSTO Nuclear Medicine Facility - Spent Uranium Filter Cups and other ILSW from the ANM Facility

Spent Uranium Filter (SUF) cups are produced as a by-product of the existing Mo-99 production process at the ANSTO Nuclear Medicine (ANM) Facility under licence F0309.

In summary, the SUF cups contain residual uranium in addition to solid active fission product material. The SUF cups are initially stored for decay in hot cells in the ANM facility (9 filter cups are placed in a stainless steel can, sealed with a silicon o-ring and then into an outer aluminium can with a polyurethane cap) and then transferred via purpose-built shielded flasks to the High Activity Handling Cells (HAHC) in another building as authorised under Waste Operations Licence F0260. The SUF cups are fully encapsulated by sealing them into a tertiary can using two sealing methods (metallic o-ring and welding of a tertiary lid to the can). They are then transported to the existing ILWS in the 10.3 T general purpose flask for storage.

Similar to the existing ILWS, the SUF cups will be transported to the ILWCI Facility and stored in the subfloor in-situ concrete vaults in storage tubes. The vault will be founded directly onto rock and the set-up of the vault includes:

- Covered with over 750 mm concrete floor and subdivided into separate storage areas with 300 mm concrete sub walls. The vault itself is proposed to be 8.5 m deep
- stainless steel containment tubes supported by steel framing are proposed for the vault to store the SUF cups. Each tube is proposed to be sealed with a 450 mm stepped steel plug (can be removed/installed by the gantry crane).

Aluminium Retrievable Bins (ARBs) are currently used for storage of ILSW in the existing ILWS in sub pits in a steel and aluminium frame design. The same design is proposed for the ILWCI facility whereby miscellaneous ILSW mainly from the ANM facility, will be stored in this new facility when the existing store reaches capacity. The interface with the ILWCI Facility will be the same as the interface between the ANM facility and existing ILWS in that ILSW is transported in retrievable waste storage flasks.

The proposed features of the storage pits are:

- 36 chambers built from reinforced concrete within the over-excavated rock.

- Each chamber subdivided into 8 sub-pits with each sub-pit created using the steel and aluminium frame.
- Maximum capacity of 4800 ARBs.
- As per the existing ILWS store, ARBs will be stacked vertically in the sub-pits in the frame and sealed with a stepped concrete plug (installed/removed with the gantry crane).

Other potential storage

ANSTO intends for the storage pits to also store ARBs with SyMo cans. The SyMo facility is currently only licensed for siting and construction under licence F0266. ANSTO intends to make a licence application to operate the facility in the future. Details of the regulatory assessment of the SyMo licence application to site and construct the facility are published on the ARPANSA website. The SyMo facility is a proposed purpose-built facility which if approved for operation will apply Synroc technology for the immobilisation of waste from ANSTO's Mo-99 production processes. The plant is designed to handle current alkaline Intermediate Level Liquid Waste (ILLW) from the ANM facility and the ILLW waste generated from the shutdown Mo-99 production facility.

The ARPANSA assessment for approval of the SyMo construction licence[6] noted that once waste is processed by the Synroc plant using specialist equipment inside hot cells, the waste will be incorporated into a consolidated glass ceramic (alkaline waste) form inside a stainless-steel container. Completed Synroc cans will be moved as a batch inside shielded flasks from that facility to storage pits in the existing ILWS for ongoing management by ANSTO Waste Operations under Facility Licence F0260. If operation of the SyMo Facility is approved, the intent is to use the ILWCI Facility to store SyMo cans in ARBS after the existing ILWS reaches capacity, with the interface (transport in shielded flasks) to be the same.

ANSTO may also request that storage pits be used to store future ILSW from OPAL in the ARBs subject to further approvals by ARPANSA under section 63 of the Regulations. The interface between the facilities would need to be provided in such an application but the intent would again be for Waste Operations to manage the transport of the ARBs in the existing shielded flask from OPAL to the ILWCI Facility under the ANSTO management system.

Finding - There is sufficient information provided on waste management, form, storage and interface with existing facilities to meet the recommendations of ARPANSA-GDE-1736.

2.4.4 Facility materials flow and waste characteristics

In addition to the conceptual design, details of the proposed waste management material flow have been provided in the licence application and summarised as follows:

The flask will be transported via truck from facilities including OPAL, ANM, Waste Operations and SyMo Plant to the ILWCI building truck bay. The overhead dangerous goods (DG) crane will unload the flask and move it to the targeted storage pit or tube. The pit/tube cover is removed by the DG crane and the flask moved on top (again using the crane). The waste is lowered through the bottom of the flasks using the existing flask lowering mechanism. The flask is then removed and the pit/tube cover replaced. This is the same process that is employed in the existing ILWS at ANSTO.

[6] See https://www.arpansa.gov.au/sites/default/files/legacy/pubs/regulatory/ansto/RAR-SyMo.pdf

Finding - Sufficient information has been provided on proposed material flow to meet the intent of ARPANSA-GDE-1736. Detailed operational procedures along with equipment qualification and maintenance requirements will need to be submitted as part of any future stage licence application.

2.4.5 Waste characteristics description

As discussed above the waste to be stored in the ILWCI Facility has been produced and conditioned as applicable under existing ANSTO facility operations (or future operations). It will comprise SUF cup vessels in deep storage holes and ARBs containing ILSW predominantly from radiopharmaceutical production.

A description of the waste characteristics of the SyMo cans, the SUF cup vessels, the ILSW in the ARBs has been provided. It is noted that these waste streams have been reviewed in detail by ARPANSA in the past as part of the review and approval of the ANM and Waste Operations Facility operations and the SyMo siting and construction licensing. The proposed waste meets the definition of intermediate level waste in ARPANSA, Radiation Protection Series, *Guide for Classification of Radioactive Waste*, RPS-G4 [7].

At the request of the ARPANSA assessor, the ANSTO *Safety Analysis Report of the Intermediate Level Waste Capacity Increase Facility, 2021*, Doc No AT-2469 [8] (the SAR) has been updated to provide expected worst case source terms for SUF cup vessels with minim decay period (18 weeks) and an ARB with two SyMo cans (most conservative case)

The applicant notes that further optimisation of the source term decay details and the subsequent impact on shielding requirements are to be submitted at the next licensing stage when the detailed design of the facility will be known. This will include more detailed calculations of a volume-averaged source term associated with a full inventory of waste.

In terms of criticality safety only the SUF cup vessels contain fissile material; this is discussed further in section 4.2.1 although in summary there are no criticality concerns given the expected amount of fissile material and the controls in place during the SUF cup conditioning.

Finding - Sufficient detail on the waste management system, transport from the interfacing sites, handling and storage in the ILWCI Facility, and the future plan to dispose of the waste to a National Radioactive Waste Management Facility have been provided in line with ARPANSA-GDE-1736. In addition, ARPANSA continues to require ANSTO to provide long term waste management strategies with contingency planning with the latest draft provided in January 2022.

In addition, the description of the waste characteristics has been reviewed and it is concluded that the information provided at this stage meets the intent of ARPANSA-GDE-1736.

2.4.6 Security and safety issues from co-located facilities

Potential safety and security issues from co-location of facilities at new or existing sites where applicable should be addressed.

This is covered in section 3.5 below

2.4.7 Operational life span/final disposal

For a storage facility: the operational life span, plans covering final disposal including transport to the disposal facility, necessary ancillary facilities for predisposal management and contingency planning for delays in the establishment of a disposal facility.

ANSTO plans to transfer the waste to a National Radioactive Waste Management Facility (NRWMF) for temporary storage, once it is established by the Australian government with plans for final disposal in an Intermediate Level Disposal Facility (again once established by the Australian Government). The establishment of these facilities will need to be approved by the CEO of ARPANSA. Any transport of waste to would also need to be approved by the CEO of ARPANSA and demonstrated to meet the requirements of Radiation Protection Series, *Code for the Safe Transport of Radioactive Material*, RPS C-1 [9].

The ILWCI Facility is proposed to be designed so that it can safely and securely manage waste for a number of decades. The maximum waste inventory has been provided which at current production rates conservatively allows 10 years of additional storage for ILW at ANSTO until 2037. ARPANSA continues to require ANSTO to provide contingency plans through long term waste management strategies for waste storage.

Finding – Sufficient detail on the operational life span, final disposal transport plans and contingency has been provided as per ARPANSA-GDE-1736 as appropriate for this siting licence stage.

Overall conclusions re description of facility and site

The ARPANSA assessor has reviewed the description and conceptual design of the facility against the requirements of the Act and relevant parts of ARPANSA-GDE-1736. It is concluded that for this stage of licensing the applicant has provided a description of the facility that satisfies the requirement of paragraph 46(1)(c) of the Act and meets the intent of ARPANSA-GDE-1736. The information provided is sufficient for a judgement on the safety and security assessment of the facility to be made at the siting licence stage.

2.5 Information relevant to the type of authorisation

This application is to prepare a site for a controlled facility. The Act is implicit in the requirement that licensing of a nuclear installation will go through a number of stages, each requiring a separate licence application and each requiring approval by the CEO of ARPANSA. Paragraph 46(2)(a) of the Regulations requires the following information to be submitted for this type of application:

Prepare a site for a controlled facility

a) A detailed site evaluation establishing the suitability of the site.

b) The characteristics of the site, including the extent to which the site may be affected by natural and man-made events.

c) Any environmental impact statement requested or required by a government agency, and the outcome of the environmental assessment.

2.5.1 Site evaluation

This is discussed in section 2.5.2 below along with the findings.

2.5.2 Site characteristics

- Characteristics of the proposed site including seismology, meteorology, hydrology, geology, demography, biology, hazards and human actions, and the environment's ability to serve as a barrier that provides protection for the facility and retards migration of radionuclides.
- Assessment of the site taking into account the implications of the site characteristics for the radiological impact of the facility on the surrounding population and the environment during normal operation and anticipated natural events.

The IAEA's *Storage of Radioactive Waste Safety Guide* No. WS-G-6.1 [10] section 6.26 recommends:

A storage facility for radioactive waste may be established in connection with, or as part of, an existing nuclear installation. In this case, the site may be selected on the basis of factors that are important for the main facility and the waste storage facility may not require any additional considerations. The safety assessment performed for the siting of the main facility may demonstrate that the waste storage facility meets the radiological protection criteria in normal operation and in incident and accident conditions. If the siting requirements for the waste storage facility are more stringent than those for the main facility, then the safety case for storage should be addressed separately.

In respect of the proposed site of the ILWCI Facility, which is located at the existing ANSTO site, the characteristics have been assessed in detail in the licensing process for the siting of the HIFAR and OPAL reactors and subsequent nuclear installations such as the ANM.

For this licence application, ANSTO's *ILWCI Facility Site Characteristics and Site Related Design Basis*, Doc No 152977 [11] has been submitted which draws on existing information from previous assessments with updated information and supplemented by studies conducted as part of conceptual design by external consultants. This is considered to be appropriate by the ARPANSA assessor and meets the intent of IAEA WS-G-6.1 section 6.2.6 quoted above.

This information has been reviewed against ARPANSA-GDE-1736 and relevant parts of IAEA Safety Requirements, Site Evaluation for Nuclear Installations, SSR-1 [12] (previously in draft when ARPANSA-GDE-1736 was published).
IAEA SSR-1 requires the following characteristics to be evaluated: geography, demography, meteorology, hydrology, geology, ecology, seismology, site services, review of nearby facilities, transport routes, baseline environmental radioactivity, suitability of the design for external natural events and external human induced event.

ARPANSA-GDE-1736 requires the following information be provided in a licence application:

- *Characteristics of the proposed site including seismology, meteorology, hydrology, geology, demography, biology, hazards and human actions, and the environment's ability to serve as a barrier that provides protection for the facility and retards migration of radionuclides.*

- *Assessment of the site taking into account the implications of the site characteristics for the radiological impact of the facility on the surrounding population and the environment during normal operation and anticipated natural events.*

Key areas relevant to the radiological safety and site characteristics are discussed further below.

Finding – The relevant requirements of IAEA SSR1 and recommendations of ARPANSA-GDE-1736 have been met in terms of providing characteristics of the site and evaluation/assessment as to site suitability. A summary of the characteristics and ARPANSA's findings are presented in the sections below.

2.5.2.1 Meteorology

The meteorology characteristics at the ANSTO site have been documented for over 50 years. Data such as rainfall, temperature, wind speed and direction have been recorded at the site laboratories since 1968. This and assessment of key atmospheric mixing and turbulence climatology have been presented as evidence of suitability for the siting of numerous nuclear installations including the HIFAR and OPAL research nuclear reactors and the ANM facility. These studies included the creation of atmospheric dispersion models for assessing the potential for transport of radiological airborne materials and verification of the results with atmospheric tracer studies.

No issues have been raised previously by ARPANSA about the suitability of the site for nuclear installations. The conceptual design report for the ILWCI Facility noted that it is proposed to be built to withstand lightning strike and protection from extreme weather by applying standard building codes and standards. The requirement for the basement to have permanent drainage to the existing ANSTO storm water drainage system along with advanced sump features to mitigate the potential ingress of surface water was also noted. Conceptual details of the proposed drainage system are covered in section 2.4 above. This is in line with other facilities at the ANSTO site with basement features and in particular the existing ILWS which has not reported any water ingress issues since operations began.

The meteorological characteristics were reviewed as part of the Hazard and Accident Analyses (see section 4) and the majority considered to not likely to create a credible initiating event whereby radioactivity could be released from the ILWCI Facility given the proposed design of the facility and the frequency of severe weather-related events expected at the site. One credible postulated event was identified where water ingress (from internal or external flooding) into the pits and/or tubes could cause contamination from stored waste transfer to ground water. However, a number of mitigations are to be imposed including the proposed drainage system, the fact the waste will be encapsulated and/or contained in stainless steel ARBs and the fact the design of the pits is proposed to direct water to run off to the drainage sumps. This, as well as the proposed presence of moisture probes which alarm to the ANSTO Site Operations Centre, mean that the residual risk is considered **very low**. ARPANSA agrees with this finding but will further assess the mitigations and drainage design if there is a construction licence application

Finding - The ARPANSA assessor is satisfied that the meteorological characteristics of the site would not preclude the ILWCI Facility from being sited given the proposed design features and analysis of credible mechanisms through which a meteorological event could cause a radiological release from the stored waste. The scenario whereby heavy rain could cause a potential leaching of contaminants to ground water is discussed further in section 4 but the ARPANSA assessor agrees that with the mitigating controls in place this is **very low** residual risk. This will be further considered if there is a construction licence application where detailed design features for mitigating against water ingress will need to be submitted.

2.5.2.2 Geology

The geological characteristics of the ANSTO site were assessed in detail in geotechnical and geophysical studies for the OPAL reactor siting application. As a recap, ANSTO is sited on Hawksbury sandstone approximately 192 m thick. During excavations for the OPAL reactor two fault strands were revealed although intensive investigations demonstrated that there had been no fault movement for at least the last five million years, and it was concluded that the faults were not capable.

A geotechnical investigation was conducted specifically for the proposed ILWCI Facility by a consultant engineering company, Douglas Partners – see *Report on Geotechnical Investigation*, Lucas Heights [13]. The study included boreholes to a 10 m depth for soil classification and analysis of continuous core rock samples for identification and strength testing. Virgin Excavated Natural Material classification of material results from the study confirmed the in-situ material is consistent with the expected soil and bed rock type for the ANSTO site. The strength of the rock core was confirmed to be suitable for the proposed facility although recommendations for further assessments and surveys were made prior to commencing any construction work.

The ground water level was confirmed to be well below the proposed level of the ILWCI sub floor storage. Recommendations for deep pad footing/bored piles based on the geology to ensure stability have been included in the concept design. These will be assessed further if there is a construction licence application when detailed design will be submitted.

Finding - The geological characteristics of the site would not preclude the ILWCI Facility from being sited given the proposed design features which have been based on geotechnical investigations. These design features and response to recommendations made by the external consultants will be reviewed by ARPANSA if there is a future construction licence application.

