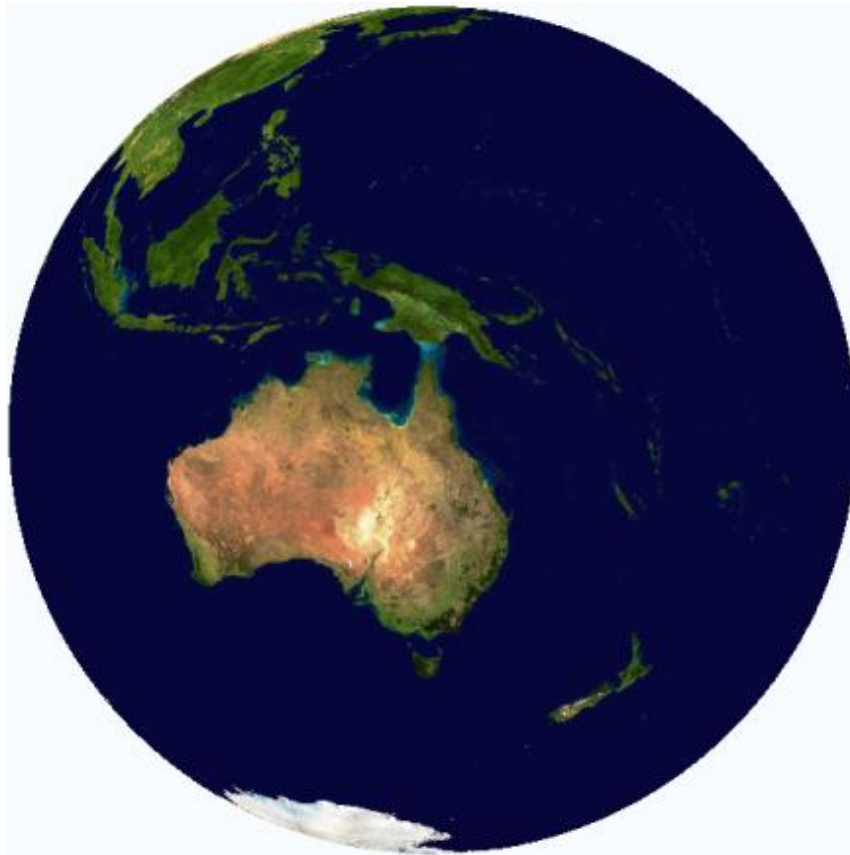


Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management



National Report of the Commonwealth of Australia

27 October 2020

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A. Introduction

This is the seventh Australian National Report, prepared for the Seventh Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the 'Joint Convention')¹. This National Report provides an update on all relevant issues under the terms of the Joint Convention. Sufficient background is included to enable it to be read as a stand-alone document; however, where noted, additional information can be found in previous National Reports.

The main developments in Australia since the sixth National Report are:

- The Australian Government continues to undertake a process to site a national facility to permanently dispose of low-level radioactive waste and temporarily store intermediate-level waste until a permanent disposal solution is developed. A preferred site in South Australia has been identified following a nationwide site selection process which commenced in early 2015.
- In April 2018, the [Australian Radioactive Waste Management Framework](#) was published, outlining the Government's approach to the long-term management of radioactive waste.
- In August 2018, a Commonwealth Parliamentary Inquiry, through the Senate Economics References Committee (the Committee), determined that the complex process associated with determining an appropriate site for a National Radioactive Waste Management Facility (NRWMF) had been well run. The report also confirmed that the site selection process had been consistent with the *National Radioactive Waste Management Act 2012* and guidance given to the communities. The Committee made a number of recommendations in its [report](#), to which the Government agreed either in full or in principle and is in the process of implementing.
- In November 2018, Australia hosted an International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) mission. The mission included participation from the Commonwealth regulator, ARPANSA, and all state and territory regulators. Relevant recommendations were that the Commonwealth Government should establish and implement a strategy to give effect to the policy principles and goals in the Australian Radioactive Waste Management Framework, and to establish a national policy and strategy for decommissioning of facilities operated by the Commonwealth. Progress on implementing these findings continues, and further information is provided in Section K.
- Over 2019-20, three jurisdictions held parliamentary inquiries into nuclear energy or amending nuclear prohibition legislation.
 - The New South Wales Parliament's Standing Committee on State Development held an inquiry into the Uranium Mining and Nuclear Facilities (Prohibitions) Repeal Bill 2019. Hearings were undertaken in November 2019, and the [report](#) was issued on 4 March 2020. The report recommended, amongst other things, that New South Wales repeal the prohibition on the issuing of a mining licence for uranium. The NSW government responded on 4 September 2020 stating that it has decided against any further debate on the Bill and that future amendments to the *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* would be initiated through NSW legislative processes.

¹ The Joint Convention entered into force for Australia on 3 November 2003.

- A Commonwealth Parliamentary Inquiry, through the House of Representatives Standing Committee on the Environment and Energy (the Standing Committee), investigated the prerequisites for any future government consideration of nuclear energy generation in Australia. The Standing Committee specifically inquired into waste management and storage for nuclear energy as a term of reference. Hearings were undertaken nationally, and build on previous inquiries into the nuclear fuel cycle including the [South Australian Nuclear Fuel Cycle Royal Commission](#) in 2016 and the 2006 [Uranium Mining, Processing and Nuclear Energy Review](#). The Standing Committee submitted its [report](#) to Parliament on 13 December 2019. One of the recommendations was that ARPANSA or other equivalent expert reviewer, lead and coordinate a whole-of-government assessment that identifies the major requirements that would need to be in place before Australia was ready to adopt nuclear energy, including waste management. The Australian Government has yet to respond to the review.
- The Victorian Legislative Council's Environment and Planning Committee held an inquiry into potential benefits to Victoria in removing prohibitions enacted by the *Nuclear Activities (Prohibitions) Act 1983* and exploring an expansion of uranium mining and other nuclear activities. The inquiry's report is expected in late 2020.
- In July 2020, the Australia Government established the Australian Radioactive Waste Agency (ARWA) to manage Australia's radioactive waste and to deliver Australia's NRWMF. ARWA's responsibilities include managing applications for NRWMF regulatory approvals in consultation with the community.
- ARPANSA has continued to publish new and updated national codes and guides in the Radiation Protection Series (RPS).

Australia has continued to focus on the ongoing challenges associated with ensuring a uniform approach to regulation and waste management practice in view of the complex nature of radiation protection legislation in Australia's federated system of government. Australia continues to address these challenges through the ongoing development and application of the *National Directory for Radiation Protection* (NDRP),² the development of a national strategy for radiation safety, and the implementation of findings from international reviews such as the Integrated Regulatory Review Service mission in 2018.

The following three challenges were identified for Australia at the Sixth Review Meeting:

- Establishment of the NRWMF as the process places a strong emphasis on voluntary land nominations and community consent.
- Achieving national harmonisation/uniformity of legislation and regulatory requirements for management of legacy sites across the federal system.
- Development of a national policy and strategy for disposal of ILW.

While progress has been made over the last three years, these remain ongoing challenges for Australia.

² The aim of the *National Directory for Radiation Protection* (NDRP) (ARPANSA, 2017a) is to provide nationally uniform requirements for the protection of people and the environment against the exposure or potential exposure to ionising and non-ionising radiation and for the safety of radiation sources, including provision for the national adoption of codes and standards. The NDRP has been developed to assist radiation protection regulators and other sectors involved in implementing radiation controls such as mine operators and occupational health and safety regulators.

Background: Australia's federal system



Figure 1 Map of Australia showing states and territories

Australia is a federation of nine jurisdictions (

Figure 1): the Commonwealth of Australia, six states [New South Wales (NSW), Victoria (VIC), Queensland (QLD), Western Australia (WA), South Australia (SA), Tasmania(TAS)], and two territories [Northern Territory (NT) and the Australian Capital Territory (ACT)].

In 1998, the Commonwealth Government (the federal government or Government of Australia) created a regulator for Commonwealth entities, the CEO of ARPANSA, to regulate the radiation protection and nuclear safety activities of Commonwealth entities, regardless of the jurisdiction in which the operations are undertaken. These entities include, but are not limited to, the Department of Defence, the Australian Nuclear Science and Technology Organisation (ANSTO) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). In addition, one of the functions of the CEO of ARPANSA is to promote national uniformity in radiation protection across all jurisdictions.

The Commonwealth Department of Industry, Science, Energy and Resources (DISER) administers the National Radioactive Waste Management Act 2012 and, as such, is responsible for the identification of a site on which the NRWMF will be located. On 21 July 2020, the Australian Government announced the establishment of the Australian Radioactive Waste Agency (ARWA), which will be dedicated to managing Australia's radioactive waste in accordance with domestic and international regulations and best practice. In addition to establishing the NRWMF, ARWA will coordinate Australia's radioactive waste inventory, progress long-term work to site a separate, permanent location for disposal of intermediate level waste, as well as other waste management functions outlined in the Australian Radioactive Waste Management Framework. ARWA will initially sit within DISER and will later become a non-corporate Commonwealth entity.

Assessment of Australia's compliance with the Joint Convention

The governments of the Commonwealth of Australia and the states and territories reconfirm that each has in place the framework of appropriate law, and the legislative, regulatory and administrative measures, including a system of authorisation, monitoring and inspections, necessary for implementing all obligations under this Joint Convention.

It should be noted that while Australian states and territories supported ratification of the Joint Convention, compliance of the states and territories of Australia is not subject to separate Commonwealth Government legislation. The Commonwealth Government is committed to further development of a framework governing the long-term management of radioactive wastes arising from its activities, including, as appropriate and necessary, long-term storage and disposal.

Most Australian jurisdictions do not define radioactive waste in their legislation and many do not classify radioactive materials in long-term storage as waste as defined by the Joint Convention. However, each jurisdiction has storage arrangements for radioactive materials and radioactive waste. This report can only assess compliance with the Joint Convention in relation to those facilities containing radioactive materials that have been characterised as waste for the purpose of the Joint Convention.

B. Scope of Report

This report outlines Australia's policies and practices associated with the safety of the management of spent fuel and radioactive waste.

As a contracting party to the Joint Convention, Australia declares that:

- Reprocessing activities are not included in this report. No spent fuel reprocessing facilities exist in, or are proposed for, Australia.
- Wastes that contain only naturally occurring radioactive materials (NORM) that do not originate from the nuclear fuel cycle are not declared as radioactive waste for the purpose of the Convention.
- Radioactive wastes managed within military programs are not declared as radioactive waste for the purposes of the Convention and no details of legacy radioactive waste held by Defence are given in this report. Australia has no spent fuel within military or Defence programs.

However, wastes containing only naturally occurring radioactive materials, and radioactive waste held by Defence, are managed in accordance with applicable Australian legislation. This means their management takes international best practice into account, is consistent with IAEA general safety standards and also with specific national and international standards for radioactive waste management.

C. Policies and Practices

Article 32 Reporting (1)

Spent fuel management policy

Australia's policy on spent fuel management has not changed since the 2017 National Report. Australia sends spent nuclear fuel to France for reprocessing. The spent fuel is not reprocessed in isolation, but rather in batches with waste from other countries. In accordance with contractual obligations, the resulting intermediate level waste (ILW) is returned to Australia at a mutually agreed time for storage. Careful measurements are undertaken to ensure Australia receives processed waste with proportionate activity to the spent fuel sent.

In line with international conventions, reprocessed waste returned to Australia is considered Australian waste. The *National Radioactive Waste Management Act 2012* expressly includes this waste in the definition of waste that can be sent to the proposed NRWMP for storage.

Spent fuel management practices

In Australia, the Commonwealth Government is the only jurisdiction in which spent fuel is managed. Practices remain unchanged since the 2017 National Report.

The OPAL reactor commenced operation in 2006 and is Australia's only operating reactor. OPAL is a 20 MW thermal, open pool, light water reactor designed for low-enriched uranium (LEU) aluminium-clad fuel. The reactor currently operates on uranium silicide (U_3Si_2 -Al) fuel.

OPAL's spent fuel is stored onsite until it is periodically transported to La Hague, France, for reprocessing, with the waste arising from reprocessing to be returned to Australia as ILW. The first return shipment occurred in mid-2018. Assuming up to 30 spent fuel elements arising per year, it is envisaged that, on average, there will be one overseas shipment of spent fuel every six or seven years. The returned ILW is held in interim storage at ANSTO pending the availability of an appropriate storage or disposal facility.

The High Flux Australian Reactor (HIFAR), a 10 MW research reactor, was permanently shut down in January 2007. As stated in previous National Reports, ANSTO and the United Kingdom (UK) Nuclear Decommissioning Authority enacted a substitution agreement in 2013, under which ANSTO gave up title to the reprocessed residues from the reprocessing of 114 HIFAR spent fuel elements at Dounreay. In exchange, ANSTO agreed to take a radioactive equivalent to the Dounreay waste in the form of four canisters of CSD-V vitrified material currently held at Sellafield. Planning for the return of this material is underway. The vitrified waste from the UK is planned to be transported in a TN-81 dual purpose package, and timing of the removal from storage and transportation of the vitrified waste is under discussion with the UK. It is anticipated that the shipment to Australia will occur before 2023, resulting in the full disposition of spent fuel from the HIFAR reactor.

Radioactive waste management policy

The policy objective of the Commonwealth Government is to ensure radioactive waste is managed in a safe, secure and sustainable manner over generations. The Commonwealth Government is committed to ensuring there is adequate allocation of financial and human resources to achieve this over time.

Implementation of this policy objective will be achieved through the establishment of a national facility that is based on international best practice, conforms to international treaty obligations, and can accept the highest achievable proportion of Australia's current and future radioactive waste. The preferred approach for the NRWMF is to have appropriate functionality for:

- Low-level waste (LLW) disposal to cater for the volume of waste reasonably foreseeable for the next 100 years, with a sufficient period of institutional control without causing undue reliance on future generations or harm to the environment.
- The temporary storage of ILW for a period of time sufficient for the Commonwealth Government to establish a permanent disposal facility.

The Australian Radioactive Waste Management Framework sets out the key elements for the long-term management of Australia's radioactive waste, including the storage or disposal of this waste at suitably sited facilities, after being categorised in accordance with the national classification scheme. This is consistent with international practice. A key responsibility of ARWA is to develop a final disposal pathway for ILW as per international obligations and best practice. Initial work has already commenced to this end, through a joint ANSTO and CSIRO project to assess the potential for the development of a demonstration borehole and on an assessment of the surface handling requirements for eventual disposal of suitable intermediate-level waste. CSIRO is developing safety assessments and support is being provided by the SANDIA National Laboratory in the United States, which has extensive research experience in borehole disposal of nuclear waste.

In November 2018, Australia hosted an Integrated Regulatory Review Service (IRRS) mission. One finding from the mission was for Australia to establish and implement a strategy to give effect to the policy principles and goals in the Australian Radioactive Waste Management Framework. The establishment of ARWA will help progress the implementation of this finding, and further information is provided in Section K.

Radioactive waste management practices

Radioactive waste management practices are largely unchanged since the 2017 National Report. Low and intermediate-level radioactive waste continues to be stored by Commonwealth, state and territory government regulators and licence holders at over one hundred locations around Australia in both rural areas and urban centres.

As described in the 2017 National Report, ANSTO manages wastes arising from its research reactor operation, radioisotope production, and research activities in accordance with nationally and internationally accepted guidance. Waste volumes are minimised by conditioning and/or processing and releasing decayed and decontaminated material that is below criteria for discharge based on rigorous assessment and cautious assumptions.

The majority of medical waste from hospitals is short-lived and managed via delay and decay facilities at the point of generation until it can be legally disposed of or discharged due to being below regulatory

concern. It is then managed with other non-radioactive medical wastes. Some of the major hospitals utilise delay tanks for control of liquid effluent.

Although all Australian regulators have small stores for abandoned sources, legacy wastes or wastes that have arisen within their jurisdiction, many individual producers currently have responsibility for managing their own radioactive waste. As a result, most users of radioactive materials are encouraged to return disused sources to the supplier. If this is not possible, licence holders are expected to store their radioactive waste until it decays to a point below which it is no longer of regulatory concern, or until such time as an appropriate avenue for disposal becomes available.

The Australian Government continues to develop the detailed business case and the costings estimates for the construction and operation of a NRWMF in consultation with expert entities. Following acquisition of a site, design work will continue and the variabilities and uncertainties in the business case and associated costings estimates will be refined.

Following four years of community consultations and technical assessments of three shortlisted sites, a site at Napandee in Kimba, South Australia, has been identified to host Australia's National Radioactive Waste Management Facility. The Australian Government was satisfied a facility at Napandee will safely and securely manage radioactive waste and that the local community has shown broad community support for the project and economic benefits it will bring. The National Radioactive Waste Management Amendment (Site Specification, Community Fund and Other Measures) Bill 2020 (the Bill) specifying Napandee as the site to host the NRWMF was introduced in February 2020 to ensure the Parliament has an opportunity to consider the merits of the site selection, rather than it being the decision of a single Minister. Subject to passage of the Bill, the site in Kimba, South Australia, will be acquired by the Commonwealth following Royal Assent.

Criteria used to define and categorise radioactive waste

RPS G-4 *Safety Guide: Classification of Radioactive Waste* (ARPANSA, 2020b) is based on the IAEA *General Safety Guide: Classification of Radioactive Waste* (GSG-1) (2009), adapted for the Australian situation. This Safety Guide provides a national classification system for radioactive waste. While the guidance is advisory, all jurisdictions have indicated their intention to adopt the scheme.

A categorisation of radioactive waste for operational purposes, based on Australian holdings, has also been developed as part of the safety guide: RPS 16 *Predisposal Management of Radioactive Waste* (ARPANSA, 2008b). In most cases, wastes are categorised for management purposes as long-lived or short-lived, liquid or solid, and sealed or unsealed. In some jurisdictions, waste is regulated according to whether it complies with the criteria in the NDRP for disposal or discharge of very low-level waste for which no authorisation is required (ARPANSA, 2017a) or if not, then under a special licence.

