



Australian Government
**Department of Industry,
Innovation and Science**

Australian Radioactive Waste Management Framework

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Definitions

ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARPANS Act	<i>Australian Radiation Protection and Nuclear Safety Act 1998 (Cth)</i>
ANSTO	Australian Nuclear Science and Technology Organisation
ASNO	Australian Safeguards and Non-proliferation Office
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CPPNM	Convention on the Physical Protection of Nuclear Material
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
ILWDF	Intermediate Level Waste Disposal Facility
LLW	Low Level Waste
NDRP	National Directory for Radiation Protection
NORM	Naturally Occurring Radioactive Material
NPT	Treaty on the Non-Proliferation of Nuclear Weapons (Non-Proliferation Treaty)
NRWM Act	<i>National Radioactive Waste Management Act 2012 (Cth)</i>
NRWMF	National Radioactive Waste Management Facility
RWMO	Radioactive Waste Management Organisation
Safeguards Act	<i>Nuclear Non-Proliferation (Safeguards) Act 1987 (Cth)</i>
The department	Department of Industry, Innovation and Science
The Joint Convention	The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
WAC	Waste Acceptance Criteria

1 Summary

Purpose

This framework sets out principles and long term goals for radioactive waste management in Australia

The need for a framework

- Establishing appropriate institutional arrangements and setting out clear practices and policies on coordinating and managing radioactive waste management between jurisdictions will help to meet policy objectives.
- Articulating the framework is essential preparatory work ahead of siting a National Radioactive Waste Management Facility, and developing a separate disposal option for intermediate level waste.
- While Commonwealth agencies hold the majority of legacy and future waste, this framework seeks holistic engagement and input at all tiers of government, including regulators.

Overarching policy objectives	<p>Safety, security, safeguards-compliance and minimisation of waste and appropriate safe disposal of radioactive waste that cannot be managed by other means.</p> <p>The right legislative and regulatory settings are in place.</p> <p>Regulatory certainty for waste management licensing processes.</p> <p>Open and transparent waste management practices in line with Commonwealth policy.</p>
Roles and responsibilities	<p>Confirm roles and clarify responsibilities of the Commonwealth Government, states and territories, waste producers / holders, regulators and policy makers.</p> <p>Clearly define waste liability arrangements both before and after acceptance of waste at the Facility.</p>
Institutional arrangements	<p>Establish overarching oversight of the full life cycle management of Australia's radioactive waste – from production to disposal.</p> <p>Provide oversight of planned activities for the complete management of Australia's legacy, current and future waste.</p> <p>Adopt an engagement plan with current regulators.</p>
Sustainable long-term funding arrangements	<p>Establish cost structures for waste management activities and services.</p> <p>Provide resources required to ensure sustainable governance arrangements.</p>

Outcome

To clearly articulate arrangements and responsibilities for managing Australia's radioactive waste.

2 Introduction

Australia is committed to providing for the safety and sustainability of radioactive waste management over generations, and for the adequate allocation of financial and human resources to achieve this over time. The objective is to maintain intergenerational equity, so that the benefits received by one generation do not create obligations and unfair burdens on succeeding generations.

This Australian Radioactive Waste Management Framework (the framework) describes the institutional arrangements for the full life cycle management of Australia's radioactive waste. Full life cycle management includes identification and monitoring of key waste streams, waste reduction and conditioning, requirements and methods of national waste management including inventory keeping and international reporting, and transportation and acceptance of waste for long-term storage and disposal.

By clearly setting out the various elements of Australia's arrangements for the management of radioactive waste, the framework:

- ensures consistency in how waste is managed across Australian Government agencies (as the largest waste holders and generators)
- identifies appropriate accountability for Australia's radioactive waste management practices
- provides explicit and mutually agreed principles and long-term goals to form the basis of Australia's national approach to radioactive waste policy making
- provides greater certainty to Commonwealth, state and territory regulators in facility licensing decisions
- ensures that Australia's domestic arrangements align with its international obligations.

The framework will be implemented through the various strategies and operational plans of the organisations responsible for all phases of the waste life cycle, and for regulation of these activities.