2.5.2.3 Surface hydrology

The hydrology characteristics at the ANSTO site are understood through previous geophysical and hydrogeological investigations, including for the siting of the OPAL reactor which was the most significant study. This study included investigations which drilled to 45 metres at selected locations and installed deep and shallow piezometers, groundwater sampling, water analysis and hydraulic parameter testing.
Key surface hydrology features are summarised as follows:

- The principal surface stream immediately adjacent to the ANSTO site on the side from which the proposed ILWCI Facility is the Woronora River. On the north side of the ANSTO site is a ridge drained by Mill and Barden Creek. The study reviewed details such as flow rates of the waterways and monthly discharge volumes.
- There are no known private dams in the vicinity or known ground hole bores that could be affected by site run off.
- It was concluded that the surface hydrology characteristics were acceptable for the siting of the OPAL reactor (and subsequent nuclear installations such as the ANM facility).

The surface hydrology characteristics are not considered to preclude the ILWCI Facility since there is no regional flooding due to the location and the mechanism for radiological release to local water ways is not considered credible.

Finding - The ARPANSA assessor is satisfied that the surface hydrological characteristics of the site would not preclude the ILWCI Facility from being sited given proposed design features.

2.5.2.4 Groundwater hydrology

The OPAL site characteristics study and subsequent investigations for facilities such as the Little Forest Legacy Site have characterised the groundwater hydrology with the following key points noted:

- The ANSTO site is located on geology that comprises weathered and unweathered Hawkesbury sandstone.
- Principle water-transmission is dependent on features such as joints and bedding planes in the sandstone and on the condition of the weathering.
- Standing ground water levels have been confirmed for existing nuclear installations at ANSTO and are considered acceptable.

For the proposed ILWCI Facility, an additional assessment of the topographical setting of the site noted that the basement would be well above the regional ground water table. This was confirmed by the geotechnical study conducted by Douglas Partners [13] which undertook intrusive ground investigations (see 2.5.2.2 above). The study made recommendations to include drainage systems in the design to prevent seepage of water into the sub surface vaults (see section 2.4 for details). This is the case with other ANSTO facilities and will be assessed further by ARPANSA if there is a construction licence stage. See section 2.5.2.1 for discussion of one credible postulated event scenario identified where an ingress of water to the pits/vaults which could cause contamination of groundwater was considered.

Finding - The hydrology assessments conducted indicate that groundwater hydrology is not likely to result in any mechanism for the release of radioactivity from the proposed ILWCI Facility to waterways given the proposed design and controls in place. The postulated scenario whereby surface water (external/internal) could cause potential leaching of contaminants to ground water has been covered in section 2.5.2.1 above and will not be repeated here. Overall, the ARPANSA assessor concludes that the groundwater hydrology characteristics of the site should not preclude the siting of the ILWCI Facility but the design features will be verified if there is a construction licensing stage.

2.5.2.5 Seismology

Seismic studies of the ANSTO site conducted previously have concluded that it lies in a low intensity seismic zone. No seismically active geological structures have been identified and there are no major capable faults within 35 km.

As part of the geotechnical investigation by an external consultant conducted for the proposed ILWCI Facility site in 2019 [13] an assessment was conducted in accordance with AS1170-2007 *Structural Design Actions - Earthquake Actions in Australia* [14] and a hazard factor of 0.08 was allocated to the site which confirms the previous studies' conclusions that there is low seismic risk. The geotechnical investigation concluded that the site was acceptable for the ILWCI Facility, noting that the facility would have to be constructed to Australian building standards

Finding - The ARPANSA assessor has reviewed the history of the seismic studies conducted of the ANSTO site along with the specific geotechnical investigation results for the proposed site of the ILWCI Facility. The assessor agrees there is low seismic risk to the ANSTO site. In addition, it is concluded that there is no credible mechanism that a seismic event could cause a release of radioactivity from the ILWCI Facility (given the design for safety is mostly achieved via passive features, such as deep storage). The compliance of the facility to relevant Australian building standards will be reviewed if there is a construction licence application.

2.5.2.6 Demography

The population within a 25 km radius of the ANSTO site from a 2020 study along with the estimated onsite population is presented in the licence application. However, the hazard and accident analyses found that there was no credible mechanism or scenario where a radioactive release could occur from the ILWCI Facility that posed a conceivable risk to the public or surrounding population from the proposed facility design and nature of its operations. This analysis is discussed further in section 4. See also section 3.4.4 for discussion of airborne discharges.

Finding - The demographic information has been presented as per the recommendations of ARPANSA-GDE-1736 and IAEA SSR1. Given the lack of credible mechanisms by which radioactivity could be released from the proposed ILWCI Facility, there is no conceivable risk to the surrounding population.

2.5.2.7 Ecology

The physical and biological characteristics of the ANSTO site including flora and fauna are well understood through the Environmental Impact Statement (EIS) conducted for the siting of the OPAL Reactor. The hazard and accident analysis conducted for this licence application did not identify any credible mechanism or event whereby the ILWCI Facility could release radioactivity and harm ecology. This is discussed further in section 3.7 and section 4.

Finding - The ARPANSA assessor concurs with the overall conclusion that there could be no effect on surrounding ecology from the proposed facility. This would need to be further reviewed at the construction licence application stage however. See section 3.7 and 4 for more discussion.

2.5.2.8 Risk from other onsite facilities

The ANSTO site houses a range of buildings conducting multiple operations. All onsite operations are controlled under the existing work health and safety management system (see section 3.1 for more details). Those with the potential to release significant levels of radioactivity are licensed by ARPANSA with controls required to be in place. Mitigations in place to reduce risks from other onsite facilities include:

- no large, high energy rotating machines or large, high-pressure machines on the ANSTO site. The effect of the generation of missiles is therefore not considered credible.
- Operations at the ANSTO site involving conventional industrial activities or chemical storage are subject to Work Health and Safety legislation.
- small quantities of flammable liquids, cryogenic and non-flammable gases stored in nearby buildings to the proposed ILWCI Facility site are reported to be compliant with the applicable codes for storage and it is considered there are no safety issues arising from these chemicals.

The safety assessment considered a postulated event where an onsite vehicle accident could pose a risk to the transport of the waste onsite, and this is discussed in section 4. In summary, the residual risk was calculated to be very low.

The safety assessment has taken into account the effects from adjacent facilities and activities onsite. This also includes the possibility of concurrent events affecting more than one facility or activity. Safety analyses show that any effect from adjacent facilities can be compensated for by engineered features, site protection measures, or administrative controls.

Finding - The ARPANSA assessor has noted the information provided regarding the co-located facilities. Safety analyses of other facilities, including concurrent events, show that any effect from the adjacent

facilities can be compensated for by means of engineered features, site protection measures and administrative controls. This will be further assessed if there is a construction licence application.

2.5.2.9 External natural events

In line with IAEA SSR-1 and ARPANSA-GDE-1736 a range of external natural events have been assessed as to their potential impact on the ILWCI Facility including high winds, lightning, extreme temperatures, fog, intense precipitation and volcanic activity, tsunami events, soil shrink/swell. The assessment concluded that such events were either precluded by the location of the ANSTO site (Tsunami, volcano, regional flooding etc) or could be mitigated by the design of the ILWCI Facility. Key events are discussed below:

2.5.2.9.1 Bush fire

Large bushfires can be expected every 8–12 years at ANSTO with the potential to burn to the site boundary. The proposed location of the ILWCI Facility is in a lower risk area for bushfires away from the site perimeter. The Jacobs conceptual design assessment [6] included determination of the Bushfire Attack Level (BAL) for the proposed site of the ILWCI Facility taking into consideration the vegetation, communities and the topography which combine to affect the potential behaviour of a bushfire. It was concluded that no part of the site was classified as BAL-FZ (extreme risk) meaning that exposure to flames from the fire is not an anticipated risk and at worst the site will be exposed to ember attack and burning debris ignited by windborne embers. It was noted that the facility needs to be constructed to BAL-29 (high risk mainly from embers and debris) requirements.

The ILWCI facility will also be subject to the existing ANSTO bushfire management plans. This plan includes the requirement for an annual ANSTO site bushfire review and hazard reduction program which is carried out in conjunction with the NSW Rural Fire Services and onsite trained bushfire responder teams.

During 2001 the site was subjected to a large bushfire with a severe rating. The ANSTO site was closed and isolated, but no damage occurred to any onsite building or licenced facility. The results of an extreme bushfire are considered to result in a loss of site power. This does not present a challenge to the safety of the proposed ILWCI Facility as the design for the radiological safety of the waste is predominantly passive. Specifically, the waste encapsulation (in the case of SyMo and SUF cup vessels) and the fact it is stored in concrete bunkers means that fire is unlikely to result in radiological release.

The hazard and accident analysis therefore, did not identify any credible postulated events whereby a fire could lead to a release of radioactivity from the ILWCI Facility given the design for storage of waste and the site characteristics. This is discussed further in section 4 below.

Finding - The ARPANSA assessor concurs that the assessments conducted on the bushfire characteristics of the proposed site should not preclude the siting of the ILWCI Facility. The site is unlikely to be subject to a direct bushfire and there is no credible mechanism whereby a fire could cause a release of radioactivity from the ILWCI Facility given the proposed design. This will be confirmed through further review on the detailed design if there is a construction licence application.

2.5.2.9.2. High winds

A wind hazard analysis performed for the HIFAR probabilistic safety analysis determined that the design basis for a facility at the ANSTO site needed to withstand a wind speed of 170 km per hour and tornado of 135 km per hour. Given the facility is proposed to store waste in sub-vault pits, and the detailed design will take into account the potential for these high winds, there is not considered to be a credible mechanism whereby high winds could result in release of radioactivity from the ILWCI Facility given the fact the waste will be in an underground concrete vault.

Finding - The high wind data has been provided as per the requirements of IAEA SSR1 and recommendations of ARPANSA-GDE-1736. Given the proposed design features and operations of the ILWCI Facility, the ARPANSA assessor concurs that it is not considered credible that high winds could create any pathways for a radiological release. This will be further reviewed if there is a construction licence application which will present detailed design.

2.5.2.9.3 Flooding

The ANSTO site is not subject to regional flooding due to the geology and location. The potential for local flooding due to heavy rain causing ingress of water into the deep storage holes and pits has been discussed in 2.5.2.3 above.

Finding – As per 2.5.2.3 above.

2.5.2.10 Human induced external events

At the time of the siting application for the OPAL reactor, evaluation of site characteristics to select human induced credible events that required more detailed analysis was conducted[7]. No new human induced external events have been identified relating to the ILWCI Facility. The human induced external events that required more analysis were as follows:

- Road and rail transport accidents involving dangerous goods
- Aircraft crash
- Nearby industrial activities
- Military activities, including impact by a stray artillery shell

2.5.2.10.1 Road or rail transport accident

The rail routes carrying dangerous goods are sufficiently far away to have no significant impact on the ANSTO site in the event of an accident and hence this also applies to the proposed ILWCI Facility.

For road accidents, it was assessed that the only hazardous substances regularly transported on the road near the ANSTO site are petrol and diesel. No explosives are carried on the road near to the ANSTO site.

At the time of the OPAL siting, DNV Consultancy Services performed an analysis of a range of potential transport accidents on the New Illawarra Road (240 m away) and the nearest railway (3000 m away). Five scenarios were considered, including explosion of tankers containing chlorine, LPG, ammonium nitrate, and petrol. The analysis concluded that such accidents would have no significant effect on the ANSTO site aside from possible window glass breakage. This includes the impact of potential formation of a gas cloud from the rupture of an LPG road tanker.

Therefore, there will be no significant impact of road or transport accidents on the proposed ILWCI Facility as it is bound by this assessment.

2.5.2.10.2 Aircraft crash

[7] See https://www.arpansa.gov.au/regulation-and-licensing/regulation/about-regulatory-services/who-we-regulate/major-facilities/open-pool-light-water-reactor for details of the assessments conducted

A conservative estimate of 30,000 flights a year in the vicinity of the ANSTO site with a potential trajectory that could impact the OPAL reactor was determined and hence the probability of a large aircraft impacting the site, estimated at less than 1 in 5 million years. This estimated low probability remains valid for the ANSTO site and given the much smaller effective target aspect of the ILWCI Facility compared to the OPAL building, aircraft crash is considered beyond design basis.

2.5.2.10.3 Industrial activities

Offsite accidents at nearby industrial facilities are noted to remain bound by the road transport accident analyses above. This is because the effect of a road transport accident is considered to be greater than any nearby industrial activity event that could affect the ANSTO site.

2.5.2.10.4 Military activities

The HIFAR site assessment concluded that the likelihood of the ANSTO site being hit by a stray artillery shell from the nearby Holsworthy military area is less than 1 in 10 million years. It is therefore not considered credible. This remains the case in 2022 and therefore the proposed ILWCI Facility is bound by this assessment.

Finding - The ARPANSA assessor has reviewed the human induced external events that were considered at the time of siting the OPAL reactor. The data is considered to remain relevant, and it is concluded that the ILWCI Facility is bound by the existing analyses and in all cases no effect on the proposed facility could occur from transport, industrial, aircraft or military activities.

Overall conclusions re site characteristics and evaluation

The assessor considers that the application provides satisfactory information on the site characteristics and an evaluation of site suitability for the ILWCI Facility; the details are in line with IAEA SSR-1 requirements and recommendations of ARPANSA-GDE-1736.

An adequate assessment of the site characteristics and the potential impact of/on the ANSTO site has been conducted and supplemented with new data where appropriate (such as the additional geotechnical and bush fire categorisation work). The ARPANSA assessor concurs with the overall findings that there are no site characteristics (including human induced external events and the external natural events) that would preclude the ILWCI Facility from being sited at the proposed location. The majority of scenarios assessed were either beyond design basis or the risks could be engineered out at the detailed design phase. Verification of the detailed design features such as compliance with Australian building standards will be conducted by ARPANSA if there is a construction licensing stage, once detailed design is available.

2.5.3 Environmental impact statement

On 25 September 2021, ANSTO submitted a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to the Department of Agriculture Water and Environment (DAWE) (referral reference 2021/9025)[8]. On 13 October 2021 DAWE issued a response that the referral does not constitute a controlled action provided certain conditions are met.

[8] See http://epbcnotices.environment.gov.au/referralslist/

Finding – No environmental impact statement is required by DAWE and therefore this section is not applicable.

3. Plans and Arrangements

Paragraph 46(1)(d) of the Regulations requires the applicant to submit plans and arrangements for managing safety. This requirement is consistent with Principle 11 of the IAEA *Fundamental Safety Principles (2016)* SF-1 [15].

The ILWCI Plans and Arrangements were submitted in support of this application. These have been reviewed against ARPANSA Regulatory Guide *Plans and arrangements for managing safety* (ARPANSA-GDE-1735) [16].

3.1 Effective control arrangements

> The applicant must describe the organisational arrangements for managing the safety of the conduct and dealings to ensure the health and safety of people and the protection of the environment. This should include a description of responsibilities and lines of authority, and information on a quality system covering all activities that may impact on safety.

ANSTO has submitted *ILWCI Facility Siting Licence Effective Control Plan*, 2021, Doc no 152971 [17] in support of the application.

3.1.1 Statutory and regulatory compliance

> Paragraphs 1.1 to 1.4 of ARPANSA-GDE-1735 recommend that processes and systems should be in place to ensure applicable statutory and regulatory requirements are identified (including new ones), communicated to relevant staff and complied with.

ANSTO intends to apply its existing processes to ensure that the ILWCI Facility meets this guidance. These are laid out in the ANSTO Compliance Policy which is aligned to Australian Standard AS 3806-3006 and overseen by the ANSTO board. As per existing licensed facilities a licensing officer/facility officer will be allocated to the role of ensuring compliance with statutory/regulatory requirements for radiation protection. These roles are supported by a central Regulatory Affairs Manager who oversees processes for ongoing communication with relevant staff on requirements including new or amended ones.

Finding – Sufficient information has been provided to offer assurance at the siting licence stage that effective control will be adequately applied in terms of statutory and regulatory compliance. This will mostly be achieved through the existing ANSTO processes.

3.1.2 Management commitment

> Paragraphs 1.5 to 1.8 of ARPANSA-GDE-1735 recommend that the applicant should demonstrate management endorsement and promotion of the arrangements, and commitment to the principles of holistic safety. In addition, it should be demonstrated that management is committed to ensuring compliance, allocating appropriate resources and maintaining control over a licensed facility.