The 2018 IRRS mission identified that there was no national protocol for clearance in Australia and recommended that "The Commonwealth Government, in conjunction with the state and territory governments, should progress the adoption and implementation of uniform clearance levels." In response to this recommendation, Australia has committed to the development of regulatory guidance on clearance level concepts and mechanisms to apply the clearance levels. Furthermore, the NDRP (under revision) will adopt the clearance levels in Schedule 1 of the *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3* (GSR Part 3) (2014).

Uniform provisions for exemption based on international guidance from the IAEA have been agreed by all jurisdictions as part of the NDRP. An amendment to ensure application of exemptions to bulk quantities of raw material such as might be encountered in mining and mineral processing industries has been adopted into the NDRP. Exposures that are not amenable to control are excluded.

D. Inventories and Lists

Article 32 Reporting (2)

List of spent fuel management facilities

The ANSTO site at Lucas Heights is the only site in Australia with spent fuel management facilities. These spent fuel management facilities are described in Section C of this report.

Spent fuel inventory

Inventory of OPAL spent fuel elements located at ANSTO:

| <i>Material description</i> | <i>Number*</i> | <i>Mass of Uranium (total) kg</i> |
|-----------------------------|----------------|-----------------------------------|
| OPAL spent fuel elements | 151 | 338 |

* As at 22/09/2020

Inventory of OPAL spent fuel elements (sent overseas for re-processing with a contractual requirement for the return of waste to Australia):

| <i>Location</i> | <i>Number</i> | <i>Mass of Uranium (total) kg</i> |
|-------------------------|---------------|-----------------------------------|
| Orano, La Hague, France | 236 | 506 |

Inventory of HIFAR spent fuel elements (sent overseas for re-processing with a contractual requirement for the return of waste to Australia):

| <i>Location</i> | <i>Number</i> | <i>Mass of Uranium (total) kg</i> |
|-------------------------------|---------------|-----------------------------------|
| UKAEA, Dounreay, Scotland, UK | 114 | 16 |

Radioactive waste management facilities

Commonwealth Radioactive Waste Management Facilities

ANSTO operates several facilities for managing liquid and solid radioactive waste arising from its routine operations. These facilities have remained the same as reported in the 2017 National Report, with the following exceptions:

- The storage of low-level solid waste has been extended next to the super compactor facility as the existing infrastructure is at capacity
- The storage of intermediate-level solid waste has been extended in the existing building as the capacity was being reached

- The Little Forest Legacy Site (referred to as Little Forest Burial Ground in previous National Reports) has been studied and a best available technique assessment of medium and long term management solutions has been undertaken. Initial assessment reports on the site are currently under review by ARPANSA.

In addition to the facilities managed by ANSTO, the Commonwealth Government is also responsible for:

- Eight small radiation waste stores at four CSIRO sites located around Australia
- A store for the Commonwealth Government's radioactive waste located at Evatt's Field on the Woomera Prohibited Area, South Australia. It contains approximately 10,000 200 litre drums of predominantly contaminated soil remediated from a former research site that undertook studies into uranium and thorium ore processing
- A small waste store located at ARPANSA's Yallambie (Victoria) site.

State and Territory Radioactive Waste Management Facilities

As detailed in the 2017 National Report, state and territory governments manage a number of facilities across Australia for the interim storage of radioactive waste.

The Mt Walton East Intractable Waste Disposal Facility (IWDF) is used for the disposal of intractable (chemical and radiological) waste generated within Western Australia. Additional details are provided in the 2017 National Report.

A proposal is currently being assessed for a privately-owned and operated near-surface facility for low-level radioactive waste and chemical waste generated in Australia. The proposed site is located at Sandy Ridge in Western Australia, approximately 5.5 kilometres to the west of the Mt Walton site. It is anticipated that the Sandy Ridge site will accept NORM for disposal from 2020, and plan to accept disused sealed radioactive sources at a later stage.

Waste facilities at current mining operations and from past practices

| <i>Mining operation</i> | <i>Waste structures</i> |
|---|--|
| Ranger Uranium Mine (Northern Territory) - mining has ceased and processing of stockpiles will continue until 2021 | Tailings dam, pit in-fill, water retention ponds, and solid waste disposal stockpiles |
| Beverley (including Beverley North & Four Mile) Uranium Project (South Australia) - operational | Evaporation ponds, liquid waste re-injection wells and low-level radioactive waste disposal facilities |
| Honeymoon Uranium Project (South Australia) - operational | Evaporation ponds, liquid waste re-injection wells and low-level radioactive waste disposal facilities |
| Olympic Dam Mine (South Australia) – operational | Tailings dams, associated evaporation ponds and a solid waste disposal pit |
| Port Pirie Plant (South Australia) – past practice | Uranium and thorium tailings dams |

| | |
|--|--|
| Radium Hill Mine (South Australia) – past practice | Tailings and a low-level waste repository |
| South Alligator Disposal Facility (Northern Territory) – disposal facility | Near-surface containment facility for abandoned uranium mining and milling tailings and contaminated materials from past practices in the South Alligator region |

Radioactive waste management inventory

Australia has approximately 4146 m³ of radioactive waste suitable for near-surface disposal within civilian programs awaiting disposal. This total consists of the following approximations:

- 2100 m³ of lightly contaminated soil from ore-processing research
- 1970 m³ of operational waste stored at the ANSTO site
- 6 m³ waste stored at CSIRO sites
- 70 m³ of miscellaneous waste including contaminated items, medical equipment and luminous signs.

It should be noted that these figures are estimates of waste volumes for disposal. Waste that has already been disposed is not included in the above volume estimates. This includes waste disposed at:

- Mt Walton East IWDF in Western Australia (near-surface disposal facility)
- South Alligator Disposal Facility in the Northern Territory (UMMT)
- Radium Hill Low-Level Radioactive Waste Repository in South Australia (near-surface disposal facility)
- Maralinga in South Australia (remediated nuclear weapons test site)
- Little Forest Legacy Site managed by ANSTO, New South Wales (legacy waste).

The current estimated inventory of radioactive waste in Australia that is not suitable for near-surface disposal consists of a waste volume of approximately 535.1 m³. Of this:

- 323 m³ is from irradiation cans, ion exchange resins (HIFAR and OPAL), irradiated aluminium cut from HIFAR spent fuel assemblies, HIFAR coarse control arms and general waste from radiopharmaceutical production
- 165 m³ is uranium and thorium residues stored at ANSTO
- 21 m³ is liquid waste from production at ANSTO of Mo-99 for radiopharmaceuticals
- 6.6 m³ is ILW returned from overseas following reprocessing, currently stored at ANSTO³
- 3.3 m³ is waste stored CSIRO sites
- 16.2 m³ is miscellaneous waste held at various storage sites in Australia.

Annex A includes an inventory of radioactive waste stored in facilities in Australia and waste that has been disposed of at the Little Forest Legacy Site, South Alligator Disposal Facility, Maralinga and Mt Walton East

³ 3.6 m³ is vitrified ILW stored in a TN-81 cask, 3 m³ is cemented technological waste. Additional details regarding the ILW held in the TN-81 cask can be found at:

https://www.arpsa.gov.au/sites/default/files/legacy/pubs/regulatory/ansto/SOR_operationIWS.pdf

facilities. Data has been provided by the relevant regulatory authorities with responsibility for maintaining the inventories of radioactive waste in their jurisdictions. Volumes of sealed sources, sources of unknown activity and sources of unknown radionuclides are not included. Where possible, the activities of waste with mixed radionuclides have been apportioned to individual nuclides. Inventories of sealed sources requiring disposal, radioactive waste in storage at ANSTO's radioactive waste management facility and of wastes from the mining and milling of radioactive ores are also provided.

There have been no burials at the Mt Walton East IWDF in Western Australia since 2011 therefore the inventory is unchanged. A disposal campaign is planned for the first half of 2021.

Nuclear facilities in the process of being decommissioned

There are no nuclear facilities currently being decommissioned in Australia.

E. Legislative and Regulatory System

Developments since the Sixth Review Meeting:

Australia has continued to develop national guidance relating to radioactive waste management as part of the national uniformity process, in which standards are developed, referenced in the NDRP and adopted by Australian regulators.

A number of Codes and Guides have been published since the 2017 National Report. They are as follows:

- **RPS C-1 (Rev.1) Code for Radiation Protection in Planned Exposure Situations (ARPANSA 2020a)**
This Code sets out the requirements in Australia for the protection of occupationally exposed persons, the public and the environment in planned exposure situations. The primary means of controlling exposure in planned exposure situations is by good design of facilities, equipment, operating procedures and through training; all of which contribute to optimisation of protection.
The edition of RPS C-1 has been amended to include the dose limits for age group of 16 years to under 18 years; it replaces the 2016 edition of RPS C-1.
The 2016 edition remains current in some jurisdictions pending legislative changes necessary for adoption of this latest edition.
- **RPS C-2 (Rev.1) Code for the Safe Transport of Radioactive Material (ARPANSA 2019a)**
This Code sets out the objectives to establish uniform requirements for the transport of radioactive material in Australia by road, rail and those waterways not covered by maritime legislation. It is intended to be adopted into legislation by all Australian jurisdictions.
This edition of RPS C-2 adopts the International Atomic Energy Agency Regulations for the Safe Transport of Radioactive Material 2018 Edition (SSR-6, Rev. 1); it replaces the 2014 edition of RPS C-2.
- **RPS C-3 Code for Disposal Facilities for Solid Radioactive Waste (ARPANSA 2018a)**
This Code describes the objectives for protection of human health and of the environment, drawing upon international best practice in relation to radiation protection and radioactive waste safety. The safety case and supporting safety assessment provide the basis for the demonstration of safety and for authorisation of all stages of a radioactive waste facility. They will evolve with the development of the disposal facility, and will assist and guide decisions on its siting, design, operation and closure.
This publication, together with RPS C-1 Rev.1, supersedes the Radiation Health Series (RHS) No. 35 Code of practice for the near-surface disposal of radioactive waste in Australia (1992) (NHMRC 1992).
- **RPS C-6 Code for Disposal of Radioactive Waste by the User (ARPANSA 2018b)**
This code sets out the levels for disposal to landfill and discharge to sewers and the atmosphere, below which no authorisation is required from the relevant regulatory authority. It is intended that RPS C-6 can be incorporated into regulatory instruments to ensure a uniform approach to the disposal and discharge of radioactive material across Australia.
- **RPS 11 Code of Practice for the Security of Radioactive Sources (ARPANSA 2019g)**

This Code sets out the security requirements to be implemented by persons dealing with sealed radioactive sources. An amendment to this Code was published in 2019.

- RPS G-3 Guide for Radiation Protection in Emergency Exposure Situations (ARPANSA 2019b)

This Guide describes the objectives for protection of human health, drawing upon international best practice (IAEA's General Safety Requirements Part 7) in relation to planning, preparedness, response and transition in nuclear or radiological emergencies. The Guide is published in 2 parts. Part 1 of the Guide establishes a national framework and sets the relevant safety requirements for protection of human health in emergency exposure situations. Part 2 of the Guide sets out guidance for the planning, preparedness, response and transition required in order to effectively respond to a nuclear or radiological emergency.

This publication supersedes RPS 7 Recommendations for Intervention in Emergency Situations Involving Radiation Exposure (ARPANSA 2004).

- *Guide for Classification of Radioactive Waste* (RPS G-4) (ARPANSA 2020b)

The *Safety Guide for Classification of Radioactive Waste* (RPS 20) (ARPANSA 2010) has been amended to ensure consistency with IAEA's *General Safety Guide No. GSG-1* (2009). The waste classification scheme has not changed in the amended 2020 version of the Guide and is consistent with the IAEA GSG-1 scheme.

Article 18 Implementing Measures

Each jurisdiction has taken the necessary administrative steps to enable its regulatory body to undertake functions allocated to it under the enabling legislation. Details of the legislative and regulatory framework and regulatory body for each jurisdiction are contained below under Article 19. Annex B contains a list of the statutory instruments currently in force.

Article 19 Legislative and Regulatory Framework

Establishing and maintaining a legislative and regulatory framework

The objective of the Australian Government's radiation protection legislation includes protection of the health and safety of people and the environment from the harmful effects of radiation.

The legislation in each jurisdiction:

- Establishes a regulatory body accountable to a Minister of the Crown and through that Minister to the Parliament
- Includes requirements to comply with accepted national standards for occupational exposure limits, public dose limits, disposal of radioactive waste, transport of radioactive material, and landfill, air and waterborne discharge limits (discharge limits are set in the RPS C-6)
- Requires reporting of incidents and exposures above dose limits
- Gives the regulatory body powers to monitor and enforce compliance with legislative requirements.

A national regulatory framework for protection of the environment is established under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)⁴.

The *Australian Radioactive Waste Management Framework* released in 2018 describes the current arrangements and sets out the principles, responsibilities and long term goals for radioactive waste management in Australia. It also provides for the establishment of a centralised waste management function within the Commonwealth Government to oversee technical aspects of the construction and operation of the NRWMF and the staged relocation of radioactive waste to the NRWMF.

For radioactive waste that is also nuclear material, the security systems and infrastructure protecting the nuclear material are required to comply with the *Amendment to the Convention on the Physical Protection of Nuclear Material* (IAEA, 2016) and the IAEA guidance document *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* (IAEA INFCIRC/225/Rev.5, 2011). Nuclear material is managed through permits issued under s13 of the *Nuclear Non-Proliferation (Safeguards) Act 1987*, administered by the Australian Safeguards and Non-Proliferation Office (ASNO).

Australian jurisdictions are working together to further develop and implement a uniform national set of policies and practices for the safety of radioactive waste management. The NDRP contains the agreed minimum regulatory requirements for all Australian jurisdictions. The NDRP is the principal means for establishing consistency in radiation protection regulation across the various Australian jurisdictions. It provides an overall agreed framework for radiation safety, together with clear regulatory statements to be adopted by the Commonwealth Government and the states and territories. The NDRP is developed collaboratively through the Radiation Health Committee. This Committee, established under the ARPANS Act, includes radiation regulators from each jurisdiction. The NDRP is a dynamic document that evolves as nationally agreed positions are reached by jurisdictions and are made effective by adoption into jurisdictional laws or by inclusion as conditions of jurisdictional licenses. Additions to the NDRP require approval from the health ministers of the Commonwealth, state and territory governments before being adopted in the respective jurisdiction.

Safety requirements and regulations for radiation safety in Australia

Nationally accepted standards are imposed in each jurisdiction by way of Regulations made under the relevant Acts that establish the jurisdiction's regulatory framework. Standards may also be imposed as specific conditions of licence or registration. The key principles and requirements are detailed in the 2017 National Report.

Below is a table identifying the standards relevant to radioactive waste management and spent fuel management by topic, and the IAEA or ICRP equivalent where applicable. Copies of the Australian standards are available at <https://www.arpana.gov.au/regulation-and-licensing/regulatory-publications>.

⁴ Further information on this framework is available at www.ea.gov.au/epbc/index.html

| <i>Regulatory topic</i> | <i>Australian standard</i> | <i>International equivalent</i> |
|--|--|--|
| Occupational and public exposure and dose limits | RPS F-1 <i>Fundamentals for Protection against Ionising Radiation</i> (ARPANSA 2014a) RPS C-1 (Rev.1) <i>Code for Radiation Protection in Planned Exposure Situations</i> (ARPANSA 2020a) | IAEA Fundamental Safety Principles SF-1 (IAEA 2006) IAEA General Safety Requirements GSR Part 3: <i>Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards</i> (IAEA 2014) <i>The 2007 Recommendations of the International Commission on Radiological Protection</i> (ICRP Publication 103, 2007) |
| Transport of radioactive material | RPS C-2 (Rev. 1) <i>Code for the Safe Transport of Radioactive Material</i> (ARPANSA 2019a) | IAEA <i>Regulations for the Safe Transport of Radioactive Material 2018 Edition</i> (SSR-6 (Rev. 1), IAEA 2018) |
| Mining and milling of radioactive ores | RPS 9 <i>Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing</i> (ARPANSA 2005) *Currently RPS 9 is under review to accommodate the IAEA's General Safety Guide: Occupational Radiation Protection (GSG-7, IAEA 2018) | IAEA Safety Standard Series: <i>Safety Guide Management of Radioactive Waste from the Mining and Milling of Ores</i> (WS-G-1.2, IAEA 2002) IAEA Safety Standard Series: <i>Safety Guide Occupational Radiation Protection in the Mining and Processing of Raw Materials</i> (RS-G-1.6, IAEA 2004) IAEA Safety Standard Series: <i>Safety Guide Application of the Concepts of Exclusion, Exemption and Clearance</i> (RS-G-1.7, IAEA 2004) |
| Disposal of radioactive waste | RPS C-3 <i>Code for Disposal Facilities for Solid Radioactive Waste</i> (ARPANSA 2018a) <i>Regulatory Guide: Applying for a licence for a radioactive waste storage or disposal facility</i> (ARPANSA 2019f) RPS C-6 <i>Code for Disposal of Radioactive Waste by the User</i> (ARPANSA 2018b) | IAEA Specific Safety Requirements: <i>Disposal of Radioactive Waste</i> (SSR-5, IAEA 2011) IAEA General Safety Guide: <i>Regulatory Control of Radioactive Discharges to the Environment</i> (GSG-9, IAEA 2018) |
| Classification of Radioactive Waste | RPS G-4 <i>Safety Guide: Classification of Radioactive Waste</i> (ARPANSA, 2020b) | IAEA General Safety Guide: <i>Classification of Radioactive Waste</i> (GSG-1, IAEA 2009) |

| Regulatory topic | Australian standard | International equivalent |
|---|--|--|
| Transition from emergency to planned or existing exposure situation | RPS G-3 <i>Guide for Radiation Protection in Emergency Exposure Situations – The Framework Part 1</i> (ARPANSA 2019b) RPS G-3 <i>Guide for Radiation Protection in Emergency Exposure Situations – Planning, Preparedness, Response and Transition Part 2</i> (ARPANSA 2019b) | IAEA General Safety Requirements GSR Part 7, <i>Preparedness and Response for a Nuclear or Radiological Emergency</i> (IAEA 2015) |
| Remediation of contaminated site and associated waste management | RPS G-2 <i>Guide for Radiation Protection in Existing Exposure Situations</i> (ARPANSA 2017b) | IAEA General Safety Requirements GSR Part 3: <i>Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards</i> (IAEA 2014) |
| Decommissioning | Regulatory Guide: Decommissioning of controlled facilities (ARPANSA 2019c) | IAEA Specific Safety Guide: <i>Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities</i> (SSG-47, IAEA 2018) |

Licensing system, including prohibition without a licence, for spent fuel and radioactive waste management activities

Spent fuel

Regulation of spent fuel is only undertaken within the Commonwealth jurisdiction by the Commonwealth Government regulator, the CEO of ARPANSA. Spent fuel management is regulated under facility licences authorising the operation of the relevant facilities. Commonwealth Government legislation prohibits dealing with controlled material or conduct relating to a controlled facility without a licence.