The framework draws on radioactive waste management policies from leading nuclear countries with established regulatory frameworks, tailored to meet the Australian radioactive waste management context. By international standards, Australia has only a relatively small amount of radioactive waste to manage. Australia's waste arises from important uses of nuclear research and development facilities, including a research reactor, and from the use of radioisotopes in medicine and industry. Australia has no nuclear power reactors.

The framework has five main elements:

- **Overarching policy objectives** such as safety, security, safeguards compliance and waste minimisation
- **Roles and responsibilities** including the responsibilities of waste producers/holders, regulators and policy makers
- **Institutional arrangements** underpinning the full life cycle management of radioactive waste in Australia – from planning new waste producing activities to implementing, decommissioning and waste disposal activities
- **Strategic planning of radioactive waste management**, which identifies the main sources of radioactive waste in Australia, including the decommissioning of facilities, and assists in the establishment of a common national inventory for radioactive waste
- **Sustainable long-term funding arrangements**, including full life cycle waste management costs being factored into consideration of new waste producing activities.

3 Background

3.1 Categories of Waste

Radioactive waste is material that no longer has any foreseeable use and contains radioactive materials with activities or activity concentrations at levels that require ongoing management to ensure its safety. The Australian classification scheme for disposal of radioactive waste is based on the international scheme issued by the International Atomic Energy Agency (IAEA). This considers the safety of disposal pathways, taking into account the radioactivity level of the waste and the time it will take for the radioactivity to decay (half-life). Australia's radioactive waste classification system and the intended pathway for storage and disposal of Commonwealth government waste is consistent with international best practice and is outlined in Table 1. Further details of these waste types are discussed in Section 6.2.

In addition to the safety requirements identified in the IAEA's classification guide, some material will be subject to additional regulatory requirements. For example, nuclear material (uranium, thorium and plutonium) is subject to safeguards and nuclear security regulation, irrespective of its radiological classification. There are different criteria for exemption from regulatory control for radiation safety purposes and for nuclear safeguard purposes. There are circumstances where nuclear material may be exempt from regulatory control for safety purposes because the level of radioactivity is low, but not exempt for safeguard purposes because it is still nuclear material.

Table 1. Classification and disposal of radioactive waste¹

Classification	Description	Disposal method	Storage facility	Disposal facility
Exempt Waste (EW)	Contains very low levels of radioactivity where safety measures are not required.	Can be safely disposed of in the same way as non-radioactive waste.	Not required.	Ordinary waste disposal methods (e.g. landfill)
Very Short Lived Waste (VSLW)	Contains very short lived radioactivity.	Can be safely stored for short time periods and then disposed of the same way as non-radioactive waste.	Short term storage until decayed sufficient for ordinary waste disposal.	After decay, ordinary waste disposal methods.
Very Low Level Waste (VLLW)	Contains low levels of short lived radioactivity.	Can be safely disposed of in existing industrial or commercial landfill-type facilities with limited regulatory control.	Not required – can go straight to disposal.	Will require an appropriate disposal facility (e.g. appropriately licensed landfill-type facility).
Low Level Waste (LLW)	Contains higher levels of short lived radioactivity and low levels of long lived radioactivity.	Can be safely disposed of in an engineered above-surface or near-surface (3-30 metres) facility.	Onsite at producer until transported to National Radioactive Waste Management Facility (NRWMF).	NRWMF
Intermediate Level Waste (ILW)	Contains higher levels of long lived radioactivity.	Can be safely disposed of at greater depths (up to a few hundred metres).	Onsite at producer until transported to NRWMF.	Intermediate Level Waste Disposal Facility.
High Level Waste (HLW)	Contains levels of radioactivity high enough to generate significant amounts of heat during the radioactive decay process.	Disposal in deep, stable geological formations (several hundred metres below the surface) is recognised as the safe disposal pathway.	Australia does not have HLW.	

¹ Based on Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) waste classification at <https://www.arpansa.gov.au/understanding-radiation/radiation-sources/more-radiation-sources/radioactive-waste-safety>

3.2 Volumes and storage of waste

The main holders and producers of radioactive waste in Australia are Commonwealth agencies, accounting for about 96 per cent of estimated ILW legacy inventories and nearly all legacy LLW as at 10 January 2018 (Table 2). The Commonwealth is expected to continue to be the main producer of radioactive waste into the future.