ANSTO intends to apply existing processes in order to ensure that the facility meets this guidance. In summary this includes:

- ANSTO's existing budgetary process that management uses to justify and acquire appropriate staffing numbers for safety.
- A compliance policy requires commitment and accountability to the ANSTO board for statutory/regulatory compliance and the Work Health and Safety System contains a range of requirements in line with holistic safety principles (promotion of human factors in design, use of defence in depth, continuous learning etc).
- Management commitment is communicated to staff through regular meetings, the annual performance and development reviews, and regular CEO communication and meetings.

Finding - Sufficient information has been provided to assure that the effective control applied will include an appropriate level of management commitment as per ARPANSA-GDE-1735. It is noted that commitment is difficult to gauge from the application due to the characteristics of safety leadership. However, from experience working with other ANSTO facilities, the ARPANSA assessor notes that management commitment is demonstrated. Commitment to the ILWCI Facility (if approved) will be assessed on an ongoing basis through ARPANSA's inspection program. Therefore, it is concluded that adequate information has been provided to demonstrate management commitment at this stage of licensing.

3.1.3 Accountabilities and responsibilities

Paragraphs 1.9 to 1.11 of ARPANSA-GDE-1735 recommend that the applicant should clearly define and describe accountabilities and responsibilities for overall management of the plans and arrangements, all conducts, dealings and operations, and maintain control over facility safety and security, compliance, resources and implementation of processes.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes:

- Established roles and processes for assuring accountabilities and responsibilities for safety and operations. A summary of these roles is provided in Table 2 below for information.
- A proposed organisational chart for the ILWCI Facility has been provided should approval to operate be granted at a later licensing stage. This chart is in line with the existing established processes and demonstrates that accountabilities and responsibilities have been considered.

Table 2: Proposed Accountabilities and Responsibilities for ANSTO Safety and Security

Task	Responsibility
Safety	All personnel are responsible for safety, with co-ordination and monitoring provided by the ANSTO High Reliability Group which includes the Work Health and Safety (WHS) Adviser and the Health Physicist. For any modification/upgrade to the facility, ANSTO Safety Reliability Assurance (SRA) process provides safety approvals.
Security	General Security is the responsibility of ANSTO Security and Safeguards
Statutory and regulatory compliance	Licensing and Facility Officers, liaising with the ANSTO Regulatory Affairs Manager, who reports to the Chief Operating Officer (COO)
Resources	Managers, liaising with ANSTO Human Resources
Process Implementation	Managers
Daily operations	Supervisors, liaising with the Manager, Licensing and Facility Officers
Management of Plans and Arrangements	The Nominee is responsible for the overall management of the plans and arrangements

Maintaining control of the facility	The Nominee, Project Manager (during the project phase only) and Manager

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate accountabilities and responsibilities have been defined.

3.1.4 Resources

Paragraphs 1.12 to 1.16 of ARPANSA-GDE-1735 recommend the applicant should demonstrate the systems in place to identify and control resources, including how radiation protection and nuclear safety are considered amongst these. It also notes that systems should be in place to monitor and review resource allocations if circumstances change.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes:

- The existing ANSTO Investment and Portfolio Management process AG-7438 [18] was applied to review and ensure necessary funding and resources for safety and security.
- The construction of the ILWCI Facility, if approved, is intended to be conducted under the oversight of the ANSTO Capital Committee made up of executive management which manages funding and resourcing throughout major projects (including resourcing for safety and critical control functions).

In addition, for operation of the facility (if approved) early analysis has been conducted which indicates that the resources needed for operation of the facility should not change. This will however be confirmed once further risk assessments are conducted on operation and if required resources are noted to be available.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate resourcing will be in place. This will be further assessed at later licensing stages.

3.1.5 Communication

Paragraphs 1.2.1 to 1.24 of ARPANSA-GDE-1735 recommend the applicant should demonstrate that communication needs are identified, the modes of communication for staff, including contactors laid out, how processes and infrastructure for communication will be established or maintained, and how information on radiation safety will be communicated.

ANSTO intends to apply existing processes to ensure the facility meets this guidance. In summary this includes:

- Development of a project communication plan which identifies stakeholders, methods of dissemination of information along with frequency of communication. The plan lays out key performance indicators for the project manager to monitor against. Part of the project manager's role will be to ensure the infrastructure for the ongoing communication processes required in the plan are maintained and reviewed.
- As per the existing WHS management system, contractors will work under ANSTO supervisors, who maintain ongoing communication and supervision of them and conduct regular toolbox talks etc.
- All contractors will undergo induction training which includes relevant radiation safety and actions to take in the event of an emergency as per the ANSTO WHS management system.

- If the ILWCI Facility is approved for operation, communications will be via the existing ANSTO processes such as management review, training, communication with radiation protection advisors and health physics surveyors, staff forums, email, intranet etc.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate communication needs around safety have been identified, and established methods will be in place.

3.1.6 Process implementation

Paragraphs 1.21 to 1.24 of ARPANSA-GDE-1735 recommend the applicant should demonstrate that there is a methodology for developing, approving and rolling out new processes and operations or reviewing existing one and that all staff and contractors should follow and adopt this. In addition, there should be demonstration of ways for staff and contractors to be included in process development/implementation and how in general process implementation is to be monitored and controlled.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance.

In summary this includes application of the existing WHS procedure relating to control of new or changed processes with implications for radiological and security. This procedure includes requirements for justification of changes, consultation with relevant staff/contractors, approval via the ANSTO Safety Reliability Assurance Process if required, evaluation of the impacts, regulatory approval if needed and a process to verify all actions are completed and to monitor the implementation if appropriate.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate process implementation procedures are in place.

3.1.7 Documentation and document control

Paragraphs 1.25 to 1.30 of ARPANSA-GDE-1735 recommend that plans and arrangements should demonstrate that processes with implications for safety and security are conducted in accordance with written procedures, conducts with implications for radiological safety are adequately documented and reviewed and there are manuals/methods outlining what processes and operations need to be documented. It is also recommended that staff should have easy and quick access to documents and that documents be integrated and consistent with each other and managed in an accredited system.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes:

- Application and regular audits of the ANSTO Business Management System which comprises overarching policies for safety and security. The policies and procedures are accessible to all staff. Training programs further expand and explain the intent of the procedures if required.
- The Work Health and Management System contains integrated systems for managing safety and risks and requires work with implications for safety or security to be conducted in accordance with procedure and documented.
- There are also requirements laid out on how to produce new procedures to ensure consistency and integration with the existing management system.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate documentation and documentation management systems are in place.

3.2 Safety Management Plan

The application should include a Safety Management Plan that demonstrates safety management practices are in accordance with internationally accepted principles and practices and duty of care obligations.

ANSTO has submitted *ILWCI Facility Siting Licence Safety Management Plan*, Doc No 152972 Rev 0 [19] in support of the application.

3.2.1 Safety policy and objectives

Paragraphs 2.1 to 2.5 of ARPANSA-GDE-1735 recommend that an adequate overarching safety policy be in place with objectives that are communicated to and understood by all staff and reviewed as appropriate.

ANSTO intends to apply the existing safety policy to the ILWCI Facility. This comprises the ANSTO Work Health and Safety and Environment (WHSE) policy which is supported by the existing work health and safety management system. The WHS policy, along with existing safety standards is approved by the CEO of ANSTO.

The WHS management system provides guides, procedures and forms to assist management of safety and staff are trained in relevant procedures (see training section below). The documents are reviewed every 3 years or as required.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate policy and objectives are in place.

3.2.2 Monitoring and measurement

Paragraphs 2.6 to 2.13 of ARPANSA-GDE-1735 recommend that operations be tracked monitored and measured by use of processes to collect safety data from incidents, tests, assessments, feedback etc. The plans are arrangements should demonstrate the type of safety data to be collected, reported, analyses and how hazards throughout operations etc are identified. The plans and arrangements should include ways to assess and promote safety culture.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes:

- Existing monitoring programs to monitor and analyse data from incidents, radiation monitors, dosimetry data, airborne discharges, inventory of waste, maintenance and performance data, and occupational health and hygiene data will be applied if the facility if approved for construction/operation.
- Safety culture and security culture surveys/assessment programs as per other facilities at ANSTO.
- Audits are intended to be conducted at the facility once operational and during construction including the existing workplace safety inspections, management system audits, housekeeping inspections, WHSMS contractor compliance audits.

- In addition to site wide existing key performance indicators, Waste Management Services intends to apply their own performance indicators to the facility which cover finance, safety, maintenance, waste capacity and incident reporting.
- The data from these monitoring programs are fed into the learning and improvement systems already in place and investigated with relevant actions tracked to completion.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate monitoring and measurement processes are in place for continuous improvement.

3.2.3 Risk assessment and mitigation

Paragraphs 2.14 to 2.21 of ARPANSA-GDE-1735 recommend that plans and arrangements should demonstrate that risks are reduced to acceptable level through application of risk assessment and mitigation strategies. This should include the process by which data from monitoring is assessed according to risk, investigated where appropriate and mitigations implemented.

ANSTO intends to apply existing processes in order, to ensure that the facility meets this guidance. In summary this includes:

- Application of the existing ANSTO WHS Risk Management Standard (AE 2301) which is supported by the risk assessment and investigation procedures and guides in the WHS management system. This existing risk process covers how to identify hazards, how to assess, control and treat risks, investigations and review and approval processes.
- In the case of significant hazard investigation and mitigation the use of specialists such as the Systems Safety and Reliability group or the Radiation Protection Services are employed.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate risk assessment and mitigation processes are in place. This is demonstrated in the siting stage safety assessment which is discussed in section 4.

3.2.4 Managing change

Paragraphs 2.22 to 2.29 of ARPANSA-GDE-1735 recommend that a formal change management policy should be in place which includes how the need/objective for change is established, evaluates preferred options, includes how implementation of changes is controlled and monitored for success in terms of radiation/nuclear safety.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes the existing change management process for ANSTO which covers detailed actions to be taken for changes including for the design phase, the planning phase, the implementation phase and for post implementation/review. The documentation, assessment, consultation and communication plans are laid out as appropriate for each phase.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate change management processes are in place.

3.2.5 Learning and continuous improvement

Paragraphs 2.30 to 2.35 of ARPANSA-GDE-1735 recommend that learning from experience and continuous improvement underpin all operations. The plans and arrangements should demonstrate the procedures in place to ensure learning from all operations, how review will occur and by who and how improvements will be implemented and reviewed.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes:

- Existing procedures will apply to the ILWCI Facility for learning and improvement. These include the ANSTO Incident Management procedure (AR-6350) [20], the ANSTO Safety Incident Response and Notification Process (AP-2372) [21] which describes the Governance Risk and Compliance (GRC) cloud system used to record, triage, manage and monitor status of actions from investigations.
- Reporting and communication of safety data and learnings is promoted through the culture of no blame and full disclosure safety culture. Staff are trained in investigation of events.
- Where significant events occur, the use of investigators from specialised groups are employed including Safety Systems and Reliability, Radiation Protection Services and WHS.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and appropriate procedures for learning and continuous improvement are in place.

3.2.6 Training

Paragraphs 2.36 to 2.41 of ARPANSA-GDE-1735 recommend that plans and arrangements should demonstrate the processes for determining competency requirements for operations with safety implications and how training identified is planned in terms of delivery, review and succession. It is also recommended that training be developed, approved and continually reviewed to ensure it continues to be effective with a focus on delivery methodology and performance assessment as well as adequate record keeping.

ANSTO intends to apply the existing processes for competency, training and support to the ILWCI Facility as appropriate. A full list of courses and retraining requirements is covered in AG-2364 *WHS Training Need Analysis Guide* [22] and the ANSTO *WHS Training Handbook* AG-2058 [23].

Key points are summarised below:

- Recruitment stage where suitably qualified and experienced staff are selected for the role. Induction safety training for ANSTO is required for all staff and contractors.
- Basic Radiation Safety training course requirement prior to working in classified areas which has assessment and refresher requirements. Further radiation safety courses are also undertaken as identified in line with a training needs analysis process.
- Security training is also required and refreshed annually.
- All training is developed by qualified staff in the Work Health Safety group, the Radiation Protection Group and Security Groups on site or, if required external trainers are engaged. Annual performance and effective appraisals identify ongoing and new training needs.
- For Waste Management Services the facility specific training procedure is P-6599 [24] which lays out management responsibilities for requiring staff to be fully competent. For specific roles, for

example waste technician, which require training, the requirement for supervision, on the job training and evaluation are described prior to the technician becoming 'authorised'.

- Training is tracked and monitored by management using the ANSTO Learning Management System.
- Health Physics Surveyors are given theoretical and practical training and are authorised following assessment. Workers who are assigned to do specialised tasks will be provided with task-specific training prior to undertaking the role/task by the Health Physics staff.
- Contractors are required to hold appropriate qualifications where applicable (such as forklift truck licence or white card) and these are checked prior to engagement using the ANSTO contractor management systems. Workers who supervise high risk contractor activities must have been formally nominated by their General Manager and completed the ANSTO Contractor Supervisor (C1 – High Risk) course qualification. Contractors must undergo induction and radiation safety training (if they are working in classified areas).
- Visitors are subject to management including escort and induction training as appropriate.

Finding - The ARPANSA assessor is satisfied that the recommendations from the ARPANSA-GDE-1735 have been addressed and appropriate training systems are in place.

3.3 Radiation protection plan

The applicant has submitted the *ILWCI Facility Siting Licence Radiation Protection Plan*, 2021, Doc No 152973 Rev 0 [25], in support of the application.

3.3.1 Principles of radiological protection

Paragraphs 3.1 to 3.7 of ARPANSA-GDE-1735 recommend that plans and arrangements should demonstrate that the fundamental principles of radiation protection – Justification, optimisation and limitation are applied to conducts and dealings.

ANSTO intends to apply existing processes to ensure that the facility meets this guidance. In summary this includes application of the existing ANSTO *Radiation Safety Standard* (AE-2310) [26] and the supporting guides and procedures. These lay out the descriptions of the principles and how they are applied to new activities and changed activities as applicable. For example, the principle of optimisation is followed and decision-making tools for optimisation of protection are laid out in AE-2310.

ANSTO has provided details of justification, optimisation and limitation of risks in the Safety Analysis Report and these are discussed in section 4 of this report.

Finding - The ARPANSA assessor is satisfied that the recommendations from the ARPANSA-GDE-1735 have been addressed and the application has demonstrated that the principles of radiological protection have been applied in the conceptual design of the facility and operations. This will be assessed further at future licensing stages.

3.3.2 Radiation safety officer

Paragraphs 3.8 to 3.10 of ARPANSA-GDE-1735 recommend that a suitably qualified radiation safety officer is appointed as appropriate to undertake specific duties in relation to nuclear and radiation safety.

ANSTO has provided the details of the appointed radiation safety officer. This position is the lead of the ANSTO Radiation Protection Services which currently provides specific duties in relation to radiological and nuclear safety to existing facilities across ANSTO.

Finding - The ARPANSA assessor is satisfied that the recommendations from the ARPANSA-GDE-1735 have been addressed and suitably qualified radiation safety officer positions are in place and have been consulted in the concept design of the ILWCI Facility.

3.3.3 Radiation safety committee

Paragraphs 3.11 to 3.22 of ARPANSA-GDE-1735 recommend that a suitably qualified radiation safety committee (RSC) be appointed as appropriate to undertake specific duties in relation to radiation protection and nuclear safety.

ANSTO intends to apply the existing Safety Reliability Assurance (SRA) process under ANSTO procedure AP 1094 [27] to the ILWCI Facility as appropriate. This process includes details of the terms of reference of the SRA committee and their tasks including specific duties in relation to radiation and nuclear safety. The process was approved by ARPANSA under section 63 of the Regulations in January 2020.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and a radiation safety committee is in place. This committee process was approved by ARPANSA in 2020.

3.3.4 Planning and design of workplace

Paragraphs 3.23 to 3.25 of ARPANSA-GDE-1735 recommend that arrangements are in place and are implemented to ensure that the planning and design of any workplace where conducts and dealings are undertaken is optimised for radiation protection and that the design is in compliance with relevant national and international standards and codes.