Radioactive waste management activities

The legislative framework established by all Australian jurisdictions prohibits the use of non-exempt radioactive material (including radioactive waste) and apparatus without an authorisation or licence and requires the material/apparatus and premises to be registered, or the subject of a licence condition requiring a detailed inventory to be maintained and amenable to regulatory inspection. In most jurisdictions, licensing is also required where premises are operated by the regulator, such as stores for radioactive waste. Radiation regulators in most jurisdictions also licence the transport of radioactive material.

Naturally occurring radioactive material (NORM)

Guidance for deciding whether natural sources should be controlled is provided in the RPS 15 *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM)* (ARPANSA, 2008a). This is consistent with the IAEA Safety Reports Series No. 49 *Assessing the Need for Radiation Protection Measures in Work Involving Minerals and Raw Materials* (2006). Additional detail on NORM management in Australia is provided in previous National Reports.

Radioactive ores

Radiation protection regulation of the mining and milling of uranium ores is undertaken by radiation regulators in the states or territories where such ores are mined. Additional detail is provided in previous National Reports.

Institutional control, regulatory inspection, documentation and reporting

Through implementation into respective jurisdictional laws, users of radioactive materials, including radioactive waste, are subject to the responsibilities detailed in RPS C-1 Rev. 1 (ARPANSA, 2020) RPS C-3 (ARPANSA 2018a) and RPS 9 (ARPANSA 2005). This includes requirements for institutional control, documentation, record keeping and reporting.

Each jurisdiction has legislation in place to provide powers to conduct inspections and to monitor and enforce compliance with regulations. For example, Part 7 of the ARPANS Act prescribes powers available to the Agency to conduct inspections⁵ to monitor and enforce compliance with the Act, Regulations⁶ and licence conditions. ARPANSA's Regulatory Activities Policy⁷ provides the framework within which ARPANSA's regulatory activities are carried out.

When conducting inspections, ARPANSA uses performance objectives and criteria (PO&C)⁸. This aims to support a consistent, transparent and rigorous approach to inspection that is consistent with the risk of a facility or source. The PO&Cs provide a comprehensive list of features, controls and behaviours that contribute to safety. When considered with relevant codes and standards, the PO&Cs assist the detailed planning and conduct of each inspection and support a qualitative assessment of safety.

The ARPANS Regulations require licence holders to review and update any plans and arrangements for managing a controlled facility, controlled material or controlled apparatus at least once every 3 years, to ensure the health and safety of people and protection of the environment. Section 36 of the ARPANS Act

⁵ A copy of ARPANSA's Inspection Manual is also available for viewing at:
<https://www.arpansa.gov.au/regulation-and-licensing/regulation/our-regulatory-services/how-we-regulate>

⁶ A copy of the ARPANS Act and Regulations is available at:
www.arpansa.gov.au/regulation-and-licensing/regulation/about-regulatory-services/why-we-regulate/arpans-legislation 3

⁷ The Regulatory Activities Policy is at <https://www.arpansa.gov.au/about-us/our-policies/regulatory-activity-policies>

⁸ The Performance Objectives & Criteria are at <https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/inspections/performance-objectives-and-criteria>

allows the CEO of ARPANSA to impose additional, or vary existing licence conditions. ARPANSA has published guidelines⁹ on how Commonwealth licence holders should report their compliance with the Act, the Regulations and licence conditions.

Further detail, including examples of the regulatory requirements for the operation of the Mt Walton East IWDF and for the mining of radioactive ores in South Australia, can be found in the 2017 National Report.

ANSTO radioactive waste and spent fuel

Under the ARPANS Act, ANSTO must comply with the following statutory conditions set out in the subordinate Regulations in the management of waste facilities and spent fuel:

- The licence holder must investigate suspected breaches of licence conditions. If a breach is identified, the licence holder must rectify the breach and any of its consequences as soon as reasonably practicable. The licence holder must also inform the CEO about the breach as soon as reasonably practicable.
- The licence holder must take all practicable steps to prevent accidents involving controlled material, controlled apparatus or controlled facilities described in the licence. If an accident happens, the licence holder must take all practicable steps to control the accident, minimise its consequences (including injury to any person and damage or harm to the environment), tell the CEO about the accident within 24 hours of it happening and submit a written report within 14 days.

Mt Walton East Intractable Waste Disposal Facility

The safe operation of the Mt Walton East IWDF in Western Australia is assessed regularly as required by the conditions of the authorisation. The monitoring is undertaken by an approved licensed Radiation Safety Officer (RSO) who has qualifications and experience in health physics. The RSO reports the results of monitoring and any other factors of radiological concern after any site changes in writing to the Radiological Council, including the inventory of material for disposal and sealing of the trenches for disposal campaigns.

The site operator must hold a registration under the *Radiation Safety Act 1975* (Western Australia). The conditions imposed on the registration cover aspects of packaging, transport, radiation monitoring, operational requirements and reporting. Direct reference is made to such documents as the *Radiation Safety (General) Regulations 1983*, *Code for the Safe Transport of Radioactive Material (2008)* and the near-surface disposal code (NHMRC, 1992). Additionally, reference is made to documentation specifically developed for the IWDF. Work is currently underway to transition to requiring compliance with *RPS C-3* which has replaced the *Code of practice for the near-surface disposal of radioactive waste in Australia (1992)* (NHMRC 1992), and to *RPS C-2 (rev.1)*.

Each disposal campaign needs to be individually approved by the Radiological Council and the Environmental Protection Authority of Western Australia.

⁹ These guidelines can be found at:
<https://www.arpana.gov.au/sites/g/files/net3086/f/legacy/pubs/regulatory/guides/OS-COM-SUP-274A.pdf>

Enforcement of regulations and licence conditions

Legislation in each jurisdiction provides for authorisations to regulate various dealings with radiation sources. The holding of the relevant authorisation is a mandatory condition of engaging in a particular dealing, unless exemptions apply. The authorisation can be effected through a single authorisation covering various dealings or through separate authorisations covering particular dealings.

Legislation in each jurisdiction enables the regulator to refuse to grant an authorisation if:

- the applicant is not a fit and proper person
- it is necessary to do so in the interests of public health and safety
- the proposed use of radiation is inappropriate or unjustified.

Legislation in each jurisdiction also enables the regulator to suspend, vary or cancel an authorisation in specific situations.

Where a regulator makes a decision to suspend, vary or cancel an authorisation, the NDRP states that all other relevant regulators within and outside of its jurisdiction should be advised of the decision.

Compliance is assessed by site inspections, and routine and non-routine reporting by the licence holder. The frequency and extent of inspections depend on the risk posed by the facility, equipment or material concerned and past conduct of the licence holder. The regulatory body in each jurisdiction has legislative powers to undertake inspections, gather evidence and enforce conditions of licence.

Clear allocation of responsibilities

As stated in the 2017 National Report, the regulatory frameworks require that a ‘responsible person’ be primarily responsible for radiation protection and safety, and that regulators establish and enforce standards through a system of regulation. Responsible persons¹⁰ are required to make notifications, or gain approvals and authorisations from regulators before conducting a practice. Authorisations include registrations, licences and accreditations.

In jurisdictions where mining of radioactive ores takes place, radiation regulation can be undertaken in conjunction with regulators of mining and transport. Additional detail outlining these arrangements is provided in the 2017 National Report.

¹⁰ The definition of a responsible person is stated as the following in RPS C-1 Rev.1 (2020).

In relation to any radiation source, prescribed radiation facility or premises on which radiation sources are stored or used means the legal person: (a) having overall management responsibility including responsibility for the security and maintenance of the radiation source, facility or premises (b) having overall control over who may use the radiation source, facility or premises (c) in whose name the radiation source, facility or premises would be registered if this is required.

Article 20 Regulatory Body

Regulatory authorities (responsibilities, competence and resources)

The regulatory authority established in each jurisdiction for the purpose of implementing their radiation safety regulations is also designated with implementation and maintenance of the requirements of this Joint Convention.

All jurisdictions have reported that regulatory authority staff possess the essential skills, knowledge and expertise to assess the safe management of radioactive materials and waste within their jurisdiction and to conduct the necessary inspections for regulatory compliance monitoring. The staffing of radiation protection regulators in each jurisdiction varies from two up to about 20 staff depending on the population and scale of operations within that jurisdiction. The majority of license holders in state and territory jurisdictions are medical users of radiation sources.

The nine radiation protection regulatory bodies within Australia are as follows:

| <i>Jurisdiction (population)</i> | <i>Radiation protection regulatory body (and relevant section)</i> | <i>Approximate number and type of licensees/licences</i> | <i>Number of staff involved in regulatory activities and their areas of expertise</i> |
|---|--|---|--|
| Commonwealth (N/A) | Australian Radiation Protection and Nuclear Safety Agency (Regulatory Services Branch) | 91 licences (58 source and 33 facility) including for a radiopharmaceutical production facility and 2 research reactors (1 operating, 1 shutdown) | 23 (20 regulatory officers, senior regulatory officers and managers, and 3 administrative staff. In addition expertise and support functions can be sourced from the whole of ARPANSA's workforce of approximately 140) |
| South Australia (1,759,200) | Environment Protection Authority | 6, 718 use licences 3,927 registrations (2,218 apparatus registrations, 129 premises registrations, 719 sealed source registrations) 861 business activities licences (including facilities) | 11 (9 regulatory and scientific officers and managers and 2 administrative staff) |

| <i>Jurisdiction (population)</i> | <i>Radiation protection regulatory body (and relevant section)</i> | <i>Approximate number and type of licensees/licences</i> | <i>Number of staff involved in regulatory activities and their areas of expertise</i> |
|---|---|---|--|
| New South Wales (8,129,000) | Environment Protection Authority (Hazardous Materials, Chemicals and Radiation Section) | 3,418 radiation management licences to sell/possess radioactive substances or radiation apparatus, under which are held 1,244 sealed source devices and 249 premises where radioactive substances are kept or used 16,068 radiation users licences (either radiation apparatus or radioactive substances) | 9 (7 scientific and technical, including policy, and 2 administration staff) |
| Queensland (5,130,000) | Queensland Health (Radiation Health Unit) | 2522 possession licensees 18920 use and transport licensees 5864 sealed radioactive sources registered 12241 radiation apparatus registered | 21 within the Health Protection Branch (10 scientific, 5 technical/policy, and 6 licensing/ administrative; 8 of these are appointed as inspectors under the Radiation Safety Act 1999). A further 105 Environmental Health Officers from Public Health Units across Queensland have been appointed as inspectors to assist in the department's compliance monitoring and enforcement activities. |
| Tasmania (537,000) | Department of Health (Radiation Protection Unit) | 484 licences (consisting of 946 apparatus, 474 radioactive materials, 2625 authorised persons) 521 registered premises | 4 (3 scientific and 1 licensing officer) |
| Victoria (6,651,100) | Department of Health and Human Services (Radiation Safety section) | 14,837 use licences 2,687 management licences 45 approved testers | 14 (10 technical and policy staff, 4 administrative staff) |
| Western Australia (2,639,100) | Western Australian Radiological Council (Radiation Health Unit) | 8701 licences (covering users, service, manufacture, transport and sale), 2544 registered premises (a registration is equivalent to a management licence) including 39 registrations covering the mining and milling of radioactive ores | 10 (1 technical and 9 scientific and policy staff) |

| <i>Jurisdiction (population)</i> | <i>Radiation protection regulatory body (and relevant section)</i> | <i>Approximate number and type of licensees/licences</i> | <i>Number of staff involved in regulatory activities and their areas of expertise</i> |
|--|---|--|--|
| | | and including 1 operating disposal facility 8307 sealed sources registered 6951 radiation apparatus registered | |
| Australian Capital Territory (427,400) | Australian Capital Territory Radiation Council (Radiation Safety Section of the Health Protection Service) | 590 registrations, 1100 licensees | 2 (2 scientific) |
| Northern Territory (244,800) | Department of Health (Radiation Protection Section of Public Health Directorate) | Approximate number of authorities: 1520 licensees (use and possess) 629 registered apparatus 412 registered sealed sources 382 Registered radiation places | 2.5 (2 scientific, 0.5 administrative) |

ARPANSA

ARPANSA staff possess the essential skills, knowledge and expertise to assess the safety of spent fuel management and radioactive waste management facilities, and to inspect these facilities for regulatory compliance.

Recruiting qualified staff is sometimes an issue, as there is a relatively small pool of qualified radiation protection and nuclear safety experts within Australia. Measures have been put in place to maintain training and professional development opportunities for younger or less experienced staff and to allow staff to attend courses, seminars and conferences as needed. A number of staff are supported by ARPANSA to complete graduate studies at Australian universities. Over the last three years ARPANSA has continued to develop cooperative relationships with key universities and other partner organisations to support the research and innovation programs and ARPANSA.

Effective independence of the regulatory function

There is effective independence between the appropriate regulatory authorities for radiation safety and other areas within organisations dealing with spent fuel or radioactive waste management, noting that all regulatory bodies have some sources and store a small quantity of radioactive waste. This is managed in various ways. For example, some jurisdictions have a form of executive management, independent of the regulatory body that can make decisions upon the safe management of facilities belonging to the

regulatory body. Others maintain requirements for regular, independent audits and/or inspections. Additional detail can be found in the 2017 National Report.

There is effective independence between ARPANSA and all its licence holders. For example, ARPANSA and ANSTO report to different ministers, and ARPANSA reports directly to parliament on a quarterly and annual basis. The ARPANSA CEO does not seek or require approval from a minister to issue a licence or report a breach, and can, under the *ARPANS Act*, table a report in Parliament relevant to any of the CEO's functions.

F. Other General Safety Provisions

Article 21 Responsibility of the Licence Holder

In accordance with the NDRP, legislation requires that a 'responsible person' be primarily responsible for radiation protection and safety. The responsible person is defined as the person who has overall management responsibility for the safety, security and maintenance of the sources, apparatus, installation or facility and in whose name the source, apparatus, installation and facility would be registered if required.

The uranium mine facilities in South Australia and in the Northern Territory are privately owned and any liability will be carried by the owner. To protect against the contingency of a private company ceasing to exist, the South Australian and Northern Territory regulatory bodies require a bank guarantee or cash deposit before operations can commence. As the Ranger Uranium Mine (Northern Territory) operates under a specific (s41) authority issued under the *Atomic Energy Act 1953*, a security (comprising a combination of cash and financial guarantees) is held by the Commonwealth.

Dedicated facilities for storage of radioactive material in each of the jurisdictions are owned and operated by the relevant state or territory.

Enforcement actions

A range of enforcement provisions exist in Australian jurisdictions, such as imposition of improvement notices, prohibition notices, seizure of radiation sources as well as revocation of licences and court action. The potential for seizure of radiation sources is seen as the most effective means of quickly achieving compliance.

For Commonwealth Government regulated entities, penalties incurred for non-compliance with the ARPANS Act are based on the provisions of the Commonwealth Criminal Code. The imposition of penalties is the most severe enforcement action that could be taken against a licence holder and would only be resorted to if lower order enforcement action was either inappropriate, given the seriousness of the circumstances of the breach, or had not had a desired effect on the behaviour of a licence holder.

Article 22 Human and Financial Resources

Spent fuel and radioactive waste management facilities

All jurisdictions require operators and licence holders to be responsible for providing qualified staff and financial resources to enable appropriate controls and monitoring of radioactive waste. A number of different approaches are used commensurate with the types of sources and expertise of the licence holder.

Under the *Mining Management Act 2001* (NT) and the *Work Health and Safety (National Uniform Legislation) Act 2011* (NT) the operator of a mine must ensure all workers are trained and competent to perform the work they are employed for. In the case of the Ranger Uranium Mine, the authorisation requires the operator to implement a system to control radiological exposure of people. There is radiation reporting and monitoring requirements and the need for a radiation safety officer as defined in the mining code (ARPANSA, 2005).

Tasmania requires that all licence holders who are authorised to possess a radiation source have radiation management plans that specify a radiation safety officer, their duties and the roles and responsibilities of all persons expected to be dealing with radiation sources. Changes to the plan or personnel specified must be approved in advance. Other jurisdictions specify in conditions of licence that adequate staffing is required or that a list of all holders of authority be provided. In remaining jurisdictions, inspection of premises to ensure necessary safety requirements are being met and an emphasis on the responsibility of licensees to comply with requirements are used. With respect to operator capabilities, if the support required is of a significant level, authorised practices that generate radioactive wastes are generally advised to access commercially available health physics support to assist with waste management.