These figures exclude waste arising from mining activities, which is considered out of scope for the purposes of this framework (see section 6.2.7).

Table 2. Radioactive waste inventory volumes (cubic metres) as at 10 January 2018^a

	Low Level Waste		Intermediate Level Waste	
	Legacy	Future ^b	Legacy	Future ^b
Commonwealth				
ANSTO	2,771	4,685	1,211	1,849
ARPANSA	6	36	1	43
CSIRO	1,967	40	419	62
Defence	224	83	60	9
Subtotal C'wth	4,967	4,843	1,691	1,963
States and Territories	8	Not reported	66	Not reported
Industry, hospitals, universities ^c	Not reported	Not reported	13	Not reported
Total	4,975	4,843	1,771	1,963

a. Expected waste arising from current or future activities until 1 January 2070.

b. Data reported for these bodies only includes nuclear material held under permit from the Australian Safeguards and Non-proliferation Office (ASNO). There may be other radioactive waste held by these bodies which does not require an ASNO permit, and that is not currently reported in the inventory.

Estimated volumes now account for an estimation of the volume of waste including packaging, that is required for disposal or long term storage at the NRWMF. They also detail improved understanding of historical or 'legacy' waste, and updated estimates of expected future waste volumes. It is important to note these estimated inventory volumes have a level of uncertainty, and are derived from incomplete data which are being continually refined. Individual figures may not add to totals due to rounding.

Storage of this radioactive waste at various sites around Australia is strictly regulated by Commonwealth, state and territory governments. Independent regulators oversee the activities of organisations dealing with radioactive waste to ensure they protect people and the environment from the harmful effects of radiation, and to ensure that Australia meets its obligations under international treaties and agreements to which Australia is a party, including those relating to security and safeguards.

3.3 National radioactive waste management facilities

The Australian Government is moving to ensure the long-term safe and secure management of radioactive waste by building a single National Radioactive Waste Management Facility (NRWMF) to permanently dispose of Australia's LLW and temporarily store Australia's ILW. A separate process will be put in place to develop a permanent disposal facility for ILW (an Intermediate Level Waste Disposal Facility or ILWDF).

The move away from multiple storage sites is aligned with international best practice for the long-term management of radioactive waste as recognised by the Commonwealth radiation protection and nuclear safety regulator, ARPANSA.

The NRWMF will primarily be a facility for the management of waste generated, possessed or controlled by the Commonwealth or a Commonwealth entity. The NRWMF can also manage other radioactive waste (such as that generated by the states, territories or private sector), as long as possession or control of the material passes to the Commonwealth.

4 Radioactive waste management policy

The aim of Australia's management of radioactive waste is to safely and securely manage Australia's past and future radioactive waste holdings through appropriate processing, containment and eventual disposal. Doing so will reduce, to as low as practicable and justifiable, the associated health, safety, environmental, financial, security and safeguards risks to current and future generations.

The current policy, legislative and regulatory framework for the safe management of radioactive waste in Australia includes each jurisdiction licensing radioactive waste management activities. Radioactive waste management methods must conform to the highest appropriate standards as determined by Commonwealth, state and territory regulators, and requires acceptance by the general public.

To achieve these aims, implementation of this national framework involves active engagement across a number of key stakeholder groups including government (policy and regulatory), waste producers, and the general public. All radioactive waste management activities will be based on the best available science and technology and conducted in an open and transparent manner.

The Australian Government's approach towards long-term radioactive waste management includes implementing policy to site and establish a centralised, purpose-built NRWMF. This facility will dispose of Australia's domestically produced LLW, and store ILW for a period of time sufficient for the Australian Government to establish a permanent ILW disposal facility, consistent with international obligations and best practice. The Australian Government has also implemented policy, legislation and regulations aimed at ensuring Commonwealth waste holders and producers:

- adopt measures for minimising the generation of radioactive waste
- safely manage their waste until it is accepted by a national storage or disposal facility
- dispose or store their waste at the NRWMF or the ILWDF to the maximum extent possible, rather than in other facilities.