The application has submitted a conceptual design of the facility and included a preliminary material flow. This is discussed more in the Safety Analysis Report and discussed in section 4 of this report. The conceptual design includes design for decommissioning as well as operational safety. Examples of this are:

The design will include (but not limited to):

- Design to relevant Australian Standards
- The use of existing approved, interlocked shielded flasks will be used to transport the waste
- Remote transfer of waste using the crane and flasks within the facility
- Wide access for trucks (no reversing required)
- The use of below ground shielded pits and tubes for the storage of the waste
- Inclusion of radiation monitoring, active drainage and ventilation systems.

Finding - The ARPANSA assessor is satisfied that the recommendations from the ARPANSA-GDE-1735 have been addressed and the application has demonstrated that planning and design is optimised in the conceptual design. However, the detailed design will need to be assessed at the future licensing stages to verify that this remains the case and to further review optimisation.

3.3.5 Classification of work areas

Paragraphs 3.26 to 3.31 of ARPANSA-GDE-1735 recommend that plans and arrangements demonstrate that work areas are classified as controlled areas wherever there is potential for significant internal or external exposure from radiation or contamination. The areas must include as appropriate, physical delineation, with suitable warning notices and instructions as well as monitoring equipment, safety showers at exits.

ANSTO intends to apply existing processes to the ILWCI Facility. In summary:

- The classification of areas will be done in compliance with approved existing guide: *Classification of Radiation and Contamination Areas* (AG-2509) [28] (in line with the Australian Standard AS 2243:4 *Safety in Laboratories: Ionizing Radiation* [29]).
- Classifications for contamination within radiological areas are based on annual limits on intake, derived air concentrations and potential airborne contamination levels. Radiological areas are classified based on potential radiation exposure levels (individual ,effective mSv per year).
- Areas are reviewed for new activities or modifications to existing ones in consultation with management and the area radiation protection advisor.
- Requirements are in place for monitoring of individual and areas, signage, delineation and monitoring equipment and surveys are included in the supporting radiation guides and local rules and procedures.
- Safety showers etc are provided as appropriate.

The ILWCI Facility is predicted to be a white contamination area and a blue radiation area however this will be confirmed at the later licensing stages once the source term is further refined.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and the application has demonstrated that an appropriate classification of work areas and controls will be applied to the ILWCI Facility.

3.3.6 Local rules and procedures

Paragraph 3.32 of ARPANSA-GDE-1735 recommends that local rules and procedures are in place and are implemented to provide an adequate level of protection, safety and supervision for controlled persons and visitors.

ANSTO intends to apply the existing radiation protection management system to the ILWCI Facility once operational. This will therefore include the use of local rules, procedures, guides, hazard notice boards and requirements for entry to the facility (including training) and enrolment on ANSTO dosimetry.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and the application has demonstrated that local rules and procedures will be in place for the ILWCI Facility.

3.3.7 Personal protective equipment

Paragraphs 3.33 to 3.37 of ARPANSA-GDE-1735 recommends that plans and arrangements demonstrate the provision of adequate and appropriate personal protective equipment (PPE).

ANSTO intends to provide appropriate PPE in line with existing guide ANSTO *WHS Radiation Protection Requirements in Radiological Areas* (AG-2511) [30] which outlines the PPE and additional monitoring equipment that is needed based on the classification and risk of the work which is assessed in consultation with Radiation Protection Services and reviewed as appropriate. The guide has previously been assessed by ARPANSA against IAEA *Practical Radiation Technical Manual – Personal Protective Equipment* [31] and no issues raised.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and the application has demonstrated that appropriate radiological protection PPE will be in place for operations in the ILWCI Facility.

3.3.8 Monitoring of the workplace

Paragraphs 3.38 to 3.44 of ARPANSA-GDE-1735 recommends that plans and arrangements demonstrate regular radiation and contamination monitoring of the workplace will take place as appropriate, to include frequency, types, methods, calibration of instruments and analyses of results.

ANSTO intends to apply the existing radiation protection processes to monitoring the ILWCI Facility once operational to predominately ensure dose rates and contamination levels are to the set parameters of the allocated area classifications.

A survey schedule will be established, and monitoring conducted by trained health physics surveyors. Waste operations staff will also be trained to perform task specific monitoring as required.

The environmental monitoring program established at ANSTO (see section 3.7) will be applied to the facility as appropriate.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and the application has demonstrated that the applicant has the capability and systems in place to conduct comprehensive monitoring of the workplace.

3.3.9 Monitoring of individuals

Paragraphs 3.45 to 3.56 of ARPANSA-GDE-1735 *recommends that plans and arrangements are in place and are implemented for individual monitoring and assessment of exposure to controlled persons and visitors.*

ANSTO intends to apply the existing process ANSTO *WHS Personal Dosimetry*, AG-2521 [32] which lays out the routine dosimetry program for ANSTO staff and contractors. In summary this includes:

- Routine external monitoring using thermo-luminescent dosimeters (TLDs) for the measurement of effective dose (β/γ exposure to the whole body) and to the extremities (β/γ) will be carried out.
- The TLDs will be assessed either monthly or quarterly based on the exposure. Electronic personal dosimeters (EPD) will also be used as part of dose control measures for workers entering radiologically controlled areas for operational control of exposure.
- Task and external individual monitoring are applied as required through consultation with radiation protection advisors.
- Monitoring equipment will be in line with the existing ANSTO equipment and calibrated by the existing ANSTO calibration facility (which is licensed by ARPANSA)

- The applicant has appropriate investigation levels and dose constraints in place which are expected to also be applied to the ILWCI facility.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and the application has demonstrated that the applicant has the capability and systems in place to conduct comprehensive monitoring of individuals. Doses are currently reported quarterly to ARPANSA from relevant ANSTO facilities, and this will also likely be a requirement for the ILWCI Facility.

3.3.10 Transport

Paragraphs 3.63 to 3.77 recommend that plans and arrangements demonstrate that processes to ensure safe transport of controlled material and apparatus both on and off site are in compliance with the ARPANS legislation and international standards and codes such as Code of Practice for the Safe Transport of Radioactive Material RPS-C2 and Radiation Protection Series No 11 Code of Practice for Security of Sources.

ANSTO intends to apply existing controls to the movement of radioactive materials internal and externally (if required) which is the *WHS Safe Movement and Transport of Radioactive Materials*, AG-2515 [33]. Waste is transported onsite in existing approved General Purpose and Retrievable Waste Flasks (licensed under Waste Operations Licence F0260).

Finding – There is no intention to move waste offsite and therefore RPS-C2 [6] does not apply at this stage. Movement of waste onsite is conducted in line with ANSTO AG-2515 which has previously been assessed by ARPANSA and no issues raised. The information provided meets the recommendations of ARPANSA-GDE-1735.

3.4 Radioactive waste management plan

ANSTO has submitted *Siting Licence Waste Management Plan* (2021) Doc no 152988 Rev 0 [34] in support of the application.

Paragraphs 4.1 to 4.8 of ARPANSA-GDE-1735 recommend that plans and arrangements include details of the waste expected to be generated, provision for collection, characterisation, treatment and storage and how compliance with any appropriate statutory authorities such as trade waste agreements will be met. This also includes the requirement to manage fissile material where present.

ANSTO has indicated that, at the operational stage, minimal waste is expected to be generated from the facility (potentially small amounts of low level solid waste from maintenance activities and waste movements in the facility including gloves, paper etc).

This will be managed under the existing ANSTO *Safe Management of Radioactive Waste Guide* AG2517 [35]. Decommissioning of the facility and expected waste is discussed in section 3.8 below.

No routine radioactive liquid discharge is expected from the facility at the operational stage. Showers and sinks will be in place and connected to either a storage tank (which will then feed to the ANSTO B line) or directly to the ANSTO Active B line. The liquid will ultimately be treated and processed at the ANSTO effluent treatment plant and must comply with the Sydney Trade Waste Agreement prior to being discharged offsite.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed in terms of describing the waste expected to be produced by the facility which is minimal.

3.4.1 Limiting exposure to waste

Paragraphs 4.9 to 4.12 of ARPANSA-GDE-1735 recommend that plans and arrangements demonstrate that exposure of radiation workers and members of the public is limited during the handling, treatment, transport, storage and transfer or ultimate disposal of radioactive waste.

ANSTO has stated that the waste to be stored at the ILWCI Facility once operational is intended to have several controls for safe management (discussed further in section 4 below). These include:

- Sub ground storage with concrete shielding
- Shielded flasks (existing for transport)
- Engineering controls such as active ventilation, interlocks etc
- Documented inspection testing and maintenance procedures where necessary
- Pre-treatment/Encapsulation of waste in welded SUF cups (already approved by ARPANSA)
- Use of ARBs (approved packaging used in the existing ILWS store)
- Radiation monitoring

The only source of fissile material is within the SUF cups, and the amount will be below the subcritical limit as per the SUF cups in the existing ILWS (see section 4.2.1 for further discussion). The amount of fissile material in the facility will be subject to a criticality certificate that will stipulate the conditions related to handling of fissile material. Ultimate disposal will be assessed once facilities become available and is outside the scope of this assessment.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed in terms of limiting exposure to waste.

3.4.2 Documentation of radioactive waste

Paragraphs 4.18 to 4.19 of ARPANSA-GDE-1735 recommend that plans and arrangements demonstrate that documentation of the radioactive waste arising from conducts and dealings, its location and all safety and security procedures will be maintained.

ANSTO intends to apply the existing Waste Management Services Business and Compliance Management System to the waste in the ILWCI Facility if approved for operation. This requires inventory control, authorisation, and tracking of waste movements and locations. The data is recorded in the existing site electronic data bases and includes details of waste characterisation, chain of custody records and locations. The data records are comprehensive and include radionuclide type/content, matrix (for immobilisation), treatment and ID of packages.

Finding - The ARPANSA assessor is satisfied that the recommendations from ARPANSA-GDE-1735 have been addressed and the application has demonstrated that the applicant has the capability to document radioactive waste.

3.4.3 Routine discharge of radioactive waste to the sewer

Paragraph 4.20 of ARPANSA-GDE-1735 recommends that plans and arrangements demonstrate that all radioactive waste arising from existing and anticipated conducts and dealings that is to be discharged to the sewer is disposed of safely.

ANSTO stated that once the ILWCI Facility is operational, any liquid discharges will be from the safety shower and eye wash stations. The drainage system at the ILWCI Facility is intended to be linked to the existing Active B line which is connected to the ANSTO site effluent treatment plant. Liquid from the Active B line is decayed, characterised and discharged offsite by ANSTO Waste Operations in line with a Sydney Water Trade Waste Consent.

Finding - The ARPANSA assessor is satisfied that the recommendations from the ARPANSA-GDE-1735 have been addressed in terms of routine discharge to the sewer.

3.4.4 Routine discharge to atmosphere

Paragraph 4.21 of ARPANSA-GDE-1735 recommends that plans and arrangements demonstrate that all radioactive waste arising from existing and anticipated conducts and dealings that is to be discharged to the atmosphere is disposed of safely.

Since the facility proposes to store ILW from the ANM processes, there is the risk that if waste is not decayed enough prior to being transferred to the storage pits, there could be a release of Iodine-131 from waste bins in the pits. Therefore, ANSTO proposes to have an active ventilation system in place for the ILWCI Facility. This will be as per the existing ILWS with the intent to control any gaseous waste, particulates or other airborne emissions from the facility through the use of HEPA and carbon filters. The stack will be subject to the routine monitoring programme that is already in place at ANSTO.

The airborne discharges are predicted to be equivalent to the discharges that are currently recorded from the existing ILWS. This is because the discharge rates are expected to be proportional to the rate the waste is generated, and the new facility is not expected to result in any significant change to the site waste generation. Therefore, the impact on overall ANSTO site discharges is expected to be minimal. The existing ILWS has the following discharge notification limits imposed by ARPANSA under licence F0260.

- Gross Alpha (MBq) greater than ambient
- Gross Beta Notification Limit: 60 MBq
- Total all other nuclides: 500 MBq

The existing ILWS discharges are reported quarterly to ARPANSA and remain below the notification levels.

It is known from a previous ARPANSA assessment[9] that modelling of potential discharges using IAEA, (2001) *Generic Models for Using in Assessing the Impact of discharges of Radioactive Substances to the Environment,* SRS 19 [36] showed that a release of I-131 with no filtration (so highly conservative) gave an estimated annual dose at 400 m of 3.7 µSv which is well below statutory annual limits for members of the public and concluded to be negligible.

Finding - The ARPANSA assessor has reviewed the airborne discharge information provided with the application. This information was limited given that source terms are still being refined. However, it is expected that discharges will be similar to the existing ILWS facility. If this is the case, the airborne

[9] Section 63 Approval to Install Active Ventilation in the ANSTO ILWS Store Pits (2010) – Memo Building Stack Release Routine Offsite Dose [37]

discharges are expected to have minimal effect on the overall site discharges and negligible dose to members of the public. This will be confirmed in future licensing stages.

3.5 Security plan

ANSTO has submitted *Siting Licence Security Management Plan* (2022) Doc no 153246 'The Security Plan' [38] in support of the application.

> The arrangements for security have been assessed against relevant guidelines of section 6 of the Regulatory Guide, the provisions of the Code of Practice for Security of Sealed Sources (2007) (RPS 11) and relevant IAEA Nuclear Security Series documents.

The security documentation for the siting stage was developed by ANSTO Maintenance and Engineering (AME) in consultation with ANSTO Security & Safeguards. Importantly, ANSTO when developing the plans and arrangements took into consideration the impact to the overall protective security system, mitigating the risk of decreasing the integrity of the security systems for other facilities across the Lucas Heights site.

For a new nuclear installation facility, both international best practice and ARPANSA expects that security considerations during site-selection, and the design of a facility should be taken into account as early as possible. The initial site licence application to ARPANSA did not provide adequate information to undertake an appropriate assessment, and as such the ARPANSA Security Advisor requested additional information. Additional information was provided including submission of a protective security risk assessment[10] and the subsequent technical requirements security design basis[11] and a revised security plan.

The ARPANSA Security Advisor's review and assessment comprised a detailed examination and analysis of the broader project concept design document, the security plan, protective security risk assessment and security design basis along with the various existing ANSTO Security Policy, Plans and Arrangements. Further, the ARPANSA Security Advisor engaged extensively with ANSTO Security and Safeguards on documentation that required further development.

The Security Plan provides high level protective measures that reflect a range of threats to the security of the ILWCI Facility during the siting period only, where the key objectives of the ILWCI site security plan are:

- To maintain a secure worksite protected from unauthorised entry
- To implement a system for the appropriate vetting and supervision of workers and visitors
- To effectively classify and control access to documents
- To continuously review threats and implement counter measures throughout the various stages of construction

The security risk assessment was based on the Australian Safeguards and Non-Proliferation Organisation (ASNO) design basis threat, as such feedback was given to ANSTO Security and Safeguards to resolve issues around similar projects using appropriate threat assessments for the facility type and operations moving forward.

[10] Providence, 2021, Protective Security Risk Assessment, Intermediate Level Waste Capacity Increase Facility

[11] ANSTO, 2021, Technical Requirements Brief Security Design Basis (SDB), Doc Q330ASPE001

The Security Design Basis (SDB) document provides significant detail in what is required for the ILWCI Project to progress to the next stage of design for security. This detail will be reflected in a Construction Security Plan that will be developed and submitted for approval as part of the *licence to construct* application stage where the following key elements of the SDB are required, as a minimum:

- Preparation of a Functional Design Brief (FDB)
- Design and documentation of security treatments for the new facility
- Construction of the new facility in accordance with designs
- Preparation of relevant documentation to allow certification and accreditation of the new facility

Finding - The ARPANSA Security Advisor has assessed the revised ILWCI Project's Siting Licence Site Security Plan, combined with the Security Design Basis document and existing ANSTO security threat and risk assessments and concludes that adequate information has been provided to assure the sustained requisite level of protective security for the application to prepare a site in accordance with ARPANSA's regulatory requirements, expectations and international best practice.

3.6 Emergency plan

The applicant is responsible for providing detailed emergency plans for any conduct or dealing that could give rise to a need for emergency intervention. This plan should be based on an assessment of the consequences of reasonably foreseeable accidents or incidents and should aim to minimise the consequences and ensure the protection of on-site personnel, the public and the environment.