ANSTO

ANSTO is the only organisation that operates spent fuel facilities. In addition, they operate a number of waste management facilities. Within ANSTO, staff who are responsible for the management of radioactive waste and spent fuel are appropriately trained and suitably qualified to carry out their tasks using defined procedures and instructions. ANSTO uses training as a strategic performance tool to enhance both operator and facility performance. Managers are responsible for the competence of their staff and work effectively with training staff to ensure their qualification.

Waste management at ANSTO has moved towards a multi-competency training program for the radioactive waste technicians. This means that the team is trained in many skills and tasks, including liquid waste management, remote handling techniques, decontamination activities and laundry operations. This versatility allows for the team to be deployed where the demand is.

The adequacy of human resources is reviewed on an ongoing basis to ensure that operations are safe, and is captured as part of the *Effective Control Plan* required by the ARPANS Regulations.

As a Commonwealth Government organisation ANSTO has significant technical and financial resources through a mixture of government appropriation and commercial services. Further, it is a legislative requirement that the licence holders demonstrate a capacity to comply with the regulations and any conditions likely to be imposed on the licence. This includes sufficient financial and human resources to manage specific conduct (e.g. construction, operation) related to the facility.

Financing of institutional controls and monitoring after closure

This article is currently only applicable to the Mt Walton East IWDF in Western Australia. The facility is owned by the Western Australian Government and the financial responsibility for post-closure monitoring will be borne by the Western Australian Government. There are no specific funds set aside for monitoring after closure.

In the event that a licence application is submitted to ARPANSA for the proposed NRWMF, the ARPANS Regulations require the CEO of ARPANSA to consider whether the applicant has the ability to maintain effective control of the facility. This would include having adequate financial, human and technical resources in place to manage the facility throughout its lifetime, including the ability to undertake any environmental monitoring required post-closure.

Article 23 Quality Assurance

Establishment and implementation of quality assurance programs

Use of appropriate quality system by licence holders is considered by Australian radiation regulators in granting authorisation for spent fuel and waste management facilities applying a graded approach. For example, Commonwealth Government organisations managing such facilities use ISO accredited quality system including ISO 9001 and ISO 14001 for spent fuel operations and radioactive waste management facilities, as well as ISO 45001 – Occupational Health and Safety Management Systems. at ANSTO, implementation of appropriate quality system is verified through regulatory compliance monitoring processes.

Radioactive management operations regulated by the states and territories operate under appropriate quality assurance systems as part of the safety management plan required by the regulator.

Article 24 Operational Radiation Protection

RPS C-1 Rev.1 sets out the requirements in Australia for the protection of occupationally exposed persons, the public and the environment in planned exposure situations. This includes the control of radiation exposure during the operating lifetime of a spent fuel or radioactive waste management facility. The primary means of controlling exposure in planned exposure situations is by good design of facilities, equipment, operating procedures and through training – all of which contribute to optimisation of protection.

RPS C-1 Rev.1 stipulates an effective dose limit of 20 mSv per year for workers, averaged over a period of five consecutive calendar years with no more than 50 mSv in one year. For women who declare a pregnancy, the dose limit is 1 mSv to the foetus for the remainder of the pregnancy. Dose constraints are developed as appropriate for each operation. They are proposed by the operator and reviewed by the regulator.

For spent fuel facilities and waste management facilities at ANSTO, task-specific dose constraints are used for occupational workers. Further, dose constraints for members of the public within the controlled site and outside the controlled site, and investigation levels are used as part of optimisation of protection and safety. Such information is contained in the radiation protection plan and are assessed by the regulator in granting approval of operation of a spent fuel or radioactive waste management facility.

In addition to dose limits, some jurisdictions use management plans such as those required in RPS C-3 (Disposal Facilities Code) and RPS 9 (*Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (2005)). The management plan must be directed towards meeting the objectives of all relevant requirements, including those in RPS C-1 Rev.1, and must be in accordance with best practicable technology and take into account the potential dose delivery pathways. Plans should also address the measures that will be taken to avoid unplanned and uncontrolled releases and emergency management. Independent audits are generally used by Australian jurisdictions to verify compliance with management plans.

The radioactive discharges from spent fuel and radioactive waste management facilities are subject to compliance with statutory requirements and limits. For example, the airborne discharges from the ANSTO facilities require compliance with regulatory notification levels, which are based on conservative modelling

to ensure that there is no undue risk from such discharges. For ANSTO's facilities, estimates of public radiation doses and radioactive discharges are reported quarterly to the regulator.

The design features of the spent fuel and radioactive waste management facilities incorporate systems to control release of radioactive materials during normal operation and anticipated operational occurrences, and as appropriate under design-basis accident conditions. These aspects are considered in the safety analysis of these facilities. In addition, the operating arrangements and procedures for such facilities describe the corrective measures to be implemented in the event of an unplanned or uncontrolled release of radioactive materials. Additional information on emergency management is provided under Article 25.

ANSTO's operational radiation protection policies, procedures and measures with regard to spent fuel and radioactive waste management are substantively unchanged since the 2017 National Report. Radiation monitoring results show that ANSTO's spent fuel and radioactive waste management facilities continue to be operated without undue risk to the health and safety of people and the environment.

Article 25 Emergency Preparedness

Emergency plans

ARPANSA has recently published RPS G-3 *Guide for Radiation Protection in Emergency Exposure Situations* (2019) which establishes a national framework and sets the relevant safety requirements in Australia for protection of human health in emergency exposure situations. This reflects IAEA's GSR Part 7 *Preparedness and Response for a Nuclear or Radiological Emergency* (2015).

For radioactive waste storage facilities operated by state and territory radiation regulators, a variety of measures are employed to ensure preparedness for an emergency, including:

- establishing and maintaining emergency preparedness plans for the institution (such as a hospital) in which the waste facility is located
- remediation procedures in the event of an incident, requirement for periodic incident response exercises and the review of results of exercises
- advice to fire services and other emergency services of the locations of radioactive materials
- use of a model reference incident for response planning purposes of a scale that can be directly applied to a radiological emergency
- provision of additional radiation monitoring equipment for emergency services and enhanced equipment and training for staff.

At the Mt Walton East IWDF in Western Australia, an emergency response/contingency plan is developed for each burial campaign and forms part of the documentation requiring approval prior to site mobilisation.

ANSTO

On-site arrangements for emergencies at the OPAL Research Reactor and associated spent fuel management and waste management facilities at ANSTO's Lucas Heights campus are the responsibility of ANSTO. The off-site arrangements for emergencies at the Lucas Heights facility are covered in a NSW State Sub-Plan and these are reviewed and exercised regularly, in line with other NSW State Plans.

In April 2018, there was a bushfire that threatened the surrounding areas of ANSTO. A back-burning operation was subsequently undertaken, which skirted around the Little Forest Legacy Site. This burnt through the trees surrounding the site (and to one side of ANSTO), but did not burn the vegetation on top of, or immediately around, the waste trenches. There was no impact on either the LFLS or on ANSTO facilities within the perimeter of the Lucas Heights Campus.

The ARPANS Regulations require facility-specific emergency plans for spent fuel and radioactive waste management facilities. ANSTO's emergency plans and arrangements for spent fuel and radioactive waste management facilities comprise a facility-specific plan, a site-specific plan and the relevant state plans that are integrated to ensure that both on-site and off-site response personnel and decision makers act in a coordinated and harmonised manner to efficiently and effectively respond to the emergency. The efficacy of emergency plans and arrangements are verified by ARPANSA by observing a field emergency response exercise based on a scenario agreed with ARPANSA that demonstrates that the emergency response arrangements are commensurate with the emergency preparedness category of the facility.

Commonwealth support

Emergency Management Australia, which is part of the Commonwealth Government's Attorney General's Department, is the Commonwealth Government agency responsible for coordination of Commonwealth Government consequence management activities in support of state and territory governments, in accordance with existing emergency management arrangements. Commonwealth Government Disaster Plan has arrangements in the event of a radiological or nuclear incident are reviewed regularly and exercises conducted as appropriate.

ARPANSA maintains specialised teams to support state and territory arrangements to respond to radiation emergencies. These teams undertake ongoing training to ensure that the personnel in the teams have the required skills and resources to carry out the task expected of them in an emergency situation.

Radiological emergencies in the vicinity of Australian territory

Given Australia's geographical position, it is unlikely that Australia could be affected by a radiological emergency at a spent fuel or radioactive waste management facility in a neighbouring country. However, emergency plans in all jurisdictions could be applied in responding to regional emergencies if necessary.

Article 26 Decommissioning

ANSTO

Section 30(1) of ARPANS Act requires authorisation to decommission a controlled facility including spent fuel and radioactive waste management facilities. The Regulatory Guide *Decommissioning of Controlled Facilities* (ARPANSA 2019c) is based on the requirements of the IAEA General Safety Requirements (Part 6): *Decommissioning of Facilities*, published in 2018, and aims to assist in ensuring that the decommissioning of these facilities is conducted in a safe and environmentally acceptable manner in accordance with international best practice. It is also used by ARPANSA for regulatory assessment of a licence application for decommissioning of a controlled facility.

When assessing an application for decommissioning of a controlled facility, ARPANSA considers the provision of staffing, qualification and training. Further, it is a legislative requirement (s53 of ARPANS

Regulations) that the applicant demonstrates a capacity to comply with the regulations and any conditions likely to be imposed on the licence. This includes adequate financial and human resources to manage the decommissioning of a nuclear facility. Appropriate programs for radiation protection and emergency arrangements are required to be submitted with the final decommissioning plan for approval. Implementation of such programs are monitored through regulatory compliance monitoring process.

A preliminary decommissioning plan was submitted as part of the application for a licence to operate the OPAL reactor. This included the choice of materials to minimise activation, provision of space for access and minimisation of the radioactive waste that will be produced during decommissioning. In licensing OPAL for operation, ARPANSA was satisfied that ANSTO has plans and arrangements to satisfy decommissioning requirements.

A detailed characterisation program has been completed for the entire HIFAR Facility allowing for an accurate estimate of waste. That program revealed that eighty per cent of the HIFAR Facility is free-release, eighteen per cent is LLW and only two per cent of the HIFAR Facility is ILW. ANSTO has estimated that a staged decommissioning of the facility is likely to take approximately seven years.

ANSTO is actively working to ensure appropriate resources for decommissioning in future years. A staged decommissioning of the HIFAR facility will enable nuclear decommissioning knowledge transfer, including training and professional development of younger, less experienced workers.

Appropriate records and documentation related to the operating history of the facility including design specifications, structural and materials specifications, drawings and diagrams, modifications and changes to the design, and event records are maintained for decommissioning. Such information and records form part of the plans and arrangements for managing safety in decommissioning. A final decommissioning report is kept that summarises decommissioning activities undertaken including dismantling of the facility; waste management including clearance of radioactive materials or objects from regulatory control; the final status of the site at the time for release from regulatory control or for conversion to other use; and any remaining restrictions on the site.

State and territory radioactive waste storage facilities

Current regulatory requirements adequately address the provision of resources, operational limits, emergency plans and record keeping in regard to decommissioning and closure of disposal facilities as required by Article 26. The majority of storage facilities operated by the state and territory governments do not require complex procedures to be undertaken in order to decommission the facility. Hence, some do not have decommissioning plans in place but require development of plans prior to undertaking specific decommissioning activities. More complex facilities require a preliminary or conceptual decommissioning plan as part of the overall radiation management plan for the facility. Emergency plans in all jurisdictions can be applied to the operation of facilities as well as decommissioning.

Decommissioning of mining sites

Radiation protection regulation, including provision for decommissioning, for the exploration, mining and milling of radioactive ores is undertaken by radiation regulators in the states or territories where such ores are mined.

In South Australia, uranium and mineral sands mining companies are expected to provide appropriate technical expertise and resources for the decommissioning of their mining facilities. Provisions of the South Australian radiation protection legislation can be applied to require a company to provide appropriate resources and personnel for decommissioning.

Under the *Mining Act 1971* (SA), a bond may be set by the relevant Minister to recover costs of rehabilitation of mining sites. The bond is set at a level to cover the estimated cost for rehabilitation of the mine and milling site. The value of these bonds is revised periodically. In the case of the Olympic Dam project, the *Roxby Downs (Indenture Ratification) Act 1982* (SA) (Indenture Act) applies. While there is no provision for a bond under the Indenture Act, the mining company is required to maintain an ongoing rehabilitation program at the site.

In the Northern Territory, securities for all exploration sites and mines (other than Ranger Uranium Mine) are calculated by the Northern Territory Government, based on the disturbance and estimated rehabilitation cost. Mines must annually review and, if necessary, submit a Mining Management Plan for approval. The appropriate security is reviewed and upgraded where necessary, based on this plan and planned future operations. The security is lodged with the relevant government department and is held against the operator to ensure satisfactory closure and rehabilitation of the site. On successful completion and rehabilitation of the site, the security held by the department is refunded to the operator. Securities are held against all authorised exploration and mining sites.

The operator of Ranger Uranium Mine submits an annual rehabilitation plan based on a premature cessation of operations on 31 March of each year. The operator must outline the works required to close and rehabilitate the mine site. Both the Commonwealth and Northern Territory Governments and Mirarr traditional owner representative bodies, the Northern Land Council and Gundjeihmi Aboriginal Corporation, review the plan. Following acceptance of the plan by the Commonwealth Government Minister responsible for administering s 41 of the *Atomic Energy Act 1953*, it is independently costed for the Commonwealth Government. That assessment is used by the Minister to set the security bond held by the Commonwealth Government. The operator of Ranger Uranium Mine must also submit an annual mine closure plan for approval by the Commonwealth and Northern Territory Governments. This plan is made public on the operator's website.

G. Safety of Spent Fuel Management

ANSTO is the only organisation in Australia that manages spent fuel. Accordingly, this Section only refers to ANSTO and ARPANSA, which as the regulator, issues licenses for the spent fuel management facilities. The spent fuel management facilities for the OPAL reactor form part of the OPAL reactor facility and a separate spent fuel pond. As such, ANSTO's compliance with the requirements of Chapter 2 of the Joint Convention was examined in detail as part of the consideration of its applications for authorisations to prepare a site, construct and operate the facility. ANSTO has safely managed its spent fuel since commencement of reactor operations, and has stored that spent fuel in both dry and wet facilities. Currently, only wet storage of spent fuel is in practice at ANSTO (Figure 6 and Figure 7).

Article 4 General Safety Requirements

Measures to address the general safety requirements in Article 4 are largely unchanged from those reported in the 2017 National Report. In summary:

- ARPANSA requires that facilities for the storage of spent fuel at ANSTO demonstrate that sub-criticality is maintained by a suitable margin under conditions of normal operation, anticipated operational occurrences and accident conditions. Such safety analysis uses a rigorous and conservative method that considers defence in depth in design safety features of spent fuel management to ensure safety through redundancy and diversity. The safety analysis also addresses the use of safety systems which ensure residual heat removal in the design basis analysis and in the design of the facility. This must be considered in the Safety Analysis Report required under Section 46 (1) (e) of the ARPANS Regulations.
- Minimisation of the production of radioactive wastes under operational state conditions is considered in the design in a manner that is commensurate with the safety analysis. ARPANSA's expectations of arrangements for the minimisation of radioactive waste generation are described in the Regulatory Guide: Plans and arrangements for managing safety (2019d).
- Measures to take into account interdependencies remain unchanged since the 2017 National Report.
- Commonwealth nuclear safety legislation, the ARPANS Act, together with accompanying Regulations and subsidiary regulatory guidance provide for effective protection of staff, members of the public and the environment. These are based on internationally endorsed criteria and standards.
- Assessment of biological, chemical and other hazards are considered in the Safety Analysis Report as required under Section 46 (1) (e) of the ARPANS Regulations.
- 'Burden on future generations' is considered when assessing an application to operate or use a nuclear facility, equipment or material. The CEO of ARPANSA must take both current and future impacts of the facility into account when considering and assessing a licence application.

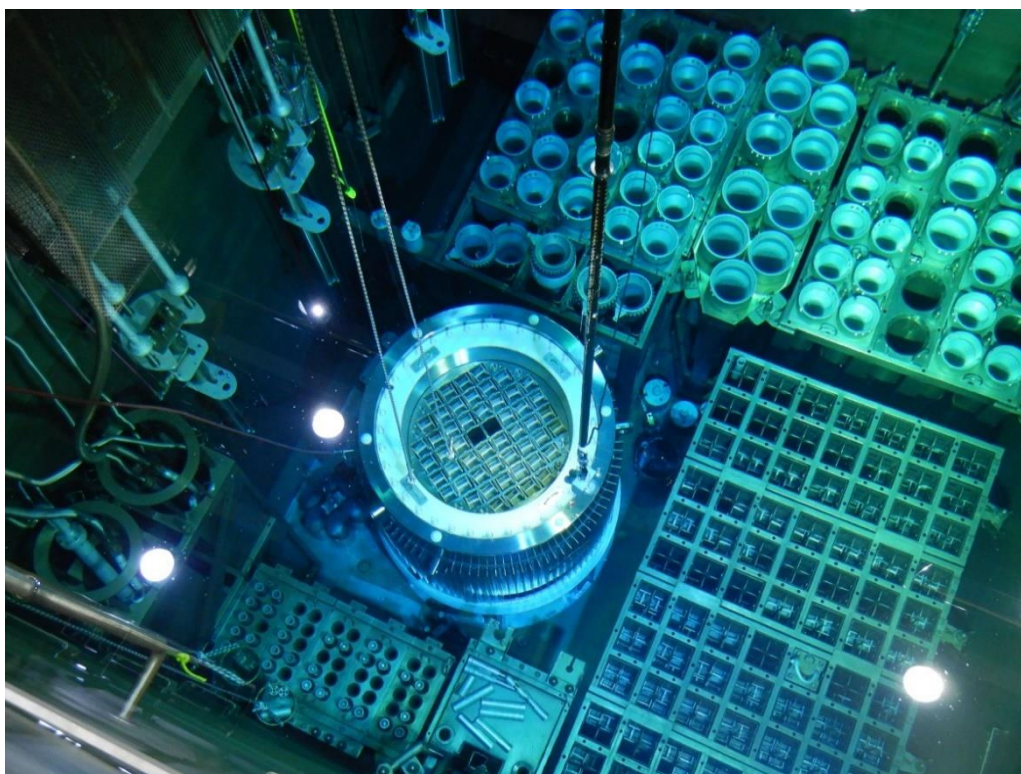


Figure 2 OPAL Reactor Service Pool including spent fuel rack storage and loaded transport cask



Figure 3 Transport of used OPAL reactor spent fuel (2018)

Article 5 Existing Facilities

A spent fuel pond at ANSTO existed at the time the Convention entered into force for Australia in 2003. This pond was and is used as a contingency. This spent fuel pond is subject to all relevant regulatory requirements as are the other facilities at the ANSTO site.