5 Roles and responsibilities for radioactive waste management

5.1 International agreements and Commonwealth legislation

The Australian Government is responsible for ensuring that radioactive waste management is carried out in a safe, environmentally sound and cost-effective manner in line with national policy objectives and international obligations.

As a party to the international Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the Joint Convention), Australia is obligated to adopt a number of specific principles regarding radioactive waste management. These cover:

- sound waste management practices focused on minimisation, volume reduction, and compaction
- plans for managing the complete life cycle of a disposal facility, including financial guarantees to support the safety of the facility during the required period of post-closure institutional control
- defence-in-depth measures in facility design and operating procedures.

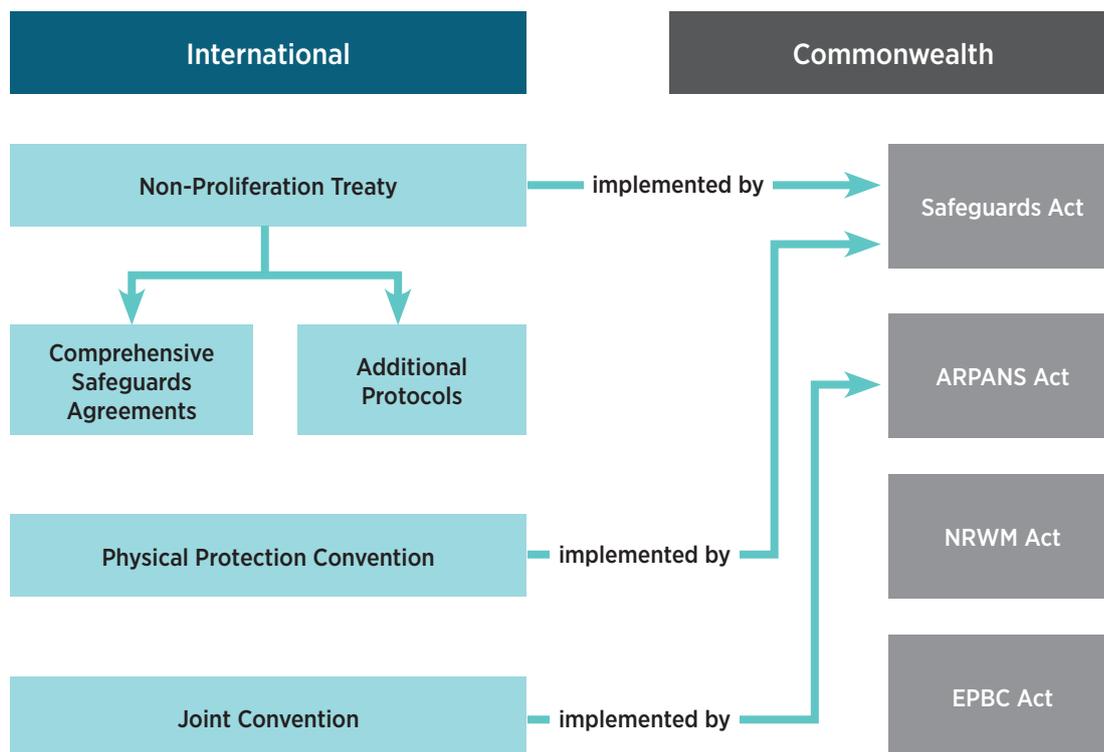
Australia is also a member of the IAEA which sets down a system of internationally recognised safety standards.

The Australian Government's focus is on safe management of radioactive waste, including safe storage and disposal. Legislation and regulations have been put in place to ensure domestic policy aims are met, while also ensuring that Australia meets its international obligations.

Legislated responsibilities are shared by several Australian Government agencies which respond to interrelated policy considerations including health, economic, and environmental issues related to radioactive waste management.

International treaties and agreements, and Commonwealth legislation, are outlined in Figure 1 and Attachment 1. Further information on international engagement and reporting is covered in section 6.8.

Figure 1. Commonwealth legislative arrangements for managing Australia's radioactive waste



5.2 Commonwealth policy and regulatory bodies

At the Commonwealth level, a number of departments and entities are jointly responsible for policies that direct the activities of waste owners to ensure their compliance with legal requirements and their ability to meet their funding and operational responsibilities according to approved waste management and disposal plans.