ANSTO submitted ILWCI Facility Siting Licence Emergency Plan (2021), Doc No 152974 Rev 0 [39] in support of the application. ANSTO intends for the existing site emergency arrangements to apply to the ILWCI Facility.

The existing arrangements and siting emergency plan were assessed against relevant parts of ARPANSA RPS-G3 *Guide for Radiation Protection in Emergency Exposure Situations* (2019) [40]. Key points noted were:

- Facility Emergency Planning Hazard Categorisation methodology has been applied appropriately and the ILWCI Facility is proposed to be Emergency Preparedness Category III.
- The existing arrangements contain clearly defined roles and responsibilities for both on-site and off-site response personnel.
- The following key arrangements are in place:
  - A radiation protection strategy that includes: (a) generic criteria; (b) operational intervention levels; (c) emergency action levels and other physical observables as well as (d) response time objectives.
    - Communications plan and arrangements
    - Arrangements for the detection, emergency classification and notification
    - Arrangements for taking mitigation actions and managing a medical response
    - Arrangements for managing radioactive waste generated in an emergency
    - Plans are integrated with state and local council plans as appropriate

- Training program and exercises

Finding - The ARPANSA assessor has reviewed the Emergency Plan against the recommendations of RPS G-3 [40] and has concluded that the proposed emergency preparedness category is appropriate and the proposed emergency plan meets the intent of the guide.

3.7 Environment protection plan

Section 8 of ARPANSA-GDE-1735 requires the applicant to have in place arrangements to ensure the radiation protection of wildlife (plants and animals) in their natural habitats consistent with international best practice.

ANSTO has submitted *ILWCI Facility Siting Licence Environmental Protection Plan* (2021), Doc no 152975 Rev 0 [41] in support of the application.

ANSTO has existing arrangements in place for radiation protection and monitoring of wildlife which will also be applied to the ILWCI Facility (noting that the facility is not considered likely to produce significant radioactive discharge/emissions). The controls are:

- Routine environmental monitoring program in place for radiological assessment of nearby river water, ground water, and surface water and in marine biota located near the ocean outlet of the Cronulla Water Treatment Plant.
- Cumulative annual effective dose from external radiation is monitored at the site perimeter fence, at the CWTP and nearby residences using environmental TLDs. Environmental gamma radiation is measured at a remote meteorological station located in the nearby suburb of Engadine, situated to the east of ANSTO.
- Wastewater to be generated from the ILWCI Facility will be managed via the ANSTO B line and any liquid discharges from the ANSTO site must be in compliance with the Sydney Trade Waste Agreement.
- The gaseous radioactive discharges from the ILWCI Facility are likely to be subject to ARPANSA notification levels and limits and are therefore will be subject to relevant licence conditions. They will be controlled through the use of active ventilation.

At the time of the ANM licence application, the dose rates to a range of marine biota in the receiving environment at Potter Point, near Cronulla, were estimated using a conservative screening benchmark of 10 µGy/hr as recommended in RPS G-1. The results were well below this benchmark. Since the ILWCI Facility will have minimal discharges/emissions, it should not change this existing assessment.

Finding - The assessor has reviewed the ILWCI Facility Siting Environmental Protection Plan against the relevant sections of ARPANSA-GDE-1735 and is satisfied that the intent of the guide has been met for the siting licence stage. The discharges/emissions will be reviewed again at future licensing stages when more information is presented, however based on the information provided they are expected to be minimal and have no effect on the environment.

3.8 Decommissioning plan

Section 7 of ARPANSA Guide Decommissioning of a Controlled Facility ARPANSA-GDE-1731 [42] recommends the applicant prepare a decommissioning plan and maintain it throughout the lifecycle of the facility to show that the decommissioning can be accomplished safely to meet the defined end

state. It recommends that for new facilities the plan should demonstrate: the feasibility of decommissioning the facility to achieve the desired end state; that the design of the facility appropriately considers and facilitates decommissioning; radiation protection to workers and the public; and minimises environmental impacts and waste generation, during decommissioning.

ANSTO has submitted *ILWCI Facility Site Licence Decommissioning Plan*, C01056 [43] in support of the application. This plan contains details of the design for decommissioning, the funding, strategy, radiological wastes expected from decommissioning (and how they are minimised), identifies likely key tasks and radiological hazards and describes how the expected wastes are proposed to be managed.

3.8.1 Design for decommissioning

ANSTO noted the following key details for future decommissioning:

- The ILWCI Facility is proposed to be designed to minimise active waste volumes during operations which should reduce the potential for doses during decommissioning as there will be less facility elements with contamination.
- In addition, the facility is proposed to have active ventilation, high floor loading, a DGR rated crane and access for vehicles (all able to be used for the removal of large items if required).
- Radioactive waste expected to be generated by decommissioning is low level waste through dismantling (gloves, paper etc.) and some small levels of ILW (details to be confirmed at the next licensing stages).

Finding – The decommissioning design presented meets the recommendations of ARPANSA-GDE-1731 in that future dismantling of the facility has been considered and features to ease the dismantling and minimise waste are planned to be included in the detailed design. Further more detailed plans are expected if there is a construction licence application.

3.8.2 Expected waste for decommissioning

The main contaminated equipment has been identified as follows:

- Active ventilation
- Storage pit steel frames
- Plug holes and covers (inner layers)
- ARBs
- Inner wall of storage holes and pit

Finding - Adequate information on key items for future decommissioning has been provided. The ARPANSA assessor concurs that these will be the main items which present radiological hazard during decommissioning given the operations proposed for the facility.

3.8.3 Expected decommissioning tasks and hazard control

Tasks for decommissioning strategy have been identified in line with operational experience:

- These includes preliminary decontamination of the facility, characterisation, disassembly of items including active drainage, storage pit frames and plugs, flasks (if not retained for use elsewhere) and general demolition.

- The radiological hazards are noted to likely be fixed, loose and airborne contamination associated with the storage holes, pits and AVS as well as gaseous contamination from the AVS and ductwork

Mitigations proposed include the use of a temporary tent with active ventilation system, removal of loose contamination in situ using existing decontamination techniques and the application of PPE, ongoing monitoring, etc.

Finding - The ARPANSA assessor has reviewed the ILWCI Facility Site Licence Decommissioning Plan and notes that is has met the intent of ARPANSA-GDE-1731. It is expected that this plan will be updated throughout the following licensing stages and it will continue to be reviewed by ARPANSA. The expected decommissioning tasks and controls align with similar ANSTO decommissioning projects which have been conducted safely in the past. The ARPANSA assessor has no concerns at this stage.

Overall conclusions re plans and arrangements

The plans and arrangements submitted in support of the siting licence application for the ILWCI Facility are determined to meet the recommendations of the relevant ARPANSA regulatory guides. As noted in section 1.2 these guides are based on international best practice. Overall, it is concluded that the applicant has sufficient plans and arrangements in place to adequately manage the radiological safety and security of the proposed facility. The plans and arrangements are expected to be developed further and will be reviewed at future licensing stages and are expected to contain more detail related specifically to operations in the ILWCI facility.

4. Safety Analysis Report

Paragraph 46(1)(e) of the Regulations requires for each activity to be authorised by the licence—a safety analysis report that is as complete as possible.

The *Safety Analysis Report of the Intermediate Level Waste Capacity Increase Facility* (SAR) [8] has been submitted in support of the application. The document has been assessed against the recommendations of ARPANSA Guide *Preparation of the safety analysis report for non-reactor facilities* ARPANSA-GDE-1925 [44] which provides detailed guidance for undertaking the safety analysis of non-reactor nuclear facilities and other controlled facilities including radioactive waste management facilities, particle accelerators and covers radiation risks and associated consequences arising from facilities.

Key assessment areas are detailed below:

4.1 Facility description

Section 2.1 of ARPANSA-GDE-1925 covers the need to provide details facility descriptions, including interfaces with other facilities, construction details such as materials, process and equipment layouts and dimensions and the design for safety.

The SAR provides conceptual detail for the facility and interfaces. This information was supported by the conceptual design document. As the facility description has already been assessed by the ARPANSA assessor in section 2.4 it will not be repeated here. The design for safety is summarised below:

4.2 Design for safety

The design for safety has been provided noting however that more detailed information will be required for the construction and operational licensing phases.

4.2.1 Design for nuclear safety

The following key principles have been considered in the design for nuclear safety: The nuclear hazards in the facility are potentially from the storage of fissile materials in the SUF Cups.

- Use of single parameter sub-critical limits for the SUF cup content so that the accumulative amount of uranium (in all forms) at all stages of the process remains less than the single parameter sub-critical limits for all normal and abnormal conditions
- Assessment by the ANSTO Nuclear Analysis group and controls via criticality certificates and monitoring to ensure the above.

Finding – The information provided gives assurance that the criticality risk from the SUF cup uranium content will be managed via existing processes. It is expected that at a future licencing stage criticality analysis will be provided and this will be reviewed by ARPANSA.

4.2.2 Design for radiological safety

The radiological hazards in the facility are from potential radiation dose rates and contamination from the transfer and storage of ILW.

The following key principles have been applied to the design for radiological safety:

- Justification of radiological exposures: benefits outweigh the risks
- Optimisation of radiation protection: implementation of controls, classification of areas and application of ALARA
- The intent in the Radiation Protection Plan to apply dose limits and constraints for future operation of the facility. The expected dose received at the ILWCI Facility is expected to be well below statutory limits as it is in the existing ILWS. This will be assessed further at later licensing stages.
- Defence in depth - design of pits and storage tubes with heavy concrete shielding
- Distance/shielding – use of purpose designed flasks for transport and remote transfer
- Radiation monitors and Active ventilation system and active drainage to the existing ANSTO B Line.

Finding – Sufficient information on the design for radiological safety has been provided in the concept design to provide assurance that postulated radiological scenarios can be mitigated effectively though engineering design (see section 4.5).

4.2.3 Design for external natural events and human induced events

Design for external natural and man-made events has already been covered in section 2.5 above and will not be repeated here.

4.3 Site characteristics

Paragraph 2.2 of ARPANSA-GDE-1925 recommends that site characteristics should be provided including facility location, information on geological, meteorological, hydrological, seismological, demographical and information on external man human induced and natural accident initiators.

The SAR provides a detailed summary of the site characteristics and evaluation which was based on the ILWCI Site Characteristic and since the assessment of the above has been detailed in Section 2.5 above, it will not be repeated here.

4.4 Structures, systems and components (SSCs)

Paragraph 2.3 of ARPANSA-GDE-1925 recommends that information be provided on the structures, systems and components (SSCs) necessary to protect the public and workers and to provide major contributions to defence in depth. It also recommends providing a description of the attributes (functional requirements and performance criteria) required to support the safety functions identified in the hazard and accident analyses and to support subsequent derivation of safety requirements. In preparing information, the Regulatory Guide: Construction of an item important for safety should be consulted.

As this facility is at the siting stage the SSCs have not yet been categorised because only conceptual design is available. This is in line with other siting licence applications for nuclear installations and the methodology and intent to categorise have been laid out in the SAR.

Details of the systems under which these will be maintained have been included, namely that the ANSTO Maintenance and Engineering (AME) group are proposed to manage this as they do other site SSCs under a service level agreement with the ILWCI Facility and using the ANSTO maintenance system for scheduling with priority given to safety related SSCs. Radiation monitors are proposed to be calibrated by the onsite ANSTO calibration facility and tracked via the existing Waste Operations Database.

It is expected that a full categorisation will be provided at the time of the construction licence application in line with ARPANSA Regulatory Guide (2021) *Construction of an item important to safety* [45].

Section 2.1 of ARPANSA-GDE-1925 recommends that the applicant list the design codes, standards and guides used for establishing the safety basis of the facility. This has been done in the SAR with the majority of the codes related to electrical installations, ventilation systems, emergency exit signage and fire protection as well as standard building codes. More detail will be submitted along with evidence of compliance with these standards at future licensing stages.

4.5 Hazard and Accident Analyses

4.5.1 Methodology

- ARPANSA-GDE-1925 recommends that detailed information be provided on the evaluation of normal, abnormal, and accident conditions. The process used to systematically identify hazards, categorise the facility, and evaluate the potential internal, man-made external, and natural phenomena events that could trigger accidents should also be described.
- Postulated initiating events including human induced events which could affect safety should be identified and their effects, both individually and in credible combinations, should be evaluated. The list of internal and external hazards, including human induced hazards should be used to select initiating events for detailed analysis. Expert judgement, feedback from operating experience of similar facilities and deterministic assessment should be used for identifying postulated initiating events.
- Certain events might be consequences of other events, such as a flood following an earthquake. An external hazard causing multiple simultaneous events on a site and major releases of hazardous chemicals and radioactive material from various source locations should be

considered in the hazard analysis. This should include the provision of external services to the facility that may be impacted. Credible consequential effects should form part of the initiating event. The impact of multiple correlated events on a single facility and the impact of a single event on all facilities on the same site should be considered in the safety analysis.

The *ILWCI Siting Licence Facility Safety Assessment* (2021) Doc No 153244 [46] presents the methodology applied for evaluation of the normal, abnormal and accident conditions. In summary, hazard identification was performed to identify credible scenarios that could arise from the proposed facility operations. The study was undertaken by staff qualified in project management, engineering, waste management, operations, safety (including human factors), radiation protection. The study employed a qualitative approach (similar to the Hazard and Operability (HAZOP) technique) and used the What-If analysis technique to identify and examine credible hazards scenarios/postulated initiated events associated with the proposed facility and processes (as well as from external events).

The study used a HAZOP checklist adapted to radiological waste storage to identify internal, external and human induced hazards as a basis from normal, abnormal and accident conditions. Following the identification of credible scenarios, further analyses were conducted and inherent and residual risks were calculated using the existing ANSTO *Risk Analysis Matrix* AG-2395 [47] and applying quantitative and qualitative assessment. Critical controls were nominated as appropriate.

The ARPANSA assessor has reviewed the assumptions behind the calculations of the inherent consequences and their likelihood as well as the residual consequences and their likelihood noting that in some cases the data used to support the analyses has been taken from exiting risk analyses conducted for approved facilities at ANSTO see references [48] to [52]. This approach was considered to be acceptable given the processes and equipment in these facilities are the same as for the proposed ILWCI Facility. For the sake of this facility licence application, the previous risk assessments were re-evaluated by the ARPANSA assessor to ensure they remain valid.

Other input parameters (frequencies and impacts) to the risk calculations included:

- Microshield™ calculations
- Use of operational data (taken directly from the existing ILWS storage facility)
- Pressure calculations for the SUF cup vessels
- Dose coefficient data from ICRP, 2017, Occupational Intakes of Radionuclides Part 3 [53]
- Data from (1983) *Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plan* Applications, NUREG/CR-1278 [54] with regards to human error in following procedures.
- C. Benhardt, et al, 1994, Human Error Database Development for Non-reactor Nuclear Facilities, Westinghouse Savannah River Company [55]
- *Data from* Quanterion Solutions Incorporated, 2016, *Nonelectronic Part Reliability Data*, Volume 3, with regards to interlock failure frequencies. [56]
- Data from the Australian Centre for Road Safety, 2018, Road Traffic Casualty Crashes in New South Wales, Transport for NSW [57]

Finding - The ARPANSA assessor has reviewed the hazard and accident analysis methodology and is satisfied that assessment conducted is in line with the recommendations of ARPANSA-GDE-1925. The assumptions and data supporting the derivation of the inherent and residual risks were reviewed and no significant issues raised.

The radiological scenario risk results are discussed further below.

4.5.2 Radiological scenarios identified

ARPANSA-GDE-1925 recommends for each hazard scenario, hazard evaluation the applicant should typically describe:

- ❖ Unmitigated hazard scenario and assumptions such as the initiating event, energy sources, qualitative or quantitative magnitude of radioactive or other hazardous material involved, release pathway(s), and initial conditions, if any
- ❖ Estimated likelihood of the unmitigated hazard scenario
- ❖ Estimated unmitigated consequences of the hazard scenario for the facility worker (qualitative or semi-quantitative), the workers of the co-located facilities (qualitative or semi-quantitative), and the public
- ❖ Available preventive and mitigating controls
- ❖ Accident analysis that includes accident selection, design basis accident and design extension conditions.
- ❖ For each design basis accident or equivalent, an evaluation of the consequences to personnel, the public and the environment.