Article 6 Siting of Proposed Facilities

The ARPANS regulations require that, when deciding whether to issue a facility licence authorising the preparation of a site, the CEO of ARPANSA must consider:

- A detailed site evaluation establishing the suitability of the site for the facility
- The characteristics of the site, including the extent to which the site may be affected by natural and human events
- any environmental impact statement required by a government agency and the outcome of the environmental assessment

In 2014, ARPANSA published a regulatory guide on the siting of controlled facilities [*Regulatory Guide: Siting of Controlled Facilities v2* (REG-LA-SUP-240L, August 2014b)] to assist applicants in meeting these criteria.

In accordance with Section 48 of the regulations, ARPANSA must invite public submissions on any application involving a nuclear installation. The CEO of ARPANSA is required to take into account the content of any public submissions in deciding whether or not to issue a facility licence that authorises conduct in relation to a nuclear installation.

In addition, the EPBC Act requires that an application for a proposed facility that is characterised as a nuclear action¹¹ must be referred to the Minister for the Environment, who determines whether an approval is needed and, if so, the required level of assessment.

As noted in the 2017 National Report, in accordance with the ARPANS Act, public submissions were invited as part of assessing the application for licences to prepare a site for, construct and operate ANSTO's OPAL research reactor, including its spent fuel management facilities. The EPBC Act also has statutory public engagement requirements.

Consultation with other Contracting Parties

Considering the geographical position and size of Australia, it is unlikely that Australian spent fuel management facilities would have impacts on other Contracting Parties.

Article 7 Design and Construction of Facilities

Commonwealth Government legislation and ARPANSA's licensing system require that the design and construction of a spent fuel management facility incorporate suitable measures to limit radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases.

At the design stage, plans and other provisions for decommissioning a facility are required in conceptual form. They must be revised and updated as the facility moves through the different licensing stages. The technologies incorporated in the design and construction of a spent fuel management facility must be supported by proven design, experience, testing and analysis. As noted in the 2017 National Report, spent

¹¹ Commonwealth actions or actions affecting Commonwealth land that have, will have or may have a significant impact on the environment are also required to be referred under the EPBC Act.

fuel from the OPAL reactor is stored in a service pool adjacent to the reactor pool, the design of which was subjected to a rigorous safety assessment process by ANSTO and INVAP (the Argentinian company that constructed the OPAL reactor) prior to approval by the CEO of ARPANSA.

Article 8 Assessment of Safety of Facilities

Commonwealth Government legislation and ARPANSA's licensing system require that, before construction of a spent fuel management facility, a safety assessment and an environmental assessment appropriate to the hazard presented by the facility, and covering its operating lifetime, must be carried out.

The updated ARPANSA Regulatory Guide *Plans and Arrangements for Managing Safety* v6.2 (REG-LA-SUP-240B, 2019) sets out the regulatory expectation and therefore the criteria by which the adequacy of a radiation management plan is judged.

Updated and detailed versions of the safety and environmental assessments must be prepared as part of the application for a licence to operate a spent fuel management facility. This application must be approved before operation can commence. Mandatory Periodic Safety and Security Reviews (PSSRs) ensure the ongoing safety of spent fuel management systems at OPAL.

Article 9 Operation of Facilities

Commonwealth Government legislation and ARPANSA's licensing system require that the approval of a licence to operate is based on appropriate safety, health and environmental impact assessments and is conditional on the completion of a commissioning program demonstrating that the facility, as constructed, can be operated safely.

Operational limits and conditions derived from tests, operating experience and assessments must be defined and revised as necessary. The IAEA defines the operational limits and conditions as a set of rules setting forth parameter limits, the functional capability and the performance levels of equipment and personnel which are approved by the regulatory body for safe operation of an authorised facility. The operational limits and conditions will be derived from periodical safety analysis and health and environmental impact assessments conducted for the facilities.

Licence conditions require that:

- Operation, maintenance, monitoring, inspection and testing must be conducted in accordance with established procedures
- Engineering and technical support in all safety-related fields must be available throughout the operating life of the spent fuel management facility
- Incidents significant to safety must be reported to the regulatory authority in a timely manner by the licence holder.

Compliance is ensured through regular inspections by the regulatory authority. Under ANSTO's Business Management System and Work Health, Safety and Environment system, ANSTO collects and analyses data on operating experience, and acts upon that data where appropriate. Decommissioning plans for spent fuel management facilities are in place and will be reviewed and updated by ANSTO before submitting to ARPANSA for approval prior to decommissioning. ARPANSA expects that the operating organisation will progressively update the decommissioning plan throughout the life of the facility and that each separate

application for authorisation under the ARPANS Regulations (siting, construction, operation and eventually decommissioning itself) will include a decommissioning plan. Each updated plan must take into account recent experience derived from international developments in decommissioning practice.

Article 10 Disposal of Spent Fuel

As Australia has no plans to undertake the direct disposal of spent fuel, this provision has no current application to Australia.

H. Safety of Radioactive Waste Management

Article 11 General Safety Requirements

Measures to address the general safety requirements in Article 11 are largely unchanged from those reported in the 2017 National Report. The legislative systems in place in Australia, described in *Section E: Legislative and Regulatory System* of this report, underpin the process of minimising the risk of harm to individuals, society and the environment from exposures to ionising radiation that result from the management of radioactive waste. In summary:

- ANSTO holds some radioactive wastes with fissile material associated with its production of molybdenum-99 for nuclear medicine. Criticality safety analysis is considered in the Safety Analysis Report as required under Section 46 (1) (e) of the ARPANS Regulations to demonstrate that sub-criticality is maintained by a suitable margin under conditions of normal operation and anticipated operational occurrences and accident conditions. ARPANSA licenses and routinely inspects these facilities.
- In most jurisdictions, licensees are required to prepare plans for the management of waste, including the processes by which the generation of radioactive waste is minimised. RPS 16 provides detailed guidance on methods of minimising waste generation both at the facility design stage and during operations. Waste minimisation practices undertaken in Australia include segregation of wastes at the source (radioactive from non-radioactive) to reduce the potential for cross-contamination, processes to identify waste that meets the regulatory criteria for free-release, decontamination of large items to reduce the volume, and the separation of short-lived from long-lived wastes to allow for delay and decay.
- Interdependencies have been carefully considered in the development of RPS 16. The guidance includes consultation with responsible personnel and organisations.
- In addition to safety, safeguards requirements may apply to waste material containing uranium, plutonium or thorium. Australia is examining how the need to condition nuclear material into a practicably irrecoverable form (from a safeguards perspective) interacts with radiation protection principles such as waste minimisation.
- RPS 16 advises that the radioactive waste management plan, safety assessment and management system should include consideration of the physical, chemical and/or biological characterisation of waste. The guide also advises that the design and operation of facilities for the predisposal management of radioactive waste should take into account any potential hazards due to non-radioactive physical, chemical or biological characteristics of the waste. Protection from non-radiological hazards should be provided in accordance with the relevant standards on health and safety and environmental protection.
- The RPS C-3 provides requirements for the safety case and supporting safety assessment which provide the basis for demonstration of safety and for authorisation. They will evolve with the development of the disposal facility, and will assist and guide decisions on its siting, design, operation and closure. It is expected that a site should have suitable geochemical and geotechnical properties in order to retard migration of radionuclides.
- As part of the application of the optimisation principle, RPS C-1 Rev.1 states that the risks to individuals in the case of potential exposures should be optimised, taking social and economic

factors into account. This requirement extends not just to the current generation but also to future generations.

- ‘Burden on future generations’ is taken into account in the decision on whether or not to give the applicant a licence to operate or use the facility, equipment or material. Some jurisdictions require that responsible persons must have adequate measures in place before they can acquire a radioactive source. These measures include an appropriate facility to store the source, measures in place to relocate or dispose of the radioactive source, return of sealed sources to the supplier as a condition of licence, and demonstration of the optimisation principle for the proposed application. Other jurisdictions have a strategy for the sustainable management of radioactive waste within their jurisdiction.

These systems are based on RPS C-1 Rev.1, which in turn is consistent with GSR Part 3 (IAEA, 2014) and ICRP Publication 103 (2007). The national standard is in the process of being adopted into legislation by each jurisdiction. Some of the state and/or territory regulations predate the ICRP 103 recommendations and are not yet up to date with respect to current dose coefficients.

Article 12 Existing Facilities and Past Practices

Existing Facilities

In this report, the term ‘existing facilities’ is taken to refer to radioactive waste management facilities that were under regulatory control at the time the Joint Convention entered into force in Australia on 3 November 2003. Existing radioactive waste management facilities are licensed under the regulatory system of the jurisdiction in which they are located. Existing legislation allows for inspections of facilities to be performed in accordance with specified criteria. Should a review of safety reveal that a facility requires upgrading, licence conditions may be amended to instigate facility improvements.

The majority of ANSTO’s waste management facilities were in existence at the time the Joint Convention entered into force in Australia. These facilities, and any new facilities constructed since the Joint Convention entered into force for Australia, are subject to regulatory requirements including inspection and ongoing review for compliance (see Annex A – Inventory of Radioactive Wastes). All other existing storage facilities are currently under regulatory control in the appropriate jurisdictions.

A summary of existing facilities for disposal of radioactive waste including uranium mining and milling tailings in Australia is provided below.

Radium Hill

The Radium Hill Low-Level Radioactive Waste Repository in South Australia was operated by the South Australian Government from 1981 to 1998. The material disposed of at this repository was mostly NORM from mining and mineral processing operations conducted in South Australia. The site was registered as a premises under Section 29 of the South Australian *Radiation Protection and Control Act 1982* in 2003. The site is now licensed under section 29A of this Act as a facility containing unsealed radioactive substances resulting from past practices. Conditions were attached to the licence to provide for development of an appropriate long-term management plan for the site. A comprehensive risk assessment was completed in 2010. The assessment showed dose levels well below the public dose limit of 1 mSv/year. The repository is now closed.

Port Pirie

The site of the former Port Pirie Treatment Plant, also in South Australia, is a legacy site where radioactive tailings remain from the processing of uranium ore concentrate from the Radium Hill uranium mine from 1954 to 1962. The site is also licensed under section 29A of the *Radiation Protection and Control Act 1982* as a facility containing unsealed radioactive substances resulting from past practices. Conditions on the licence provide for the development of an appropriate long-term management plan for the site.

Mt Walton East

The disposal of radioactive wastes at the Mt Walton East IWDF in Western Australia (Figure 4) has been regulated by the radiation regulator since 1992. The site was chosen based on criteria in the IAEA publication, *Site Investigation for Repositories for Solid Radioactive Waste in Shallow Ground, Technical Report Series No. 216* (1982). All aspects of the design, operational requirements, duties and responsibilities must comply with the Western Australian legislation and the near-surface disposal code (NHMRC, 1992). Work is currently underway to transition to requiring compliance with RPS C-3 which has replaced the *Code of practice for the near-surface disposal of radioactive waste in Australia (1992)* (NHMRC 1992). Radiation monitoring at the disposal facility is carried out in accordance with documented requirements given by the regulator. Measurements include absorbed dose rates in air, radon concentration in air, radionuclide concentrations in water, and pre- and post- disposal measurements. Personnel monitoring is carried out during a disposal campaign.



Figure 4 The Mt Walton East Intractable Waste Disposal Facility in Western Australia

Maralinga

The former British Atomic Weapons Test Site at Maralinga, South Australia, was rehabilitated through the 1990s. The organisation responsible for the ongoing management of the site was licensed by ARPANSA to possess and control radioactive material collected during the clean-up from 30 October 2000 until responsibility for regulating the site was transferred to the South Australian Government on 16 November 2009. The site is now licensed under Section 29A of the *Radiation Protection and Control Act 1982* as a facility containing unsealed radioactive substances resulting from past practices. The site is subject to the South Australian regulator's surveillance of environmental radiation and public radiation safety.

Ranger Uranium Mine

The Ranger Uranium Mine which has been in operation and regulated since the 1980s, ceased mining ore in 2013 and will end all mining and processing operations in January 2021. After this time activities will focus solely on closure and rehabilitation of the Ranger Project Area. Under the Ranger Authority, the Ranger Project Area must be rehabilitated by January 2026.

Operations on and rehabilitation of the Ranger Project Area must comply with the Environmental Requirements of the *Atomic Energy Act 1953* (Cth). The Supervising Scientist Branch, established under the Environment Protection (Alligator Rivers Region) Act 1978 (Cth), ensures the protection of the Alligator Rivers Region and local communities from the effects of uranium mining by conducting research, monitoring, participating in and overseeing the regulatory process and developing standards and practices for environmental protection. The Supervising Scientist Branch is required to ensure Energy Resources Australia (ERA) complies with the Environmental Requirements.

In accordance with the Ranger Uranium Project Agreement between ERA and the Commonwealth (1980), ERA submits an Annual Plan of Rehabilitation, describes the plans and costing of progressive rehabilitation during operations. This is used to determine the securities amount to be held by the Commonwealth for Ranger rehabilitation obligations.

The *Mining Management Act* (2001) requires ERA to provide a plan of closure as part of their Mine Management Plan. A Mine Closure Plan (MCP) is also a requirement under the Environmental Requirements.

Under Annex B of Ranger Authorisation 0108-18 under the *Mining Management Act 2001* ERA are required to submit an updated Mine Closure Plan on or before 1 October each year. The plan describes rehabilitation and closure plans and activities which have occurred in the preceding, and for the forthcoming, year which demonstrate how closure activities will achieve the relevant Environmental Requirements. ERA have taken the decision to make their Mine Closure Plan publicly available through their website at <https://www.energyres.com.au/sustainability/closureplan>.

Review of past practices

In this report, the term ‘past practices’ is taken to refer to radioactive waste management facilities that were not under regulatory control at the time the Joint Convention entered into force in Australia on 3 November 2003.

Little Forest Legacy Site

From 1960 to 1968, the Australian Atomic Energy Commission (AAEC), ANSTO’s predecessor organisation, operated a near-surface (trench) disposal facility (Little Forest Legacy Site) near the boundary of the Lucas Heights site. Since its closure in 1968, this site has been continuously under care and maintenance, inspection, and monitoring by the AAEC and, subsequently, by ANSTO. Monitoring results are provided to ARPANSA in the annual licence holder’s report. Ongoing monitoring has shown that there is minimal migration of radionuclides away from the disposal area. A medium-term management strategy is being developed to ensure ongoing safety prior to determining the long-term strategy for managing and/or remediating the site. Assessment of options such as engineered caps, in-situ grouting, and exhumation and their effectiveness for medium to long-term management of the site has been undertaken. A detailed

scientific study of the site, including investigations of radionuclide migration, characterisation of soils, vegetation and geology and compilation of inventory records, has been continuing since the 2014 National Report, as part of an ongoing research project implemented by ANSTO's Environment Research Theme. The results of this work are being published in external ANSTO reports and in refereed scientific publications. Information on the research project of the LFLS, including background material, is available on ANSTO's public website.

The site is licensed as a Prescribed Legacy Site by ARPANSA. A condition has been applied to the licence, requiring ANSTO to develop a medium to long-term plan for the site. This was provided to ARPANSA on 31 December 2019.

Australian Radium Laboratory, Parkville

Building 164 at the University of Melbourne, Parkville Victoria, was operated by the Commonwealth Government as the Commonwealth Radiation Laboratory (CRL) from the late 1920s to the 1970s. The activities that were conducted at the CRL during this time resulted in legacy contamination. The building was demolished and the site remediated during 2017-19 under the regulatory oversight of Victoria. Low-level waste consisting of building materials and soil contaminated with radium is currently being stored by the Commonwealth at the ARPANSA Yallambie site awaiting disposal in an NRWMF.

Abandoned uranium mines

A number of former uranium mines (including South Alligator Disposal Facility) in the Northern Territory and Queensland were abandoned in the past. Some of these sites have been rehabilitated.

Operations at the Rum Jungle Mine site in the NT between 1954 and 1971 produced uranium, copper, nickel and lead, and resulted in significant environmental impacts primarily due to acid mine drainage and heavy metal mobilisation. From 1983 to 1986, Rum Jungle was rehabilitated under an \$18.6 m cooperative agreement between the Commonwealth and the Northern Territory. The objectives included reduction of surface water pollution and public health hazards, including radiological hazards.

Between 1961 and 1963, the nearby former Rum Jungle Creek South Mine site was mined for uranium ore as part of the Rum Jungle operation. Between 1990 and 1991, hazard reduction works were successfully undertaken at the site to reduce potential radiological exposure to site visitors while maintaining its use as a recreational reserve.