The ARPANSA assessor notes that the analysis has included the reasons for the postulated event selection and has included intention to review the requirement for Design Extension Conditions at future licensing stages. This is considered appropriate as the full conceptual design is not yet available.

Eleven credible hazard scenarios were considered to be credible postulated events based on the initial hazard analysis (HAZID):

- Vehicle accident
- Flask lifted with the door open
- Flask dropped due to crane failure
- Waste package dropped during movement in ILWCI
- Storage pit open for longer duration due to crane failure
- Fall into an open pit
- Pressurisation of SUF cup storage vessel
- Failure of the pit AVS
- Operator exposure to tritium
- Dropped used HEPA filter
- Water ingress in the storage pit and/or tubes.

A summary of the unmitigated (inherent) and residual risks and the ARPANSA assessment are laid out in Table 3 below.

The assumptions adopted for the analysis were as follows:

- The facility will be receiving a determined number of waste packages per year based on current waste generation storage forecasts for the ANSTO Lucas Heights campus

- The maximum dose rate at 1 m from a SUF cup vessel is ~7 Sv/hr and the maximum dose rate at 1 m from any ARB received at the facility will be 1 Sv/hr based on microshield© calculations[12]
- The overhead gantry crane will be designed to interface with the existing flasks captive key interlocks. This interlock will be tested annually.
- The overhead gantry crane will be DGR certified, with additional safety features as per current ANSTO practices and undergo regular maintenance and inspection.
- Moisture detection will be implemented in the storage pits.
- Procedures and work instructions to be developed for the facility prior to commissioning.

[12] Note these calculations are from the ANM Mo99 Facility Operational Risk Assessment ANSTO/T/TN/2015-20 rev 3 2020 Appendix D2 and were assessed by ARPANSA at the time of the ANM Operating licence application.

Table 3 – Hazard Scenarios, Inherent and Residual Risk and ARPANSA Conclusions

Scenario	Consequence	Inherent Risk	Key Proposed Mitigations	Residual Risk	ARPANSA Conclusion
Fall into Open Pit	Whole Body Dose >1Sv (15 minute rescue)	High	Proposed design to include anchor points for staff to wear restraint harnesses if within 2m of open pit Exclusion zones to be set up with physical barriers for open pit Low occupancy building and process Detailed rescue plan Design of pits (small opening)	High	Concurs although will need to see detailed mitigations at next licensing stage including human factor review
Vehicle Impact accident whilst transporting RHSW – flask damage	Whole Body Dose (General Purpose Flask SUF Cups)	Low	Design of the waste flasks (Probability of Failure on Demand PFD for the shielding is 0.1) Traffic rules on site including speed limit up to 10 km/hr Qualified medium rig/heavy rig drivers No requirement for reversing by drivers at the ILWCI Transport prohibited in wet weather Staff trained to evacuate the Area	Not credible	Concurs with the findings of the risk analyses See section 4.5.1 above
	Whole Body Dose (Retrievable Waste Flask)	Moderate	As above	Very Low	Concurs with findings See section 4.5.1 above
Flask lifted with Door Open (for when SUF cup vessels need to be retrieved to measure uranium content as per Australian Safeguards and Non-Proliferation Office requirements).	Whole Body Dose (General Purpose Flask)	High (expected dose rate from scattered radiation)	Flask captive key interlock – prevents flask being lifted with flask door open Procedure (human error of omitting the step estimated as per NUREG/CR1278 to be $3X10^{-3}$) Radiation Monitor alarms/EPDs Visual indicators on flask Training	Low	Concurs with the findings See section 4.5.1 above

Dropped Waste Package during operations in ILWCI Facility	Whole Body Dose (during recovery)	Low	Recovery operation for a dropped waste package into the pit carefully planned/subject to appropriate approvals Flask grab features handle load weight with large margin Safety features in flask design prevents uncontrolled waste lowering Ongoing maintenance of flask	Low	Concurs with findings See section 4.5.1 above
Storage Pit open for longer duration due to crane failure	Whole Body Dose (**during recovery only**) ~1-20mSV	Medium	Use of recovery plan for crane failure (includes procedure, PPE, radiation plan, shielding, exclusion zones, SWMES etc) Recovery subject to ARPANSA approval.	Low	Concurs with findings See section 4.5.1 above
Pressurisation of a storage vessel tertiary can (SUF cup vessel) –vessels withstand 1Mpa	Whole Body Dose 0.1 – 1mSv) (recovery only)	Very Low	Very unlikely given vessels reach 50 kpa only Recovery operation would require a plan for recovery of vessel from pit (includes procedures, PPE, decontamination etc)	Very Low	Concurs with findings See section 4.5.1 above
Failure of the Pit Active Ventilation	Inhalation Dose negligible	Very Low	Dose is negligible. AVS failure generates alarms locally and to ANSTO Site Operations Centre AVS regularly inspected and maintained Regular Health physics surveys Radiation monitors	Very Low	Concurs with findings. The proposed doses were based on the existing ILW store. The risks from the failure of ventilation were reviewed in detail in a Section 63 to install active ventilation into this store in 2015.
Operator Exposure to Tritium (from future OPAL pond RHSW) – Tritium contamination in the storage pits	Inhalation dose (0.1-1mSv)	Very Low	This process subject to pre-approval by ARPANSA Decontamination processes required at the OPAL pond prior to transport pre-contamination checks required prior to packaging. AVS in pits Stack monitoring HPS monitoring	Very Low	Concurs – noting the detailed process will require full review by ARPANSA under Section 63 prior to be permitted
Dropped dirty (used) HEPA Filter	Inhalation Dose (0.1 to 1mSV)	Very Low	Filter design means release of activity is unlikely	Very Low	Concurs with findings

During changing/checking – drop causing the plastic containment to perforate and a re-suspension of activity on the filter.			Health physics surveyors present during filter change as part of procedure PPE, air masks, training, work procedures		
Water Ingress in the storage pit and/or Storage Tubes and then leaching contamination to groundwater (source of water – from internal flooding or External flooding)	Active Material released to the environment from water ingress into pits	Low	Conceptual design includes drainage features (see Section 2.4.1 Waste is encapsulated Moisture Probes which alarm to the ANSTO site operations centre	Very Low	Concur with findings – design to be rechecked at future licensing stages to verify drainage features
	Active Material released to the environment (leaching into pit)	Very Low	As above	Not assessed (not credible)	

Finding – The risk assessment meets the recommendations of ARPANSA-GDE-1925. The radiological hazard scenarios presented from the initial hazard identification process based on the conceptual design are considered to be credible events. For each scenario, the inherent and residual impacts and the assumptions used for the calculations (frequency and impact – see section 4.5.1 above) have been assessed and no significant issues raised by the ARPANSA assessor.

Of the 11 scenarios, only one remains with high residual risk (i.e. falling into open pit) with the rest being either low or very low. This risk is also present in the existing ILWS and is managed by the use of physical barriers to maintain a safe distance of 2 m or more if staff are present when the pit is open, and the use of custom-made temporary pit lids. It is expected that this risk will be reduced by similar mitigations and details will be provided by ANSTO of the controls if there is a next licence stage application.

At this siting stage, the ARPANSA assessor concludes that radiological hazards that could credibly occur can be managed with appropriate mitigations (design for radiological safety – see section 4.2.2). The proposed controls for the ILWCI Facility will be reviewed in detail in the next licensing stage when more information and analysis is expected to be submitted as the detailed design and source terms are refined.

4.6 Defence in depth

- In analysing the design basis accidents each event scenario (or group of event scenarios), the safety functions and corresponding items important to safety and administrative controls that are used to implement the defence in depth should be identified
- For multi-facility sites the potential interaction with or impact from accidents at other facilities on the same site should be considered in the analysis of the fourth and fifth levels of defence in depth.
- Where appropriate the analysis of design basis external events should demonstrate that the design is adequately conservative so that margins are available to withstand external events more severe than those selected for the design basis.
- The analysis of internal events should demonstrate whether the SSCs are able to perform their safety functions under the loads induced by normal operation and the anticipated operational occurrences and accident conditions that were taken into account explicitly in the design of the facility.

The ARPANSA assessor is satisfied that defence in depth controls have been applied as appropriate to the facility type noting that most of the controls are passive.

The emergency response siting plan has adequately covered impact from accidents at other facilities on site in terms of emergency response and recovery. There are no external design bases external events considered credible.

Finding - The ARPANSA assessor notes that the SSCS have not been identified at this conceptual stage but will be categorised once detailed design is completed and presented at the next licensing stage for ARPANSA review. This is considered appropriate for a siting licence application.

4.7 Operating limits and conditions

This chapter should provide and justify functional safety requirements derived from the functions of the SSCs and the accident analysis. This may include safety limits, safety systems settings, limiting conditions for operations, surveillance requirements and administrative requirements.

Since the detailed design is not yet developed and the SSCs not yet categorised, the OLCs have not been determined. This is appropriate for a siting application and will be considered at future licensing stages.

4.8 Plans and arrangements summary

Assessment of these details is covered in section 3 and will not be repeated here.

4.9 Other analyses - Reference Accident

A reference accident, *ILWCI Siting Facility Reference Accident Assessment* (2022), Doc no 153225, was submitted to determine the Emergency Preparedness Category for the proposed facility against the requirements of ARPANSA RPS G-3 [40]. The bounding scenario chosen was a security event resulting in release of activity from a SUF cup vessel.

The ARPANSA assessor notes that this event is considered to be very unlikely, but it is an appropriate bounding scenario for a reference accident. Deterministic analysis was conducted on the SUF cup source term using PC-Cosyma™ software and the same assumptions as were used for previous ANSTO reference accident assessments (for example release conditions, population data and predicted growth and taking into account night and day population differences) and are considered by the ARPANSA assessor to be appropriately conservative. The pathways considered were cloud-shine, ground-shine, inhalation, re-suspension and direct contamination. The analyses were reviewed by the ARPANSA assessor and no issues raised.

The projected doses (effective and thyroid equivalent) for exposure to different age groups at a range of distances from the proposed facility showed that the worst case doses were well below statutory limits:

- Effective Dose - less than 1 mSv short term (7 days) at the closest distance (0.2 km from the facility) and approximately 2 mSV for long term (50 years).
- Thyroid Dose – 0.035 mSV for short term (7 days) at the closest distance (0.2 km from the facility) and 0.4 mSv for long term (50 years)

For all population groups, the doses were below the generic intervention levels (GILs) that would require urgent protective measures off site. Therefore, the facility was categorised as Emergency Preparedness Category III based on the fact that this very unlikely scenario could not cause offsite doses to the public and any doses on site can be managed with the existing ANSTO emergency preparedness controls.

Finding – The reference accident used to develop the emergency preparedness category for the ILWCI facility was considered to be appropriate. The emergency preparedness category of III was reviewed by the ARPANSA monitoring and emergency response specialist and confirmed. Appropriate emergency preparedness plans are in place at ANSTO to manage EPC Cat III facilities. These will be reviewed specifically for the ILWCI Facility at later licencing stages.

Overall conclusion on the safety analysis report

The content of the safety analysis report and the supporting safety assessment documentation meets the intent of ARPANSA-GDE-1925. The postulated credible event scenarios have been assessed and the inherent and residual risk verified. The HAZID which screened out non credible scenarios has also been reviewed with no significant issues raised.

The mitigations and critical controls proposed at this stage of licensing are considered appropriate. All hazard scenarios have a residual risk of very low to low with the exception of a fall into an open pit which is high. However, proposals are in place to manage this risk as it is in the existing ILWS. These will be reviewed in detail at the next licence stages.

5. Matters to be taken into account by the CEO

The following matters prescribed by the Act and Regulations are to be taken into account by the CEO in deciding whether to issue a facility licence.

5.1 International Best Practice

Subsection 32(3) of the Act requires the CEO, in making a decision on a facility licence, to take into account international best practice in relation to radiation protection and nuclear safety

The review of this licence application took into account assessments of the application against relevant ARPANSA guidance, RPS codes, fundamentals and guides and the IAEA standards and guides listed in Table 1 in section 1.2.2. Table 1 demonstrates how the specific regulatory guides were developed from the RPS documents and international standards particularly those published by the International Atomic Energy Agency.

On this basis the ARPANSA assessor is satisfied that the applicant has considered international best practice with respect to siting and potential future operation of the proposed facility.

5.2 Information asked for by the CEO

The applicant has provided all information asked for by the CEO and has therefore complied with subsection 53(b) of the Regulations.

5.3 Undue risk

Subsection 53(c) of the Regulations requires the applicant to establish that the conduct proposed can be carried out without undue risk to the health and safety of people and to the environment.

Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm and that the environment is protected. The applicant must demonstrate that the radiation risks arising from the proposed conduct have been considered, including the probability and magnitude of potential exposures arising from accident scenarios or abnormal occurrences.

The arrangements presented for the siting stage provide a reasonable assurance that the conduct will not result in undue risk. This will be further assessed at future licensing stages when the detailed design has been completed and specific operational procedures and processes developed.

The application included a risk assessment analysing the hazardous scenarios and associated risks during proposed operation of the facility. This included normal, abnormal and accident conditions and took into account external and other facility related events. No credible event was identified that could result in significant radiological dose outside of the facility or offsite. One scenario was identified with a high radiological residual risk of an operator fall into an open pit. At this stage however, ARPANSA is satisfied that this can be appropriately mitigated as it is currently in the existing ILWS.

Radiological risks will be further considered at the next licensing stages with appropriate conditions imposed by the CEO of ARPANSA on operations if required. For future licensing when detailed design is completed, the construction of each item important for safety will be subject to individual ARPANSA approvals under section 66 of the Regulations. This assessment will take into account the safety function, safety margin and defence-in-depth as per ARPANSA Regulatory Guide *Construction of Items Important to Safety (*2021) [45].

Based on the information provided in the siting licence application, the ARPANSA assessor is satisfied that the conceptual design of safety items incorporates conservative design and technology and proven engineering practice. Further, based on experience with the current facility for ILW storage; the ILWCI Facility is expected to have similar or improved design safety features and administrative and engineering controls.

It is therefore expected the maximum individual annual effective dose to an operator should be well below the statutory limits as is the case for the existing ILWS. This will be further reviewed at future licensing stages once the source terms and shielding requirements are further refined.

Finding - The ARPANSA assessor is satisfied that the probability and magnitude of potential exposures due to incidents and accidents or abnormal scenarios have been analysed and mitigation has been demonstrated. There is sufficient information to provide reasonable assurance that for future operations, no individual should bear an unacceptable risk of harm and the environment remains protected. Future operations will be subject to further licensing approvals. Therefore, the requirements of paragraph 53(c) of the Regulations have been met.

5.4 Net benefit/justification

The applicant must demonstrate that the proposed conduct produces sufficient benefit to individuals or to society to offset the radiation harm that it might cause, that is, the conduct must be justified, taking into account social, economic and other relevant factors. Paragraph 53(d) of the Regulations requires the licence applicant to show there is a net benefit from carrying out the conduct proposed by the licence.

The benefit of the proposed ILWCI Facility is to act as a contingency for waste produced from the ANSTO Nuclear Medicine (ANM) facility (and potentially some from OPAL which is part of the ANM supply process) by acting as a temporary radioactive waste store. There is no net benefit from this conduct per se as waste material is considered to have no future use. However, the ICRP[13] has considered the issue of justification of waste management and noted the benefit should be considered in relation to the benefit of the

[13]Radiological protection in geological disposal of long-lived solid radioactive waste. ICRP Publication 122. Ann. ICRP 42 [59]

'practices' generating the waste, over the whole life-cycle. The benefit associated with the operation of the ANM is to provide medical and industrial radioisotopes.

ANSTO has demonstrated that adequate plans and arrangements for managing safety and security and controls will be in place to reduce radiation risks at all stages of the facility lifecycle. The radiation risks associated with the future lifecycle of the ILWCI Facility are therefore considered to be outweighed by the net benefit of the practices.

Finding - The ARPANSA assessor has reviewed the ILWCI Facility with regard to benefit and detriment and believes the applicant has suitably demonstrated that there is an overall benefit from the proposed conduct. Therefore paragraph 53(1)(d) of the Regulations has been met.

5.5 Optimisation of protection - ALARA

Protection must be optimised so that radiation risks are as low as reasonably achievable. The level of protection should be the best under prevailing circumstances and should provide for an adequate margin of benefit over harm. The applicant must show that the likelihood of incurring exposures, the number of people exposed, and the magnitude of exposures are as low as reasonably achievable, having regard to economic and societal factors.

The applicant has provided plans and arrangements for the siting licence which intend to provide assurance that optimisation has been applied to the lifecycle of the facility. These measures include:

- Engineering design of interlocks on the flasks, crane and waste storage holes/pits
- Encapsulation and packaging of waste to reduce dose rate
- Specific design proposed to incorporate decommissioning requirements
- Radiation Protection procedures that require application of effective work planning, dose constraints/limits/classification of areas and radiological risk assessments and which applies the principles of distance, timing, shielding.
- Passive design features- shielding application (concrete walls, rock and concrete plug covers, flasks)
- Active Ventilation System and Drainage
- Emergency planning processes to mitigate the consequence of abnormal events/accidents
- Annual ALARA objective of 2 mSv to occupationally exposed persons are set as part of further optimisation of radiation protection. For members of the public the ALARA objective is 20 µSv. Investigation limits are also set for dosimetry reporting periods such as if an occupationally exposed person receives more than 1 mSv.

Finding - Considering the design of the facility, the proposed engineering and other controls to be in place it is expected that during future operation and lifecycle of the facility the maximum annual average effective dose to the operator will be below the ANSTO annual ALARA objective and there will not be any dose implications to the members of the public. This will be confirmed at future licence stages of the application.

The above information provides reasonable assurance that protection and safety will be optimised using engineered safety features and controls, and administrative controls.

5.6 Capacity to comply

The applicant must demonstrate a capacity to comply with the regulations and any conditions likely to be imposed on the licence. This should include sufficient financial and human resources to manage the proposed conduct. Subsection 53(f) of the Regulations requires the licence applicant to show capacity for compliance with any licence issued and licence conditions that may be imposed.

The ILWCI Facility will be under the effective control of the ANSTO Waste Management Services section at the operational stage. The Waste Management Services section currently holds effective control of 5 existing facility licences at the ANSTO site. These cover an operating licence for the Interim Waste Store Facility (F0292), an operating licence for Waste Operations (F0260), a possess or control licence for the permanently shut down HIFAR reactor (F0184), a possess or control licence for the Little Forest Legacy Site (F0293), and a licence to site and construct the SyMo facility (F0266). These are routinely inspected under the ARPANSA statutory inspection program. Results of the inspections are published on the ARPANSA website[14]. In addition, compliance is reported quarterly to ARPANSA under subsection 30(2) of the Act.

Since 2012, there have been a total of 7 breaches recorded across the 5 licences shown in Table 4 below. ARPANSA adopts a graded and risk-based approach to compliance and enforcement in accordance with the ARPANSA, 2019– *Compliance and Enforcement Manual, ARPANSA-GDE-1117* [60].

Of the 7 breaches, 6 were determined to have no significant radiological safety consequences and one was considered to have potential radiological safety consequences. In all case no further enforcement action was taken by the CEO of ARPANSA. It is noted that appropriate measures have been put in place to address each breach.

Table 4 – List of breaches issued by APRANSA for Licences currently managed by Waste Operations in the past 10 years

Year	Licence	Licence condition	Breach details	Action taken by licence holder
2016	SyMo	Failure to comply with licence conditions	Failure to report a relevant change to the CEO of ARPANSA	Licence holder made improvement in reporting practices
2016	HIFAR	Failure to comply with Operating Limits and Conditions	Failure to conduct surveillance on radiation monitors & adhere to limits on hazardous waste in the facility	Licence holder Implemented improved effective controls on these limits and conditions
2016	HIFAR	Failure to comply with s60 of the Regulations	Failure to conduct structural survey on HIFAR within 5-year period stipulated in plans & arrangements	None – Licence holder conducted the required structural survey soon after the breach

[14] See Inspection reports | ARPANSA

2018	HIFAR	Failure to comply with s60 of the Regulations	Failure to complete radiation surveys to frequency required by plans & arrangements and failure to notify ARPANSA of potential breach in timely manner	Licence holder completed radiation surveys to the required schedule
2019	Little Forest Legacy Site	Failure to comply with licence conditions	Failure to seek approval to make safety significant change	Licence holder revised internal assessments and procedures for emergency exercises involving helicopters
2020	Waste Operations	Failure to comply with Operating Limits and Conditions	Evidence of compliance with required calibration frequency of hotcell interlock monitoring equipment was incomplete	Licence holder revised record documentation to adequately capture limiting condition checks
2021	Waste Operations	Failure to comply with licence conditions	Failure to provide quarterly report for airborne discharges	Licence Holder revised methodology for provision of reports and licence condition was amended by ARPANSA to allow for delays in provision of data

Finding - The ARPANSA assessor has reviewed the proposed plans and arrangements and the operating compliance history and events relating to ANSTO Waste Management Services and concludes there is evidence that the licence applicant has the capacity to comply with the Regulations and any conditions likely to be imposed on the licence. Therefore, the requirements of subsection 53(f) have been met.

5.7 Authorised signatory

The application must be signed by an officer holder of the applicant or a person authorised by an office holder of the applicant, and in the latter case, an instrument of authorisation must be provided.

The application was signed by Mr Shaun Jenkinson who is the CEO of ANSTO and therefore an office holder of ANSTO which fulfils the requirements of subsection 53(g) of the Regulations.

5.8 Content of public submissions

Regulation 40 requires the CEO of ARPANSA to advertise receipt of a facility licence application and invite public submission on applications for a nuclear installation. The CEO must consider the content of any submission made by members of the public.

ARPANSA published the following on 1 September 2021:

- A notice in The Australian & St George and Sutherland Shire Leader newspapers
- A notice on the ARPANSA website

A copy of the siting licence application submitted by ANSTO was made available to the public along with advice on how to make a submission.

On 13 October 2021, ARPANSA held a virtual public forum (due to the COVID-19 pandemic) to:

- outline the process ARPANSA uses to assess and decide the application including the way in which the agency will seek and take into account public submissions.
- Provide a presentation on the details of the application.
- Answer questions

ARPANSA received 5 written submissions on the application with one marked as confidential (and therefore details will not be given in this report). The ARPANSA assessors grouped the issues into themes and evaluated them as recorded in Appendix 3. Detailed responses are also given in the CEO of ARPANSA's Statement of Reasons for issuing a licence to site the ILWCI Facility[15]. Key themes included:

- Lack of progress establishing a National Radioactive Waste Management Facility (NRWMF) by the Department of Industry Science Energy and Resources (DSIER) and the suitability and safety of ongoing storage of ILW at the ANSTO site.
- Questions regarding why ILW has to be stored at the NRWMF once established and why it cannot remain at ANSTO until a final disposal facility has been established.
- Concerns regarding the site selection process for the NRWMF including public consultation and site safety.
- Concerns regarding the recruitment process for the new CEO of ARPANSA.

The public submissions that are not confidential are located on the ARPANSA Internet[13] and the responses are attached to this report as Appendix 3.

Conclusion

Public submissions have been requested as required by Regulation 40. The ARPANSA assessment has given due considerations to the content of the public submissions when recommending a decision to the CEO of ARPANSA.

5.9 Nuclear Safety Committee

An overview of the submission and the ARPANSA assessment was presented to the Nuclear Safety Committee (NSC) on 27 November 2021. Committee members subsequently provided advice on this assessment report, the ANSTO safety analysis report and the ANSTO safety assessment, which were considered in the ARPANSA assessment. On 25 February 2022 the NSC provided advice that they supported the decision of the CEO to issue the licence for preparation of the site for the ILWCI facility.

6. Conclusions

The application and information provided in support of the application provide evidence that:

- The application was in a form approved by the CEO under section 45 of the Regulations including payment of the relevant application fee.

[15] See https://arpansa.gov.au/ANSTO-ILWCI

- The application included all of the information required by the CEO under section 34 of the Act.
- International best practice in radiation protection, nuclear safety, and security has been taken into account.
- The information establishes that operation of the ILWCI Facility should pose no undue risk to the health and safety of people or to the environment.
- The applicant has shown a net benefit from the lifecycle of the ILWCI Facility.
- The magnitude of individual doses, the number of people exposed, and the likelihood that exposure will happen have been shown to be as low as reasonably achievable.
- The applicant has shown a capacity for complying with the regulations and licence condition

The content of public submissions and the advice of the Nuclear Safety Committee have been taken into account.

It is recommended that a facility licence be issued to ANSTO in respect of licence application A0339 authorising the preparation of a site for a controlled facility, namely the Intermediate Level Waste Capacity Increase Facility subject to the standard licence conditions.

References

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[2] Australian Radiation Protection and Nuclear Safety Regulations, 1999

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[4] International Atomic Energy Agency (IAEA), 2016. *Governmental, Legal and Regulatory Framework for Safety*, General Safety Requirements, GSR Part 1.

[5] Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2019. Regulatory Guide: *Applying for a Licence for a radioactive waste storage or disposal facility,* ARPANSA-GDE-1736.

[6] Jacobs Engineering (Nov 2019) *ANSTO ILWCI Concept Design* (30%) Report Rev 3

[7] Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2020. *Guide for Classification of Radioactive Waste*, Radiation Protection Series; G-4.

[8] Australian Nuclear Science and Technology Organisation (ANSTO), 2021 Safety Analysis Report of the Intermediate Level Waste Capacity Increase Facility rev 2 (152990)

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[10] International Atomic Energy Agency (IAEA), 2006. Storage of Radioactive Waste*,* General Safety Guides, WS-G-6.1

[11] Australian Nuclear Science and Technology Organisation (ANSTO), 2021. Intermediate Level Waste Capacity Increase Facility Siting Licence Site Characteristics and Site Related Design Basis rev 2 (152977)

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[13] Douglas Partners, 2019. *Report on Geotechnical Investigation*, Lucas Heights

[14] Australian Standard, 2007. *Structural Design Actions* Part 4: Earthquake Actions in Australia, AS 1170.4-2007

[15] International Atomic Energy Agency (IAEA), 2019. Safety Standards Series, Safety Fundamentals, SF-1.

[16] Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2020. *Regulatory Guide: Plans & Arrangements for Managing Safety,* ARPANSA-GDE-1735.

[17] Australian Nuclear Science and Technology Organisation (ANSTO), 2021. Intermediate Level Waste Capacity Increase Facility – Siting Licence Effective Control Plan rev 0 (152971).

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Appendix 1: Key documents used in assessment of ILWCI siting licence application

Table A1: Key documents mapped to International Best Practice (IBP) & Radiation Protection Series (RPS)

ARPANSA Regulatory Guide	RPS documents	Relevant IBP that Regulatory Guides and RPS docs are based on
ARPANSA Regulatory Guide – Applying for a Licence for a radioactive waste storage or disposal facility, ARPANSA-GDE-1736 [5] References relevant key guide - Regulatory Guide – Decommissioning of Controlled Facilities [6]	RPS G-4 *Guide for Classification of Radioactive Waste* [61] RPS C-1 (Rev. 1) Code for Radiation Protection in Planned Exposure Series [62] RPS C-2 (rev.1) C*ode for the Safe Transport of Radioactive Material* [9] RPS C-11 Code of Practice for the Security of Sources [63]	IAEA GSR Part 5 Predisposal management of radioactive waste [64] IAEA SSR-5 Disposal of Radioactive Waste [65] IAEA Safety Series GSG-*1 Classification of Radioactive Waste* [66] IAEA GSG-3 - The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste [67] IAEA GSR-6 *Decommissioning of Facilities* [68]
ARPANSA Regulatory Guide: Plans & Arrangements for Managing Safety [7] References relevant key guide ARPANSA Regulatory Guide – Holistic Safety [69]	RPS F-1 Fundamentals for Protection against Ionising Radiation [70] RPS G-1 *Guide for Radiation Protection of the Environment* [71] RPS 7 Recommendations for Intervention in Emergency Situations (now superseded) [72] RPS C-11 *Code of Practice for the Security of Sources [63]* RPS C-3 *Code for Disposal Facilities for Solid Radioactive Waste* [73] RPS C-2 (rev. 1) *Code of Practice for the Safe Transport of Radioactive Material [9]* RPS G-4 *Guide for Classification of Radioactive Waste[61]* RPS 16 *Safety Guide for the Predisposal Management of Radioactive Waste* [74]	ICRP103 *The 2007 Recommendations of the International Commission on Radiological Protection* [75] IAEA SSR-6 Regulations for the Safe Transport of Radioactive Material [76] IAEA GSR Part 7 *Preparedness and Response for a Nuclear or Radiological Emergency* [77] IAEA GSR Part 2 *Leadership and Management for Safety* [78] IAEA GSR Part 1 *Government, Legal and Regulatory Framework for Safety* [4] IAEA GSR Part 3 *Radiation Protection and Safety of Radiation Sources* [79] IAEA *Practical Radiation Technical Manual – Personal Protective Equipment* [29] IAEA GSR Part 5 Predisposal management of radioactive waste [64]

		IAEA Nuclear Security Series No. 13 Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities [80] IAEA Nuclear Security Recommendations No 14 Recommendations on Radioactive Material and Associated Facilities [81]
ARPANSA Regulatory Guide Preparation of a Safety Analysis Report for non-reactor facilities [9]	RPS F-1 Fundamentals for Protection against Ionising Radiation [70] RPS C-1 (Rev. 1) Code for Radiation Protection in Planned Exposure Series [62] RPS G-4 *Guide for Classification of Radioactive Waste [61]* RPS 16 *Safety Guide for the Predisposal Management of Radioactive Waste [74]* Also - Regulatory Guide – *Holistic Safety [69]*	IAEA SSR-6 Regulations for the Safe Transport of Radioactive Material [76] IAEA GSR-7 *Preparedness and Response for a Nuclear or Radiological Emergenc*y [77] IAEA GSR Part 5 Predisposal management of radioactive waste [64] IAEA GSR Part 2 *Leadership and Management for Safety* [78]

Other documents used which are not linked to a regulatory guide but have been included in the assessment are:

- IAEA SSR-1 Siting of Nuclear Facilities [12]
- RPS G-3 Guide for Radiation Protection in Emergency Exposure Situations [40]
- IAEA SSG-41 Predisposal Management of Radioactive Waste [82]
- IAEA GSR-4 Safety Assessment for Facilities and Activities [83]

Appendix 2: Proposed facility features

The proposed facility includes the following key features: *Note: at this stage the design is still conceptual*.