The rehabilitation program at Rum Jungle met its original objectives, but gradual deterioration of the site's historic reclamation works has been documented over a number of years. The current environmental issues are primarily due to acid mine drainage and heavy metal mobilisation. Further funding has recently been provided to complete a final rehabilitation strategy, including design and costing, for the former Rum Jungle Mine site and to undertake maintenance of the waste rock cover material at the nearby former Rum Jungle Creek South Mine site. This brings the total commitment by the Australian Government to \$33.6 million since 2009.

Recognising Rum Jungle's social and cultural importance, quarterly consultation meetings are held with the site's traditional Aboriginal owners. Broad engagement of other stakeholders (e.g. environmental NGOs, the local Coomalie Council) also occurs on a regular basis.

In August 2013, the Commonwealth and NT Governments signed a new Project Agreement for the Management of the Former Rum Jungle Mine Site (Stage 2).

The NT, through the Department of Primary Industry and Resources (Mining Directorate) (DPIR), project-manages the activities of Stage 2A which include:

- Site maintenance and environmental monitoring
- Rum Jungle Creek South Waste Rock Dump cover system maintenance works
- Completion of technical investigations to develop the rehabilitation plan
- Completion of rehabilitation design works and an Environmental Impact Statement for Stage 3 rehabilitation works
- Construction-ready specifications, drawings and costings for the rehabilitation design works.

Through this agreement, the Commonwealth Government has also supported capacity-building opportunities for traditional Aboriginal owners.

Mary Kathleen, in Queensland, has been rehabilitated but remains a mining lease. Since the closure and rehabilitation of Mary Kathleen, studies have found some environmental issues including seepage of radioactive waters from the base of the tailings dam wall into the former evaporation ponds and local drainage system, and colonisation of rehabilitated areas with weed species.

Summary of former uranium mine sites in Australia



1. Nabarlek

Operated 1979 to 1988. Decommissioned 1994/5. Rehabilitation objectives agreed with Traditional Owners and supervising authorities; safe for traditional hunting and gathering activities to take place. A regular monitoring program is in place.

2. Rum Jungle

Operated 1954 to 1971. Rehabilitation from 1983 to 1986. Since this time there has been a gradual deterioration of the rehabilitation works therefore a project to review and improve the rehabilitation has commenced.

3. South Alligator Valley

13 uranium mines operated between 1954 and 1964. Ore transported to Rum Jungle for processing. Mix of open cut and shaft mines. Complete rehabilitation of some sites not undertaken due to need for additional funding, but as a priority, a program of physical and radiological hazard reduction was carried out for the safety of National Park users. Radiation doses do not exceed public exposure limits. A regular monitoring and surveillance program is in place.

4. Mary Kathleen

Uranium mine closed in 1982. Rehabilitation completed in 1985.

5. Radium Hill

Mined for radium between 1906 and 1931 and for uranium between 1954 and 1961. Rehabilitation undertaken in 1962 and again in 1981.

Article 13 Siting of Proposed Facilities

Proposed radioactive waste management facilities require approval for siting according to the legislative and regulatory systems of the jurisdiction applicable to the site of the facility. If the site is to be operated by or on behalf of the Commonwealth Government, then ARPANSA will be the regulator, regardless of the location.

RPS C-3 provides site selection criteria and clear requirements for public consultation. The Code sets out the general characteristics of a site suitable for the establishment of a radioactive waste management facility, as well as describing site characteristics that will facilitate the long-term stability and provide adequate isolation of the waste. The site selection criteria include socio-economic, ecological and land use factors as well as natural physical characteristics of the proposed site.

ARPANSA has also developed a regulatory guide on *Siting of Controlled Facilities* (REG-LA-SUP-240L, 2014) to assist in the preparation of an application for a siting licence. The guidance is applicable for the siting of nuclear or radiation facilities at new sites and for the collocation of new facilities at existing sites. Applying relevant lessons learned from the Fukushima Daiichi accident, the guidance emphasises the need to consider other nearby (collocated) on- or off-site facilities which could potentially increase the risk to the public or the environment in emergency situations and which may also require local services, taking into consideration all interdependencies.

The ARPANS Regulations stipulate that the CEO may request any environmental impact statement requested or required by any Commonwealth Government, state, territory or local government agency, and may take that into account in deciding whether to issue a facility licence authorising the preparation of a site. The CEO may also request:

- A detailed site evaluation establishing the suitability of the site for the facility
- The characteristics of the site, including the extent to which the site may be affected by natural and human events

There is a separate national regulatory framework for protection of the environment established under the EPBC Act, which is binding on all jurisdictions. The definition of environment in the EPBC Act makes reference to people and communities as part of ecosystems and requires social and economic impacts, in addition to environmental impacts, to be considered. If a proposed action is referred to the Commonwealth Government Minister for the Environment, and the Minister decides that the proposed action requires approval, an assessment process (including an environmental impact assessment) must be carried out.

Public consultation

Public consultation is required as part of the environmental approval process under the EPBC Act. Licence applications to ARPANSA for the siting of a radioactive waste management facility are also subject to public consultation, if defined as a nuclear installation. This entails release of the application for public comment and the requirement for the CEO of ARPANSA to take into account the content of public submissions in deciding whether to issue a licence.

In RPS C-3, there is a requirement for the proponent and the regulatory body to consult with stakeholders to achieve the most informed decision and best practicable outcomes. This must include consideration of the health¹² of impacted communities.

The Commonwealth Government has demonstrated its commitment to ongoing public consultation through constructive and open engagement with the local communities of the shortlisted sites to host the NRWMF in order to better understand their sentiment towards hosting the NRWMF. The siting of the facility remains a topic of community debate with strong views on each side of the discussion.

Consultation and engagement have included:

- 243 community members (since 2016) visiting ANSTO's Lucas Heights facility to see firsthand how radioactive waste is stored and discuss nuclear science with ANSTO experts
- town-hall meetings and meetings with local interest group.
- engagement with the Consultative Committee.
- the publication of a monthly newsletter, distributed digitally to email inboxes and in hard-copy form to postal addresses
- engagement through social media (Facebook) which allows for greater speed and audience reach when publishing new information and in answering questions
- the redevelopment of www.radioactivewaste.gov.au to make the project's website more user-focused
- "meet the Experts" events, which have facilitated discussions between community members and technical experts and educators from other government agencies such as ANSTO and Geoscience Australia. More than 40 expert presentations have been given in the two communities
- media engagement to respond to letters to the editor and articles about the project and to keep the mainstream media informed about the project's progress
- local staff presence: DISER has maintained a weekly staff presence and employed a full-time locally-engaged officer in local communities to keep members of the public informed
- facilitating webinars with experts
- a public submissions process.

Consultation with other Contracting Parties

Considering the geographical position and size of Australia, it is not foreseeable that waste management facilities in Australia would have impacts on other Contracting Parties (outside Australia) that would require consultation.

¹² Health is defined by the World Health Organization as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Article 14 Design and Construction of Facilities

Limiting possible radiological impacts

The design safety features of radioactive waste management facilities must consider the engineering and administrative controls that will be in place in these facilities to ensure that the radiological impact on the health and safety of people and environment is expected to be negligible. RPS C-3, RPS 16 and Advisory Note: Dose and risk criteria for protection of people following the closure of a disposal facility for radioactive waste (ARPANSA 2019e) provide guidance on design and performance expectations relevant to the waste processes, operations and activities and the criteria for protection of workers, the public and the environment.

RPS C-3 provides detail on the importance of passive means of achieving safety in the containment and isolation of the waste and the demonstration of defence in depth in the design of the disposal facility.

Consideration of decommissioning/closure

Plans and other provisions for decommissioning the facility must be developed at the design stage of a waste management facility. These must be revised and updated as the facility moves through the licensing stages.

In the case of a near-surface disposal facility, RPS C-3 requires that prior to commencement of operations, the operator prepare draft or conceptual plans for closure and decommissioning of the facility and rehabilitation of the site, and that these plans be submitted for approval. These plans must be reviewed, updated if appropriate, and resubmitted for approval as required by the regulator. Approval to cease operations must also be sought prior to the proposed closure date.

Validation of technologies used

The technologies incorporated in the design and construction of a radioactive waste management facility must be supported by proven design, experience, testing and analysis. For example:

- The design and construction of SyMo Facility (Synroc plant) incorporated proven technologies in the design that were developed through innovation, laboratory scale demonstrations, operating prototypes and use in other facilities. A full-scale demonstration plant of the front end and back end processes has been built to demonstrate, test and improve the processes, using non-radioactive material, as they will be configured in the operating facility, once constructed and commissioned.
- For a near-surface disposal facility, RPS C-3 requires that the structure be constructed in accordance with best engineering practice. In the case of uranium mining operations, RPS 9 requires the use of 'best practicable technology' as part of an approved Radioactive Waste Management Plan, to ensure the release of radioactive material is minimised and to provide for the protection of people and the environment from the possible harmful effects associated with mining and milling operations.

Article 15 Assessment of Safety of Facilities

An assessment of the safety and environmental impact of a proposed radioactive waste management facility during the operational period must be approved before construction of a facility can commence. The assessment must be reviewed and updated prior to the operation of the facility. Regulators consider both safety and security when reviewing these assessments.

A radiation management plan is also required. This plan includes provisions for personnel training, personnel monitoring, knowledge management, monitoring, designation of areas of potential radiation exposure, emergency preparedness, contamination control and protective clothing and apparatus.

For disposal facilities, RPS C-3 requires a safety case and supporting safety assessment at all stages of authorisation. The safety assessment must consider the projected long-term integrity of the site after closure. The operator must remain responsible for the site and all necessary site rehabilitation work until the completion of the work has been approved by the regulator and the licence is surrendered.

Article 16 Operation of Facilities

In all jurisdictions, a licence to operate a radioactive waste management facility is required prior to operation of such a facility. The regulatory authority cannot grant the licence until, amongst other requirements, the proposed facility meets the requirements for design and construction, and an assessment of safety and environmental impact has been undertaken and approved. These requirements are presented in the ARPANSA regulatory guide for licensing of radioactive waste storage and disposal facilities (*Applying for a licence for a radioactive waste storage or disposal facility* (ARPANSA 2019f)). Additional licence conditions can be imposed as required. For example, conditions can be imposed to cover the reporting of significant safety incidents to the regulatory authority. As indicated earlier, ANSTO facilities are subject to ongoing licensing processes under the ARPANS Act and to internal safety review in accordance with the requirements of the ANSTO safety system.

All jurisdictions require that:

- Where appropriate, operational limits and conditions are derived from systematic safety assessments and/or safety analysis conducted for the facilities. These operational limits and conditions are revised as necessary.
- Operation, maintenance, monitoring, inspection and testing must be conducted in accordance with established procedures.
- Engineering and technical support in all safety-related fields must be available throughout the operating life of the waste management facility. For example, ARPANSA has prepared regulatory guidance for use in the Commonwealth jurisdiction by applicants for licences for near-surface disposal facilities and storage facilities. The guidance advises that applicants should describe in detail the knowledge, skills and experience of the operator of the proposed facility for the initial campaign and the requirements that will be placed in operators for subsequent campaigns.
- Waste holders are responsible for the characterisation and segregation of radioactive waste. RPS 16 provides specific advice on the management of wastes typical of Australia's current waste inventory and advises on approaches to the characterisation and segregation of waste.

- Incidents significant to safety must be reported to the regulatory authority in a timely manner by the licence holder. In addition, ARPANSA maintains the national Australian Radiation Incident Register. A radiation incident is defined in the NDRP as: ‘Any unintended or ill-advised event when using ionising radiation apparatus, specified types of non-ionising radiation apparatus or radioactive substances, which results in, or has the potential to result in, an exposure to radiation to any person or the environment, outside the range of that normally expected for a particular practice, including an event resulting from operator error, equipment failure, or the failure of management systems that warranted investigation.’ (ARPANSA 2017a)

The regulatory authority in each jurisdiction conducts a risk-informed, routine program of radiation safety monitoring to assess a responsible person’s compliance with the legislation and the required level of radiation safety. These monitoring activities may lead directly to investigations and inspections, followed by enforcement actions when breaches of the relevant legislation have been identified.

Inspections and investigations are formal regulatory functions that may only be conducted by an appointed inspector. Inspectors also have a number of prescribed powers, for example, issue of prohibition notices and improvement notices, seizure of radiation sources and the ability to take emergency actions.

The legislation in each jurisdiction contains reporting requirements on matters such as abnormal or unplanned exposure to radiation, out of control radiation sources, damage or malfunction of a radiation source, loss or theft of a radiation source, contamination by a radioactive substance, unintentional or accidental release of a radioactive substance, and any corrective actions taken.

Collection and analysis of operating experience

In South Australia, the responsible persons conducting mining or mineral processing operations that are licensed under the *Radiation Protection and Control Act 1982* are required to provide the regulator with the results of periodic assessments and reviews of operational experience. Quarterly and annual reports are provided for uranium mining operations. These reports provide detailed information about waste management activities, including the qualities of wastes (both solid and liquid) in storage or disposed of during the relevant reporting period.

Preparation and update of decommissioning plans

RPS 16 recommends that decommissioning be considered in the design of facilities to be used for the predisposal management of radioactive waste. The complexity of this consideration should be commensurate with the facility’s size and operations. The guide advises that design options and operating practices that will facilitate decommissioning should be chosen, and that a decommissioning plan that can be updated during the life of the facility should be prepared.

For a Commonwealth Government applicant, it is a legislative requirement to consider decommissioning at all stages over a facilities lifetime. An initial decommissioning plan should be submitted at the time of the licence application for construction. The design of a facility addresses aspects that may facilitate subsequent extension of the life of the facility and eventual decommissioning.

Uranium mines and production facilities are required under RPS 9 to submit a mine management plan (or equivalent) addressing all facets of mine management including decommissioning and site rehabilitation. The Code is applied as a condition of licence by jurisdictions.

For disposal facilities, RPS C-3 requires that closure is considered in the initial design of the facility. Before construction activities commence, there has to be sufficient evidence that the performance of backfilling, sealing and capping will function as intended to meet the design requirements. Plans for closure and seal or cap designs must be updated as the design of the facility is developed.

Article 17 Institutional Measures after Closure

RPS C-3 requires that:

- Detailed records of all waste consigned to and received at the facility be kept by the operator and the regulator. This must include the waste generator, the type of waste, the volume and weight of the waste packages, the chemical and physical form and concentration of radionuclides in the waste and details of any conditioning.
- All data from environmental and area monitoring at and around the facility must be retained along with details of any accidents and incidents and occupational dose records for all radiation workers, site records of disposal structures, the location and contents of waste packages or containers and details of backfilling and cover materials must be kept at least until the end of the institutional control period in two widely separated locations, one of which must be the government archives of the relevant jurisdiction.
- A program of surveillance involving site inspections and environmental monitoring be carried out during the institutional control period and that the historical records of the waste disposed are maintained. This includes the location and purpose of the disposal site being marked on land titles as caveats or mentions for the institutional control period.
- The perimeter fence and site markers must be maintained during the institutional control period.

The institutional control period can only end with the approval of the relevant regulatory authority. In addition, licence conditions may be imposed in certain instances. For example, conditions requiring post-closure environmental monitoring were imposed in the licence to possess the Maralinga atomic weapons test site subsequent to its rehabilitation.

Any unplanned release of radioactive materials into the environment that is detected during the institutional control period would trigger regulatory assessment of the resulting impact(s) followed by intervention measures and changes to the control procedures as required.

Records of the location, design and inventory of radioactive wastes at the former Radium Hill uranium mine and Port Pirie Treatment Plant sites will be preserved by the South Australian radiation regulator and the owner of the sites, the South Australian Government Department for Energy and Mines. Records relating to waste disposed at Maralinga are held by the Commonwealth Government and can be accessed by the South Australian regulator.

As mentioned under Article 12, ANSTO has one closed facility (Little Forest Legacy Site – formerly the Little Forest Burial Ground) that was used for disposal of radioactive material between 1960 and 1968. This facility is secure and is monitored for groundwater, airborne, and surface contamination. Test results are publicly available and confirm that the site is being safely managed.

I. Transboundary Movement

Article 27 Transboundary Movement

Requirements on import

Legislation restricting the import of radioactive substances, including waste, appears in Regulation 4R(2) of the *Customs (Prohibited Imports) Regulations 1956*.¹³

4R Importation of radioactive substances

- (2) The importation into Australia of a radioactive substance is prohibited unless:
- (a) a permission in writing to import the substance has been granted by the Minister for Health or an authorised officer; and
 - (b) the permission is produced to a Collector.

This Regulation defines ‘radioactive substance’ as any radioactive material or substance including radium, any radioactive isotope or any article containing any radioactive material or substance.

Permissions are normally granted by officers in ARPANSA who have been appointed by the Minister for Health. The Customs Regulations establishing the import control give the Minister the power to vary or revoke applications that have been granted by authorised officers. If the authorised officer has formed an opinion that the permission should not be granted, the application must be referred to the Minister for Health for the final decision, which may be to grant, or refuse to grant, the permission. There is no overlap or conflict of decision-making authority.

The *National Radioactive Waste Management Act 2012* only allows for the management of radioactive waste that is of domestic origin at the proposed NRWMF. This includes waste from the reprocessing overseas of spent fuel from the operation of Australian research reactors (HIFAR and OPAL).

Requirements on export

Australia has controls on the export of specific types of radioactive material and to certain destinations. In particular, authorisation is required from the relevant Commonwealth Government minister in the following circumstances:

- For the export of radioactive waste to Pacific Island states
- For the export of high activity sources as defined in the IAEA Code of Conduct on the Safety and Security of Radioactive Sources (2004)
- For the export of fertile and fissile materials.

¹³ www.comlaw.gov.au/Details/F2010C00785

Australia's *Customs (Prohibited Exports) Regulations 1958*¹⁴ prohibit the export of most uranium and thorium source material, most special fissionable material and other fissionable materials (as set out in Schedule 7 to Regulation 9) without the prior written permission of the Minister administering the *National Radioactive Waste Management Act 2012*.

The export of radioactive waste to the Pacific Island Developing Countries is prohibited in Regulation 13G of the *Customs (Prohibited Exports) Regulations 1958* unless permission in writing to export the radioactive waste has been granted by the Minister administering the *National Radioactive Waste Management Act 2012*, taking into account the international obligations of Australia. The Regulation defines 'radioactive waste' as waste consisting of material that emits ionising radiation as a result of the spontaneous transformation of the nucleus of the atom but does not include material that has an activity concentration below 1 Bq/g or an activity below 1000 Bq.

Return to manufacturer

The Commonwealth Government and state and territory jurisdictions allow the trans-boundary movement of disused sealed sources for return to the manufacturer. These movements must comply with all relevant legislative and regulatory requirements, and are covered by RPS 11 *Code of Practice for the Security of Radioactive Sources* (ARPANSA 2019g) and the national *Code for the Safe Transport of Radioactive Material* (RPS C-2, Rev.1) (ARPANSA, 2019a), which follows the IAEA transport requirements *Regulations for the Safe Transport of Radioactive Material 2018 Edition* (IAEA SSR-6 (Rev.1), 2018).

¹⁴ www.comlaw.gov.au/Details/F2011C00191

J. Disused Sealed Sources

Article 28 Disused Sealed Sources

Australia has strongly supported IAEA initiatives to explore synergies between the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* (2004) and the Joint Convention.

Legislative requirements for dealing with disused sealed sources

The focus of Australia's legislative control over disused sealed sources is through a requirement on the owner of the source to have a confirmed arrangement with the supplier for the return of the source at the end of its useful life. Details of the requirements are described in the 2017 National Report.

Re-entry of disused sources

Sealed radioactive sources are refurbished in a number of jurisdictions and exported to other states/territories and overseas. In each jurisdiction, possession of sealed sources (used or disused) requires a licence. Each jurisdiction allows the re-entry of disused sealed sources or devices containing sealed sources, under legislative and regulatory control and with the manufacturer's approval and Customs approval, provided that the source and/or device was manufactured within the jurisdiction and that the sealed source is ultimately to be returned to the manufacturer for recycling or disposal. Each jurisdiction requires that such manufacturers be licensed and have approved procedures in place for the management of sealed sources that are returned to them.

K. General Efforts to Improve Safety

IRRS Mission to Australia

Australia hosted its second IRRS mission in November 2018. The mission reviewed Australia's framework for radiation safety against relevant IAEA Safety Standards. The mission included participation from the Commonwealth and all state and territory jurisdictions. The previous IRRS mission to Australia was in 2007 and a follow-up in 2011.

The 2018 IRRS mission team issued its report in February 2019, which provided 23 recommendations, 12 suggestions for improvement and four instances of good practices. The most significant challenge to Australia is establishing a national framework for radiation safety that assures a consistent level of safety and protection of people and the environment across all jurisdictions, in principle and in practice. While there are on-going activities to address consistency in the Australian radiation safety programs, the IRRS team noted several areas where further efforts are warranted.

With regards to waste management, the IRRS team noted that the Commonwealth Government should make a firm commitment and take actions with specific milestones to address decommissioning of facilities and radioactive waste management by assuring the strategy, programmes, funding and technical expertise for safe completion are in place.

The IRRS report also noted that the Australian Radioactive Waste Management Framework presents the overall principles and long-term goals for radioactive waste management. However, the team observed that the document does not address the responsibilities and arrangements to ensure delivery of the commitments with associated timeframes and milestones.

Given these observations of Australia's management of radioactive waste, the IRRS team made one recommendation, which was that *the Commonwealth Government should establish and implement a strategy to give effect to the policy principles and goals in the Australian Radioactive Waste Management Framework*.

The Commonwealth has carriage of implementing this recommendation. Many aspects of the recommendation have been put in place through the Commonwealth's policy framework described in Section C under Radioactive waste management policy. The process of 'establishing and implementing a strategy' is ongoing and will take some time to come to fruition.

Australia has developed a national action plan to address the recommendations and suggestions for improvement from the IRRS mission. A follow-up IRRS mission will be scheduled for early 2022 to determine Australia's progress in implementing the changes.

Commitment to openness and transparency

Australia is fully committed to openness and transparency in implementing its obligations under the Joint Convention. All of Australia's National Reports are available to the public on the ARPANSA website, along with other readily available relevant information. In this regard, Australia commits to the decision of the 3rd

Extraordinary Meeting of the Contracting Parties (Vienna, May 2017) for the IAEA Secretariat to make publicly available each National Report, 90 days after the Review Meeting (unless a Contracting Party notifies the Secretariat otherwise).

Progress towards a national radioactive waste disposal facility

The Commonwealth Government is in the process of siting a facility under the *National Radioactive Waste Management Act 2012*. Australia's current and future radioactive waste held by the Commonwealth and any state or territory jurisdiction that chooses to use the facility will be brought together in a single, purpose built-facility, subject to waste acceptance criteria.

The Commonwealth government has announced the establishment of the Australian Radioactive Waste Agency (ARWA) which will be dedicated to managing Australia's radioactive waste in accordance with domestic and international regulations and best practice. ARWA has been established as a separately branded function of the Department of Industry, Science, Energy and Resources before it is created through legislation as an independent statutory non-corporate Commonwealth entity by 1 July 2022.

ARWA will develop the national policy, strategy and ultimately a disposal facility for the relatively small quantities of ILW that are currently being stored in Australia. The NRWMF will have appropriate functionality to be safely operated for:

- Permanent disposal of LLW for the next 100 years, whilst ensuring institutional control for an ongoing period of time which does not unduly rely on future generations nor cause harm to the environment.
- Temporary ILW storage for a period of time sufficient for the government to establish a permanent disposal facility.

These objectives will be met through a consultative process, whereby the community's views are sought, acknowledged and considered.

Between August and September 2019, staff from the Department of Industry, Innovation and Science (now DISER) undertook a research trip to France, Norway, England and Canada. The Department met with international radioactive waste management delegates and discussed radioactive waste management practices with the aim of equipping Australia with knowledge of current best international practices.

The department was due to attend and make a presentation to the WM 2020 Symposium in Phoenix in March, but the event was postponed due to COVID-19 travel restrictions. Future opportunities are being identified to demonstrate the development of the Australian's waste management capability.

Research and Innovation

CSIRO is working on an assessment and pilot-trial project to understand the composition of the radioactive material stored at Woomera in South Australia. The project will also investigate appropriate segregation and processing techniques in advance of a further project to process, treat and pre-condition the 9,726 drums of waste.

As part of its Legacy Radiation Disposal and Consolidation Project, CSIRO is currently working to consolidate its waste stores to a single location and is investigating options to dispose of most of its waste holdings via appropriate disposal pathways.

Construction of new facilities at ANSTO

ANSTO is in the process of constructing a new radioactive waste treatment facility (SyMo) to process (treat and condition) intermediate level liquid wastes from radiopharmaceutical production into a solid and stable immobile form suitable for disposal. Since the 2017 National Report, ANSTO completed extensions of its radioactive waste storage facilities, both its low-level solid waste and intermediate-level solid waste facilities, to account for future production demands of radioactive waste. The storage extension for ILW has provided for an additional five years of waste production, while the extension for LLW will provide for an additional ten years of waste production. These facilities will enable ANSTO to safely manage its waste until the NRWFMF is established.

L. Annexes

Annex A – Inventory of Radioactive Wastes

The following inventory of radioactive waste held in Australian storage and disposal facilities is provided by the relevant regulatory authorities with responsibility for maintaining the inventories of radioactive waste in their jurisdictions. Volumes of sealed sources, sources of unknown activity and sources of unknown radionuclides are not included. Where possible, the activities of waste with mixed radionuclides have been apportioned to individual nuclides. In all cases, if the date of activity measurement was unknown, it was conservatively assumed that the activity was for the date the information was provided and updated as appropriate for the given reference date in the following tables.

Inventory of disused sealed sources held in Australian storage facilities:

Site: Australian Capital Territory

Activity Reference Date: 11/09/2020

| Radionuclide | Number of Sources | Total Activity (GBq) |
|--------------|-------------------|----------------------|
| Am-241 | 720* | unknown* |
| Am-241/Be | 1 | 1.68E+00 |
| Cd-109 | 7 | 1.1E-10 |
| Co-60 | 22 | 5.7E-05 |
| Cs-137 | 10 | 2.1E+00 |
| Fe-55 | 12 | 1.1E-04 |
| Kr-85 | 20 | 2.6E-01 |
| Ra-226 | 3 | 7.2E-04 |
| Sr-90 | 6 | 4.2E+00 |
| U (nat) | 3 | 7.1E-04 |

*smoke detectors

Site: Northern Territory

Activity Reference Date: 17/01/2017

| Radionuclide | Number of Sources | Total Activity (GBq) |
|--------------|-------------------|----------------------|
| Am-241 | 62 | 3.6E-03 |
| Am-241/Be | 4 | 219.0E+00 |
| Co-60 | 3 | 0.6E+00 |
| Cs-137 | 3 | 1.6E+00 |
| Sr-90 | 3 | 3.2E+00 |

Site: Commonwealth (ANSTO)

Activity Reference Date: 08/11/2019

| Radionuclide | Number of Sources | Total Activity (GBq) |
|---|--------------------------|-----------------------------|
| Am-241 | 112 | 5.19E+01 |
| Am/Be Neutron sources | 16 | 3.05E+02 |
| Ba-133 | 21 | 5.00E-02 |
| C-14 | 9 | 1.70E+00 |
| Cf-252 | 4 | 0.00E+00 |
| Cl-36 | 13 | 0.00E+00 |
| Co-60 | 1739 | 4.93E+05 |
| Co-57 | 8 | 0.00E+00 |
| Cs-137 | 147 | 1.49E+04 |
| Fe-55 | 5 | 1.00E-01 |
| H-3 | 9 | 6.58E+01 |
| Hg-203 | 7 | 0.00E+00 |
| Ir-192 | 19 | 0.00E+00 |
| Kr-85 | 13 | 1.50E+00 |
| Mn-54 | 11 | 0.00E+00 |
| Na-22 | 14 | 1.00E-02 |
| Ni-63 | 7 | 1.90E+00 |
| Pb-210 | 6 | 2.00E-02 |
| Pu-238, 239, 241 | 44 | 1.56E+02 |
| Ra-226 | 29 | 2.10E+00 |
| Ra/Be Neutron sources | 5 | 2.05E+01 |
| Sr-90 | 90 | 4.70E-01 |
| Sr-90, Y-90 | 9 | 0.00E+00 |
| Thorium radioisotopes | 18 | 1.00E-02 |
| U-238 | 10 | 2.30E-01 |
| Mixed groups/miscellaneous sources and single radioisotope sources with less than 5 of each | 86 | 1.15E+02 |

Site: Commonwealth (ARPANSA)

Activity Reference Date: 01/06/2017

| Radionuclide | Number of Sources | Total Activity (GBq) |
|---------------------|--------------------------|-----------------------------|
| Am-241 | 1 | 1.85E+01 |
| Am-241/Be | 1 | 1.07E+00 |
| Co-60 | 6 | 2.20E-01 |
| Cs-137 | 10 | 5.38E+01 |
| Kr-85 | 1 | 1.00E-02 |
| Pu-239 | 1 | 1.00E-01 |
| Ra-226 | 40 | 9.32E+00 |
| Ra-226/Be | 2 | 6.40E-01 |

Site: Commonwealth (CSIRO)

Activity Reference Date: 01/04/2017

| Radionuclide | Number of sources | Total Activity (GBq) |
|---------------------|--------------------------|-----------------------------|
| Am-241 | 32 | 8.90E+01 |
| Am-241/ Be | 25 | 1.13E+03 |
| Am-241/ Li | 1 | 3.48E+01 |
| Ba-133 | 13 | 9.00E-01 |
| Bi-207 | 1 | 0.00E+00 |
| Bi-210 | 1 | 0.00E+00 |
| C-14 | 2 | 0.00E+00 |
| Cf-252 | 5 | 3.45E-02 |
| Co-60 | 23 | 2.99E+00 |
| Cm-242 | 1 | 1.38E+01 |
| Cm-244 | 6 | 5.02E+00 |
| Cs-137 | 26 | 1.44E+00 |
| Eu-152 | 1 | 0.000142 |
| Fe-55 | 2 | 1.95E-01 |
| H-3 | 2 | 1.22E+00 |
| I-129 | 6 | 3.18E-02 |
| Kr-85 | 6 | 7.42E+00 |
| Ni-63 | 13 | 4.76E+00 |
| Pb-210 | 1 | 0.00E+00 |
| Pu-238 | 6 | 5.91E+00 |
| Pu-238/Be | 1 | 2.98E+02 |
| Pu-239 | 2 | 5.55E-04 |

| | | |
|-----------|----|----------|
| Pm-147 | 0 | 0 |
| Ra-226 | 72 | 29.4 |
| Ra-226/Be | 5 | 1.370502 |

Note: As of mid-2019, CSIRO has provisioned funding to consolidate and dispose of its radiation waste holdings via appropriate disposal pathways. It is anticipated that CSIRO's current inventory of radioactive sources will significantly reduce as part of this project.

Site: New South Wales

Activity Reference Date: 1/09/2015

| Radionuclide | Number of Sources | Total Activity (GBq) |
|------------------------|--------------------------|-----------------------------|
| Am-241 | 139 | 3.27E+03 |
| Am-241/Be & Cs-137 | 1 | 3.70E+01 |
| Am-241/Be & Ra-226/Be | 1 | 3.70E+04 |
| C-14 | 1 | 2.70E+03 |
| Co-60 | 3 | 5.42E+03 |
| Cs-137 | 5 | 2.65E+05 |
| H-3 | 46 | 7.69E+05 |
| Kr-85 | 1 | 5.26E+04 |
| Ra-226 | 1 | 3.00E-03 |
| Cs-137/Co-60 | 1 | 4.15E+02 |
| U-238 | 1 | unknown |
| Pu-239 | 1 | 3.99E+04 |
| Sr-90 | 5 | 7.46E+05 |
| Mixed | 5 | 5.75E+04 |
| H-3 & C-14 | 1 | unknown |
| U / Th | 1 | unknown |
| Am-241 / D/U, Se-75, U | 1 | unknown |

Site: Queensland

Activity Reference Date: 14/10/2019

| Radionuclide | Number of Sources | Total Activity (GBq) |
|---------------------|--------------------------|-----------------------------|
| Am-241 | 113 | 2.1E+01 |
| Am-241 (ICSDs) | 3372 | 7.0E+00 |
| Am-241/Be | 53 | 4.6E+02 |
| Ba-133 | 19 | 5.6E-02 |
| C-14 | 24 | 5.7E-01 |

| <i>Radionuclide</i> | <i>Number of Sources</i> | <i>Total Activity (GBq)</i> |
|---------------------|--------------------------|-----------------------------|
| Cd-109 | 5 | 3.4E-05 |
| Cl-36 | 4 | 8.1E-05 |
| Cm-244 | 1 | 2.9E-01 |
| Co-60 | 229 | 2.5E-01 |
| Cs-137 | 184 | 4.2E+03 |
| Eu-152 | 7 | 2.4E+01 |
| Fe-55 | 6 | 6.3E-3 |
| H-3 | 99 | 4.0E+03 |
| Ge/Ga-68 | 1 | 2.0E-03 |
| Ho-166m | 1 | 4.9E-05 |
| I-129 | 4 | 9.2E-06 |
| Kr-85 | 1 | 1.9E-02 |
| Mn-54 | 2 | 3.2E-06 |
| Na-22 | 11 | 6.5E-02 |
| Ni-63 | 14 | 4.7E+00 |
| Pb-210 | 23 | 2.2E-02 |
| Pm-147 | 9 | 1.1E-04 |
| Po-210 | 14 | 1.2E-08 |
| Pu-238 | 6 | 5.0E+00 |
| Pu-239 | 2 | 7.4E-06 |
| Ra-226 | 308 | 1.4E+02 |
| Ra-226 (ICSDs) | 222 | 8.2E-02 |
| Ra-226/Be | 5 | 9.7E-01 |
| Sr-90 | 214 | 4.1E+01 |
| Tc-99 | 1 | 1.4E-06 |
| Th-232, Th (nat) | 9 | 1.5E-03 |
| Tl-204 | 28 | 4.5E-05 |
| U-233 | 1 | 3.4E-02 |
| U (depleted) | 8 | 9.3E-01 |
| U (nat) | 2 | 1.9E-04 |

Site: South Australia

Activity Reference Date: 12/11/2019

| Radionuclide | Number of Sources | Total Activity (GBq) |
|------------------------|--------------------------|-----------------------------|
| Am-241 | 15 | 1.79E+01 |
| Am-241 | 1400* | 3.6E-02 |
| Am-241/Be | 10 | 4.07E+02 |
| Am-241 (Am/Be), Cs-137 | 1 | 1.10E+00 |
| Ba-133 | 3 | 3.28E-05 |
| Cf-252 | 1 | 2.70E-02 |
| Co-60 | 3 | 1.15E+00 |
| Cs-137 | 28 | 4.22E+01 |
| H-3 | 8 | 1.30E-04 |
| Pu-238 | 5 | 5.66E-07 |
| Pu-239 | 3 | 2.15E-07 |
| Ra-226 | 19 | 3.72E-02 |
| Sr-90 | 5 | 2.00E+00 |
| Th-232 | 11 | 2.34E-07 |