- **Subfloor in situ concrete storage vaults** (in over-excavated rock) - supported on rock to house deep storage holes and pits for the storage of Spent Uranium Filter (SUF) cup vessels and Aluminium Retrievable Bins (ARB) respectively. This is as per the existing ILWS store.
- **Active ventilation** –The storage pits are proposed to have ducts in dedicated trenches through the concrete to connect the pits to the facility active ventilation system (AVS). The AVS will be designed with a variable speed drive and the capacity to draw air from the space in the pit area. Gases will pass through HEPA and carbon filters to remove particulates. The differential pressure (DP) will be measured across the filter banks and abnormal levels of DP will alarm to the ANSTO Security Operations Centre (ASOC). All discharges to the stack will be monitored and recorded by a stack monitoring system as per the existing ANSTO environmental monitoring processes.
- **Local Area Monitors** – Fixed dose rate monitors are proposed to be located in the facility.
- **Drainage to the Active B line –** or to a sump which then drains to the B line
- **Security systems** – See section 3.5
- **Fire detection and alarm system** – connected to the ANSTO ASOC
- **Occupant warning system** – to enable alert, action and speech signals from the ANSTO site control centre to be communicated to occupants.
- **Vehicle access via a roller door and truck thoroughfare** - The naturally ventilated truck thoroughfare will connect with external roads on either side of the facility and provide semi-truck access through the building. The entry and exit of the truck thoroughfare will be fitted with security roller doors. The width of the building will provide sufficient length for a semi-trailer to be parked inside the facility with both roller doors closed.
- **Dangerous goods rated 15 tonne gantry building crane** – The crane will be used to lift flasks to the storage pits/holes to transfer waste packages. It will be certified to DGR and meet Australian Standard *Cranes, Hoists and Winches (2002)* (AS 1418) and subject to regular maintenance.
- **Existing retrievable waste flasks (6 tonne and 9 tonne)** - The retrievable waste flask (9 t) will be used as the primary flask to transfer ARBs into the retrievable storage pits. The flasks are already in use at ANSTO, licensed under the Waste Operations Licence (F0260) and is constructed of steel and lead. It has the following features: shielding; lifting eye to interface with the crane; a winch system to raise and lower the bins; a sliding shielded door interlocked with the overhead cranes; and a safety programmable logic controller (PLC) drive control and protection system.
- **Existing General Purpose (10.3 tonne) Flask** - constructed of steel and lead and used to transport the encapsulated SUF Cup storage vessels to the ILWCI Facility for storage. Again, this flask is already in use at ANSTO and licensed under Waste Operations Licence F0260. The main functional elements of the GP flask are electrically operated hoist system for raising and lowering the load; a hydraulically operated door at the bottom of the flask; a solenoid operated grab, pick up, and release system used to load and unload the SUF vessel; and electrical controls, interlocks, protection systems and alarms.
- **Drainage** - The following design provisions have been proposed in the 30% concept design report to reduce the risk of water ingress into the storage pits due to natural causes. The design takes into account the meteorology and hydrology of the site.
    - Spoon drains will be provided around the full perimeter of the basement with falls to suitably sized soak away pits

- Vault floor will be founded directly on rock and profiled to allow drainage to a temporary storage pit.
- Drainage sump will be located at the base of the stairs at the vault floor level.
- Waterproof membranes will be provided below all basement and ground floor bearing slabs.
- Agricultural drain networks will be provided below all basement slabs leading to soak away pits.
- There will be subsurface drainage around the perimeter of below ground structures with connection to stormwater pits.
- Other proposed controls include steel sheeting roof, encapsulation of the SUF Cups and SyMo cans, transfers not permitted during wet weather, ARB pits designed so water is likely to run to the pit bottom rather than gather on top of the ARBs and seep in.

Appendix 3: Response to Public Submissions

ARPANSA received 5 public submissions as follows:

- Public Submission 1 (reference PS1)– Mr David Noonan, Independent Environmental Campaigner
- Public Submission 2 (reference PS2) – Australian Conservation Foundation
- Public Submission 3 (reference PS3)– Friends of the Earth Australia
- Public Submission 4 (reference PS4) – Sutherland Council

The above can be located on the ARPANSA website

- Public Submission 5 – Requested to be confidential so not documented – however, the contents were taken into account in the regulatory assessment of the licence application.

The responses to the public submissions have been grouped into themes in the two tables below with Table 1 addressing submissions directly about the ILWC facility and Table 2 addressing submissions about the National Radioactive Waste Management Facility.

Table 1 Responses to Public Submissions related to ANSTO's application to increase temporary storage of radioactive waste at their Lucas Height site.

Public Submission ref number	ARPANSA's response
PS1 PS2 PS3 PS4	***ILWCI Facility Justification*** The proposed ILWCI facility is part of ANSTO's longer term contingency plans for the ongoing storage of ILW in the situation that a NRWMF facility is delayed. As part of these plans, ANSTO will develop ILSW processing and packaging facilities as appropriate. ARPANSA and ARWA are aware of the waste inventory at ANSTO. The justification that capacity for ILSW is likely to run out by late 2020s has been reviewed and verified by ARPANSA. It is agreed the Lucas Heights site is not suitable for final disposal of waste. The Australian Nuclear Science and Technology Organisation Act 1987 prohibits the ANSTO site from becoming a national waste repository. However, the ANSTO site continues to be safe and secure for the temporary storage of ILW.
PS4	***ILWCI Facility Licence*** The ILWCI facility licence for siting has been assessed against international best practice for storage of radioactive waste (see Regulatory Assessment Report) including *IAEA Predisposal Management of radioactive waste GSR Part 5* and *IAEA The Safety case and Safety assessment for the pre-disposal management of radioactive waste GSG-3* with no significant deviations found. The ARPANSA CEO will only grant a licence to the ILWCI facility if there is confidence that stringent requirements have been met including no adverse impacts on human health or the environment and a clear justification for the proposed activities. This is in line with requirements of *Radiation Protection Series (RPS) C-1 Code for Radiation Protection in Planned Exposure Situations 2020.* As part of its licence review, ARPANSA assessed ANSTO's compliance with the ARPANSA Act and Regulations, including the ability to continue to apply safe management practises.
PS1 PS3	***ANSTO Long Term Strategy*** ARPANSA requires a long-term waste management strategy from ANSTO as part of ongoing regulatory oversight. The long-term waste management strategies account for delays in the establishment of a NRWMF. The latest draft document was received in January 2022. The three ANSTO responses requested are attached to Appendix 4 of this Regulatory Assessment report – namely Response to Licence Condition 5 of the Interim Waste Store F0292 and Response to Licence Condition 14 of the ANM Licence F0309

Table 2 Submissions unrelated to the Public Consultation of ANSTO's application to increase temporary storage of radioactive waste at their Lucas Height site however are related to the proposed National

Radioactive Waste Management Facility (NRWMF) and, as such, related to the system for final management of radioactive waste.

Public Submission reference number	ARPANSA's response
PS1 PS4	***Government Framework for the NRWMF*** The Australian government's plans for final management of Australia's radioactive waste are outlined in the Australian Radioactive Waste Management Framework (ARWMF)[16] The Australian Government has recently established the Australian Radioactive Waste Agency[17] for the purpose of providing policy advice to the appropriate policy department, the Department of Science, Innovation, Energy and Resources; and to prepare for seeking authorisation to establish the necessary waste facilities. ARPANSA does not have any information regarding the likely timing for establishment of a disposal facility for ILW.
PS3	***The roles of ARPANSA, ARWA, DSIER*** ARPANSA is responsible for any licencing of a proposed co-located LLW disposal and ILW store facilities which make up the NRWMF. ARPANSA sits under the Health portfolio of the Federal Government and only has a formal role in the review and assessment of the safety and security features of the facility once an application is received. ARWA is responsible for site selection, construction and operations of the NRWMF. It sits under the Science, Industry, Energy and Resources portfolio of the Federal Government.
P1 PS2 PS3	***Licensing Process*** After a licence application is received ARPANSA applies the relevant criteria in its review and assessment. The licensing occurs in stages. The stages for a LLW disposal and ILW storage facility are siting, construction, operation, decommission (the ILW Store only), closure (LLW disposal facility only) and site release and surrender. Staging the licencing process is an international best practice and allows for public consultation at each stage. Public consultation is an important factor in the decision-making process and a requirement of the ARPANS Act for nuclear installations. It is premature for ARPANSA to comment on the suitability of the selected site at Napandee as no licence application with supporting claims arguments and evidence has been received. However, once a submission has been made, ARPANSA will review against the requirements of *Radiation Protection Series*

[16] https://www.industry.gov.au/data-and-publications/australian-radioactive-waste-management-framework

[17] Australian Radioactive Waste Agency | Department of Industry, Science, Energy and Resources

	(RPS) C-3 Code for Disposal Facilities for Solid Radioactive Waste 2018 and *Regulatory Guide – Applying for a Waste Store or Disposal facility*. The timeline of the licence application is the responsibility of the applicant.
PS1 **PS2** **PS3**	***Licensing Requirements*** Due to the fundamentally different purposes, the safety case for disposal of LLW would reasonably differ significantly from the safety case for ILW disposal and require separate reviews and assessments. It is, therefore, also reasonable to consider storage and disposal at a proposed NRWMF under separate licensing in the regulatory decision-making process, potentially reaching different conclusions. The licence requirements are extensive and can be found in the *ARPANSA Regulatory Guide: Applying for a Licence for a Radioactive Waste Storage or Disposal Facility, REG-LA-SUP-240L v3.1 January 2019*. Any disposal facility for solid radioactive waste must meet the requirements set out in nationally agreed *Radiation Protection Series (RPS) C-3 Code for Disposal Facilities for Solid Radioactive Waste 2018*. The requirements ARPANSA places on an applicant for a licence for a radioactive waste storage or disposal facility are in accordance with international best practice. Part of this includes evidence that a licence applicant has appropriate safety management systems in place and demonstrates a capacity to comply with the ARPANS Act and Regulations A clear net benefit must be provided by the licence applicant to support a licence application in line with *Radiation Protection Series (RPS) C-1 Code for Radiation Protection in Planned Exposure Situations 2020* which includes justification for temporary storage of the ILW at the NRWMF. ARPANSA will engage with external experts for assessment of radiological and nuclear safety and security issues if required.
PS1 PS 2 PS3	Granting and Refusing a Licence The ARPANSA CEO will only grant a licence to a facility if there is confidence that stringent requirements have been met including evidence of no adverse impact on human health or the environment from either facility and a clear justification for the proposed activities. All requirements are outlined in Radiation Protection Series (RPS) C-1 Code for Radiation Protection in Planned Exposure Situations 2020 and includes a demonstration of a net benefit/justification for the relocation of IWS from the ANSTO site to any proposed ILW Storage Facility at the NRWMF. The review of the licence application will only commence if it is deemed reviewable, which will includes an assessment of any relevant prohibitions or other actions or instruments that would prevent the lawful establishment of the facility. The ARPANSA CEO continues to ensure that contingency plans remain in place for ANSTO's ongoing safe and secure management of ILW waste at the Lucas Heights Facility should plans for future management be altered. The latest draft of the ANSTO long term waste strategy was submitted in January 2022.

PS1 **PS2** **PS3**	***Stakeholder (including ARPANSA Nuclear Safety Committee) & Community Engagement*** As the independent regulator, ARPANSA manages stakeholder engagement independently of the applicant and government bodies. The ARPANSA CEO will assess evidence of engagement conducted with the selected site community in any application against *Radiation Protection Series (RPS) C-3 Code for Disposal Facilities for Solid Radioactive Waste 2018.* The ARPANSA *Nuclear Safety Committee* is an advisory body established under the *Australian Radiation Protection and Nuclear Safety Act 1998* (the Act) to provide advice to the ARPANSA CEO on nuclear safety regulation and the safety of controlled facilities. The advice referenced (NSC advice to the CEO, November 2016)[18] was to the CEO of ARPANSA only and related to the resourcing of the *ARPANSA Communication Strategy and Plan for the National Radioactive Waste Management Facility*. On the advice of the NSC in 2016, ARPANSA CEO made resources available for ongoing stakeholder engagement to ensure that the role of the independent regulator is communicated to stakeholders and public consultation (which includes engagement along transport routes). However, it is important to note that as part of any decision on licencing of a NRWMF, the CEO of ARPANSA will require that the licence applicant can demonstrate they have considered community well-being throughout the proposed facility life cycle. This requirement is found in *Radiation Protection Series – Code for Disposal of Solid Radioactive Waste (2018).*
PS3	***Storage Capacities*** Storage capacity will be increased to permit ILSW storage up to 2037 based on forecast waste generation rates. ARPANSA considers it desirable to explore different scenarios regarding national and international supply and demand of nuclear medicine, and the possibility that existing production facilities may retire and/or new facilities come online. A licence condition has been issued to gain more certainty regarding the time the ILWCI facility may receive waste and, as a consequence, nuclear medicine production can be sustained without the need for further contingency measures.
PS3	***Waste Acceptance Criteria Development & Waste Classification*** The *Radiation Protection Series (RPS) C-3 Code for Disposal Facilities for Solid Radioactive Waste 2018* requires the operator of a waste disposal facility to establish the Waste Acceptance Criteria (WAC), in this case ARWA. This is in line with Requirement 3 of the *IAEA Safety Standard: Specific Safety Requirements for Disposal of Radioactive Waste* SSR-5 which is considered International Best Practice. The WAC must be justified by the safety assessment which forms part of the licence application, to ensure that the disposal facility is developed in accordance with the safety case. After a licence application is received ARPANSA will assess proposed Waste Acceptance Criteria to ensure it is appropriate and complies with requirements in *Radiation Protection Series (RPS) C-3 Code for*

[18]See https://www.arpansa.gov.au/sites/default/files/legacy/pubs/nsc/nrwmf-stakeholder-engagement.pdf

	Disposal Facilities for Solid Radioactive Waste 2018. As the independent regulator, ARPANSA has no role in the preparation of a siting licence application by ARWA including establishing timelines. ANSTO does not produce High-Level Waste through any of its operations. Radioactive waste in Australia is classified using *the ARPANSA Guide for Classification of Radioactive Waste - Radiation Protection Series – RPS G4 (October 2020)* based on *IAEA General Safety Guide No GSG-1 Classification of Radioactive Waste (2009)* Spent fuel elements from the OPAL research reactor (and previously from the HIFAR research reactor) are sent for reprocessing overseas by Australian government agreement, to recycle fissile materials and process the material into a form that is safer for transport and storage/disposal, which is then returned to Australia as ILW (lower classified waste). Under RPS-G4 and in line with IAEA GSG-1 the spent fuel elements are not classified as radioactive waste while stored in Australia or in transit from Australia because they are intended to be reprocessed for further use.
PS3	***CEO Succession*** The ARPANSA CEO gets the final say on a license decision (to grant a licence, to grant a licence with conditions, or refuse a licence). The current ARPANSA CEO will retire from CEO duties on 22 March 2022. The recruitment process for the next CEO of ARPANSA is undertaken by the Department of Health. The process comprises independent interviews and assessments of potential candidates by a panel of experts unrelated to ANSTO.
PS3	***2018 Report on safety at Lucas Heights*** An independent safety review of ANSTO was issued following a series of events with safety implications at the ANSTO Health (now ANSTO Health Products) facility with the most significant involving contamination of a worker who was in excess of statutory dose limits in August 2017. The independent safety review provided 85 recommendations which are published on the ARPANSA website. In December 2019, the ARPANSA CEO considered advice from the *ARPANSA Nuclear Safety Committee* and *Radiation Health and Safety Advisory Council* and approved an implementation plan for the 85 recommendations that prioritises actions based on reduction of risk and timely protection of workers. Based on the licence condition, ARPANSA requires ANSTO to report on progress of the implementation plan every six months. The most recent report was submitted to ARPANSA in January 2022.After an action is considered by ANSTO to have reached practical completion, it undergoes a review and validation process prior to reporting to ARPANSA. ARPANSA then reviews all documentation demonstrating completion.

	As of January 2022, the majority of the recommendations have been addressed and associated actions completed and validated. The remaining recommendations and associated actions are being progressed in line with agreed timeframes. The ARPANSA CEO is generally satisfied with ANSTO's actions to address the recommendations of the independent safety review and will continue to monitor progress of the implementation of actions to ensure the highest level of protection is achieved. Sub-regulation 41(3) specifies that the CEO, in deciding whether to issue a facility licence, must consider whether the applicant has shown a capacity for complying with the Regulations and the licence conditions that would be imposed under section 35 of the Act. ANSTO is the only holder of licences for nuclear installations under the Act. In previous ANSTO licence application decisions, the CEO has drawn the conclusion that ANSTO has the capacity to comply with the conditions established by the Regulations and any additional condition(s) imposed under section 35 of the Act. Conclusions regarding whether the capacity is fully utilised for fulfilling safety functions continues to be informed by a review of the compliance history, observations made from statutory inspection programmes and observations of safety culture. The nature of some events has led ARPANSA to find ANSTO in breach of the Act for failing to comply with conditions of the licence. The breaches for licences managed under ANSTO Waste Operations from 2010 to present time are summarised in Table 4 in this Regulatory Assessment Report. The number of breaches (7) is not large enough to allow firm conclusions regarding contributing factors. However, it can be noted, that only one of the breaches recorded were considered by ARPANSA to be potentially safety significant and the majority involved the requirement to update plans and arrangement documentation. Based on previous compliance records by ANSTO in general and in relation to the ANSTO waste operations licence application, the conclusion that ANSTO has the capacity to comply remains. This will continue to be monitored through ARPANSA's comprehensive statutory inspection programme.

Appendix 4 – ANSTO Response to Licence Condition 5 of the Interim Waste Store Licence and Licence Condition 14 of the ANM Licence