*smoke detectors

Site: Tasmania*

Activity Reference Date: 3/12/2019

| Radionuclide | Number of Sources | Total Activity (GBq) |
|---------------------|--------------------------|-----------------------------|
| Am-241 | 94 | 1.8E+00 |
| Co-57 | 1 | unknown |
| Cs-137 | 22 | 3.6E+01 |
| Fe-55 | unknown | 7.0E-01 |
| H-3 | 4 | 5.3E+01 |
| Pu-238 | 2 | 2.3E+00 |
| Ra-226 | 35 | 1.5E+01 |
| Sr-90 | 12 | 1.39E+01 |

* Change in reporting function

Site: Victoria

Activity Reference Date: 15/11/2019

| Radionuclide | Number of Sources | Total Activity (GBq) |
|---------------------|--------------------------|-----------------------------|
| Am-241 | 120 | 6.73E+02 |
| Am-241/Be | 175 | 6.81E+02 |
| Ba-133 | 13 | 1.50E+00 |
| Bi-207 | 1 | 1.82E-04 |
| C-14 | 3 | 1.08E-01 |
| Cd-109 | 5 | 2.94E-01 |
| Cf-252 | 5 | 1.46E+00 |
| Cm-244 | 1 | 3.70E+00 |
| Co-57 | 32 | 1.74E+01 |
| Co-60 | 108 | 2.12E+00 |
| Cs-137 | 400 | 5.16E+02 |
| Eu-152 | 1 | 3.70E-02 |
| Eu-155 | 0 | 0.00E+00 |
| Fe-55 | 4 | 7.04E+00 |
| Gd-153 | 3 | 3.74E+01 |
| Ge-68 | 50 | 3.54E+00 |
| H-3 | 19 | 2.73E+02 |
| I-125 | 4 | 4.03E+01 |
| I-129 | 3 | 5.51E-06 |
| Ir-192 | 3 | 6.90E-06 |
| Kr-85 | 27 | 1.63E+02 |
| Na-22 | 1 | 1.38E-06 |
| Ni-63 | 5 | 8.71E-01 |
| Pb-210 | 5 | 9.59E-04 |
| Pm-147 | 4 | 1.85E+01 |
| Po-210 | 1 | 3.02E-10 |
| Pu-238 | 2 | 7.40E+00 |
| Ra-226 | 364 | 2.79E+01 |
| Ra-226/Be | 5 | 8.11E-01 |
| Ru-106 | 15 | 2.84E-01 |
| Sm-151 | 0 | 0.00E+00 |
| Sr-90 | 165 | 2.37E+02 |
| Th-228 | 1 | 3.00E-05 |
| Th-232 | 53 | 2.13E-01 |
| Tl-204 | 22 | 2.33E-02 |
| U(nat) | 47 | 2.59E-01 |
| U-238 | 57 | 1.84E-01 |

Inventory of disused sealed sources disposed of at Mt Walton East Intractable Waste Disposal Facility, Western Australia

Activity Reference Date: 1/07/2011

| Radionuclide | Number of Sources*** | Total Activity (GBq) |
|---------------------|-----------------------------|-----------------------------|
| Am-241 | 2732 | 7.4E+01 |
| Am-241/Be | 5 | 8.2E+00 |
| Ba-133 | 10 | 3.5E-02 |
| C-14 | 1 | 8.3E-03 |
| Cf-252 | 1 | 6.4E-04 |
| Co-60 | 55 | 2.3E+00 |
| Cs-137 | 142 | 2.6E+02 |
| H-3 | 2810 | 4.4E+05 |
| Ni-63 | 5 | 1.5E+00 |
| Ra-226 | 21 | 5.8E+00 |
| Ra-226/Be | 3 | 5.7E-01 |
| Sr-90 | 12 | 3.5E+00 |
| Th-232 | 12 | 1.2E-02 |
| Tl-204 | 3 | 1.1E-02 |

In addition, 25 sources containing combinations of the following radionuclides:

| Radionuclide | Total Combined Activity (GBq) |
|---------------------|--------------------------------------|
| Am-241 | 8.3E+00 |
| C-14 | 7.0E-06 |
| Co-60 | 1.1E+01 |
| Cs-137 | 6.1E+01 |
| H-3 | 6.3E+03 |
| Ra-226 | 9.2E-02 |
| Sr-90 | 2.2E-05 |
| Tl-204 | 5.9E-06 |

***The records that are available for more recent disposal campaigns are more detailed than those for earlier campaigns.

Inventory of unsealed radioactive waste:

Uranium Mining and Milling Sites

| <i>Jurisdiction</i> | <i>Site Name</i> | <i>Volume (m³)</i> | <i>Mass (Mt)</i> |
|---------------------|------------------|-------------------------------|------------------|
| Northern Territory | Ranger | 28400000 | |
| South Australia | Beverly | 5840 | |
| South Australia | Honeymoon | 1577 | |
| South Australia | Pt Pirie | 120000 | |
| South Australia | Radium Hill | 250200 | |
| South Australia | Olympic Dam | 330872953 | 183.8 |

Notes for South Australia: Olympic Dam numbers were reviewed to include all tailings from start of operation in 1988. Honeymoon volume reviewed to exclude non-radioactive pond decant liquor.

Disposal Sites

| <i>Jurisdiction</i> | <i>Site Name</i> | <i>Volume (m³)</i> |
|---------------------|-----------------------------------|-------------------------------|
| Commonwealth | ANSTO - Little Forest Legacy Site | 1718 |
| Commonwealth | South Alligator Disposal Facility | 22000 |
| South Australia | Maralinga | 432000 |
| Western Australia | Mt Walton East IWDF | 124 |

Storage Sites

| <i>Jurisdiction</i> | <i>Site Name</i> | <i>Suitable for near-surface disposal</i> | <i>Volume (m³)</i> |
|-----------------------------|-----------------------|---|-------------------------------|
| Commonwealth | CSIRO - Woomera | * | 2100 |
| Commonwealth | CSIRO | yes | 6 |
| Commonwealth | CSIRO | no | 3.3 |
| Commonwealth | ARPANSA | yes | 44.28 |
| Commonwealth | ARPANSA | no | 6.50 |
| Commonwealth | ANSTO - Lucas Heights | yes | 1970 |
| Commonwealth | ANSTO - Lucas Heights | no | 515.6 |
| Australia Capital Territory | Store | no | 0.01 |
| New South Wales | Store | yes | 5.46 |
| New South Wales | Store | no | 7.12 |
| Queensland | QRWS | no | 2.6 |
| Northern Territory | NTIWSF | yes | 2.32 |
| South Australia | EPA Store | yes | 5** |
| Victoria | VGISF | yes | 11.9 |
| Tasmania | Interim Store | yes | 0.6*** |

* Note: The waste stored at Woomera Prohibited Area (WPA) requires characterisation, treatment and pre-conditioning. Based on data obtained as part of field campaigns in 2018 and 2019, CSIRO now estimates

that the amount of LLW is less than 200 drums (in the store of almost 10,000 drums). There is no current indication that there is any ILW at the CSIRO WPA storage site.

** Volume increase from South Australia is due to inclusion of the volume of transport containers used to store some sources.

*** All sources in the Tasmanian interim store are packaged to comply with the requirements for 'Type A packages'. Volumes stated reflect the total volume of the 20 litre dangerous goods drums in which the sources are packaged (30 drums approximately, each at 20 litres).

Annex B – References to National Laws, Regulations, Standards, etc.¹⁵

Commonwealth Government

- *Australian Nuclear Science and Technology Organisation Act 1987*
- *Australian Radiation Protection and Nuclear Safety Act 1998 (No. 133)*
- *Australian Radiation Protection and Nuclear Safety Regulations 1999 (No. 37)*
- Australian Radiation Protection and Nuclear Safety Agency. *Recommendations: Intervention in Emergency Situations Involving Radiation Exposure*. Radiation Protection Series No. 7 (2004)
- Australian Radiation Protection and Nuclear Safety Agency. *Code of Practice and Safety Guide: Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*. Radiation Protection Series No. 9 (2005)
- Australian Radiation Protection and Nuclear Safety Agency. *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM)*. Radiation Protection Series No. 15 (2008a)
- Australian Radiation Protection and Nuclear Safety Agency. *Safety Guide for the Predisposal Management of Radioactive Waste*. Radiation Protection Series No. 16 (2008b)
- Australian Radiation Protection and Nuclear Safety Agency. *Fundamentals for Protection against Ionising Radiation*. Radiation Protection Series F-1 (2014a)
- Australian Radiation Protection and Nuclear Safety Agency. *Regulatory Guide: Siting of Controlled Facilities v2* (2014b)
- Australian Radiation Protection and Nuclear Safety Agency. *National Directory for Radiation Protection*. Radiation Protection Series No. 6, June 2017 (2017a)
- Australian Radiation Protection and Nuclear Safety Agency. *Guide for Radiation Protection in Existing Exposure Situations*. Radiation Protection Series G-2 (2017b)
- Australian Radiation Protection and Nuclear Safety Agency. *Code for Disposal Facilities for Solid Radioactive Waste*. Radiation Protection Series C-3 (2018a)
- Australian Radiation Protection and Nuclear Safety Agency. *Code for Disposal of Radioactive Waste by the User*. Radiation Protection Series C-6 (2018b)
- Australian Radiation Protection and Nuclear Safety Agency. *Code for the Safe Transport of Radioactive Material*. Radiation Protection Series C-2 (Rev. 1) (2019a)
- Australian Radiation Protection and Nuclear Safety Agency. *Guide for Radiation Protection in Emergency Exposure Situations*. Radiation Protection Series G-3 (2019b)
- Australian Radiation Protection and Nuclear Safety Agency. *Regulatory Guide: Decommissioning of controlled facilities* (2019c)
- Australian Radiation Protection and Nuclear Safety Agency. *Regulatory Guide: Plans and arrangements for managing safety* (2019d)
- Australian Radiation Protection and Nuclear Safety Agency. *Advisory Note: Dose and risk criteria for protection of people following the closure of a disposal facility for radioactive waste* (2019e)

¹⁵ Principal instruments appear in bold type.

- Australian Radiation Protection and Nuclear Safety Agency. *Regulatory Guide: Applying for a licence for a radioactive waste storage or disposal facility* (ARPANSA 2019f)
- Australian Radiation Protection and Nuclear Safety Agency. *Code of Practice for the Security of Radioactive Sources*. Radiation Protection Series No. 11 (2019g)
- Australian Radiation Protection and Nuclear Safety Agency. *Code for Radiation Protection in Planned Exposure Situations (2020)*. Radiation Protection Series C-1 Rev.1 (2020a)
- Australian Radiation Protection and Nuclear Safety Agency. *Safety Guide: Classification of Radioactive Waste*. Radiation Protection Series G-4 (2020b)
- *Customs (Prohibited Exports) Regulations 1958*
- Department of Industry, Science, Energy and Resources. *Australian Radioactive Waste Management Framework* (2018)
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environment Protection and Biodiversity Conservation Regulations 2000*
- International Commission on Radiological Protection. *1990 Recommendations of the International Commission on Radiological Protection*. Publication 60 (1991)
- International Commission on Radiological Protection. *Human Respiratory Tract Model for Radiological Protection*. Publication 66 (1994)
- International Commission on Radiological Protection. *The 2007 Recommendations of the International Commission on Radiological Protection*. Publication 103 (2007)
- International Atomic Energy Agency. *Management of Radioactive Waste from the Mining and Milling of Ores* (2002)
- International Atomic Energy Agency. *Occupational Radiation Protection in the Mining and Processing of Raw Materials* (2004)
- International Atomic Energy Agency. *Application of the Concepts of Exclusion, Exemption and Clearance* (2004)
- International Atomic Energy Agency. *Classification of Radioactive Waste* GSG-1 (2009)
- International Atomic Energy Agency. *Safety Requirements Near Surface Disposal of Radioactive Waste*, Safety Standards Series No. WS-R-1, 1999; superseded by International Atomic Energy Agency, *Specific Safety Requirements Disposal of Radioactive Waste*, SSR-5 (2011)
- International Atomic Energy Agency. *Regulations for the Safe Transport of Radioactive Material* 2012 Edition, SSR-6 (2012)
- International Atomic Energy Agency. *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* General Safety Requirements GSR Part 3 (2014)
- International Atomic Energy Agency. *Decommissioning of Facilities* General Safety Requirements GSR Part 6 (2014)
- International Atomic Energy Agency. *Preparedness and Response for a Nuclear or Radiological Emergency* General Safety Requirements GSR Part 7 (2015)
- International Atomic Energy Agency, *General Safety Guide, Regulatory Control of Radioactive Discharges to the Environment*, GSG-9 (2018)

- National Health and Medical Research Council. *Code of practice for the near-surface disposal of radioactive waste in Australia*. Radiation Health Series No. 35, 1992 (NHMRC, 1992)
- *National Radioactive Waste Management Act 2012 (No. 29)*
- National Road Transport Commission and Federal Office of Road Safety. *Australian Dangerous Goods Code*. 6th ed., 1998
- *Nuclear Non-Proliferation (Safeguards) Act 1987*

Australian Capital Territory

- *Radiation Protection Act 2006*
- *Radiation Protection Regulation 2007*
- *Work Health and Safety Act 2011*
- *Work Health and Safety Regulation 2011*

New South Wales

- *Contaminated Land Management Act 1997*
- *Environmental Planning and Assessment Regulation 2000*
- *National Parks and Wildlife Regulation 2019*
- *Work Health and Safety Act 2011*
- *Work Health and Safety Regulation 2017*
- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (Waste) Regulation 2014*
- *Radiation Control Act 1990*
- *Radiation Control Regulation 2013*
- *Dangerous Goods (Road and Rail Transport) Act 2008*
- *Dangerous Goods (Road and Rail Transport) Regulation 2014*
- *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986*
- *Waste Avoidance and Resource Recovery Act 2001*

Northern Territory

- *Atomic Energy Act 1953*
- *Dangerous Goods Act 1998*
- *Mining Management Act 2001*
- *Radiation Protection Act 2004*
- *Radiation Protection Regulations 2007*
- *Nuclear Waste Transport, Storage and Disposal (Prohibition) Act 2004*
- *Radioactive Ores and Concentrates (Packaging and Transport) Act 1980*

- *Radioactive Ores and Concentrates (Packaging and Transport) Regulations 1980*
- *Work Health and Safety (National Uniform Legislation) Act 2011*
- *Work Health and Safety (National Uniform Legislation) Regulations 2011*

Queensland

- *Radiation Safety Act 1999*
- *Radiation Safety (Radiation Safety Standards) Notice 2010*
- *Radiation Safety Regulation 2010*
- *Queensland Government, Agreement for the establishment and operation of a Secure Radioactive Waste Storage Facility at Esk between State of Queensland and Council of the Shire of Esk*
- *Nuclear Facilities Prohibition Act 2007*
- *Environmental Protection Act 1994*
- *Waste Reduction and Recycling Regulation 2011*
- *Mining and Quarrying Safety and Health Act 1999*

South Australia

- *Radiation Protection and Control Act 1982*
- *Radiation Protection & Control (Ionising Radiation) Regulations 2015*
- *Nuclear Waste Storage Facility (Prohibition) Act 2000*
- *Radiation Protection and Control (Transport of Radioactive Substances) Regulations 2018*
- *Mining Act 1971*
- *Roxby Downs (Indenture Ratification) Act 1982*
- *Maralinga Tjarutja Land Rights Act 1984*
- *Mines and Works Inspection Act 1920*
- *Environment Protection Act 1993*

Tasmania

- *Radiation Protection Act 2005*
- *Radiation Protection Regulations 2016*
- *Environmental Management and Pollution Control Act 1994*

Victoria

- *Radiation Act 2005 (came into force 1 September 2007)*
- *Radiation Regulations 2017*
- *Nuclear Activities (Prohibitions) Act 1983*

Western Australia

- *Radiation Safety Act 1975*
- *Nuclear Waste Storage and Transportation (Prohibition) Act 1999*
- Radiation Safety (General) Regulations 1983
- Radiation Safety (Qualifications) Regulations 1980
- Radiation Safety (Transport of Radioactive Substances) Regulations 2002
- *Mines Safety and Inspection Act 1994* (under revision)
- Mines Safety and Inspection Regulations 1995 (under revision)

Annex C – Overview Matrix of Current Policies and Practices in Australia

| Type of Liability | Long-Term Management Policy | Funding of Liabilities | Current Practice / Facilities | Planned Facilities |
|----------------------------------|--|---|--|---|
| Spent Fuel | Spent fuel to be transported to France for reprocessing. The resulting ILW is stored at ANSTO pending transfer to national facility. | Commonwealth funded. | On-site storage followed by overseas reprocessing and interim storage of returned waste. | National ILW storage facility pending development of a final disposal facility for ILW. |
| Nuclear Fuel Cycle Wastes | On-site disposal for mining and processing tailings. | Responsibility of mine owner by means of bond. For legacy wastes, funding by the relevant jurisdiction. | On-site disposal. | |
| Application Wastes | Commonwealth, state and territory management of LLW and ILW. | Funding by the Commonwealth for Commonwealth waste. For other jurisdictions, funding is by the owner of waste. | WA: disposal at state near surface disposal facility. Other jurisdictions: storage at site of generation or at central storage facilities within each jurisdiction. | NRWMF for disposal of LLW |
| Decommissioning | Planned decommissioning of HIFAR research reactor. OPAL research reactor has met preliminary decommissioning plan requirements. | Commonwealth funded. | HIFAR – licence granted to possess and control shut-down facility. A detailed characterisation program is underway. | NRWMF for disposal of resultant LLW and interim storage of resultant ILW |
| Disused Sealed Sources | Repatriation to manufacturer where possible. | Owner | Repatriation to manufacturer where possible; otherwise storage awaiting disposal. | NRWMF |