The Department of Industry, Innovation and Science (the department) has overall responsibility for radioactive waste management matters under the Administrative Arrangements Order. The department has developed and will maintain this framework. The department also administers the *National Radioactive Waste Management Act 2012* (NRWM Act), and under the NRWM Act is responsible for identifying a site for the NRWMF and setting the framework for its future operations.

The Department of Health is responsible for public health, including health protection. Within the Health portfolio, ARPANSA is the Australian Government's primary authority on radiation protection and nuclear safety. ARPANSA was established by the ARPANS Act and it:

- regulates Commonwealth entities that deal with radiation, with the objective of protecting people and the environment from the harmful effects of radiation
- leads Australia's international engagement related to radiation protection and nuclear safety, including under the Joint Convention
- promotes national uniformity in radiation protection and nuclear safety across all jurisdictions.

The Department of Foreign Affairs and Trade (DFAT) is responsible for external affairs, including among other things treaties and international security issues, including nuclear non-proliferation. The Australian Safeguards and Non-proliferation Office or ASNO is a statutory regulatory office within DFAT (established under the *Nuclear Non-Proliferation (Safeguards) Act 1987*), which ensures Australia's compliance with international obligations under the Nuclear Non-Proliferation Treaty (NPT), Australia's NPT safeguards agreements with the IAEA, the Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 amendment, and Australia's various bilateral safeguards agreements. These Treaties are given effect in Australia through the *Nuclear Non-Proliferation (Safeguards) Act 1987*.

5.3 State and territory governments

States and territories are responsible for managing a range of radioactive waste holdings, accounting for about one per cent of total radioactive waste holdings in Australia. These are managed under specific legislation for each jurisdiction. Each state or territory has its own radiation protection regulator, typically within the environmental protection or public health portfolios, which oversees storage arrangements for radioactive materials and radioactive waste. State and territory governments also manage their own radioactive waste management facilities, some of which are permanently closed.

As noted in section 3.3, the NRWMF will only be used for the management of waste generated, possessed or controlled by the Commonwealth or a Commonwealth entity. However, some waste currently managed or regulated by state or territory governments could be managed by the NRWMF, if control of this waste is passed to the Commonwealth by the relevant jurisdiction. Such a transfer of control would be subject to the waste meeting acceptance criteria for the NRWMF (or ultimately the ILWDF) and mutually agreed arrangements between the Commonwealth and the state or territory in question.

5.4 Radioactive waste producers and managers

Waste owners and producers are responsible for the appropriate management of their waste, including the production, transport and delivery of waste packages. Table 3 summarises the key waste owners and producers in Australia. Some waste owners manage waste they have inherited from past activities of other organisations.

Table 3. Major radioactive waste producers and managers in Australia

Entity	Description
ANSTO	The Australian Nuclear Science and Technology Organisation (ANSTO) has legacy and ongoing waste, primarily resulting from the production of nuclear medicine. It will continue to generate waste as it produces nuclear medicines for hospitals and clinics across Australia and around the world, and conducts research and development using nuclear techniques. It also has legacy waste generated both by itself and its predecessor, the Australian Atomic Energy Commission, over the 60 year history of the Lucas Heights facility. ANSTO will generate a significant majority of future waste.
CSIRO	The Commonwealth Scientific and Industrial Research Organisation (CSIRO) predominantly holds legacy waste from scientific research and development activities. The majority of this waste is currently held in the Woomera Prohibited Area in South Australia. CSIRO has a small amount of legacy waste at other locations and is expected to produce a small amount of future waste from ongoing research and development activities.
ARPANSA	ARPANSA holds a small amount of legacy waste it has inherited from other sources, primarily the former Australian Radiation Laboratory.
Department of Defence	The majority of waste held on Defence sites is either legacy material from the former Australian Radiation Laboratory and Commonwealth X-ray and Radium Laboratory, or material remediated from Commonwealth land as a result of Australian Government direction. The remaining waste has arisen from the disposal of unserviceable or obsolete Defence equipment.
States and territories/Private producers	State and territory holdings include waste produced by hospital and university entities that produce and store radioactive waste from nuclear medicine and scientific research, as well as some waste from the private sector (primarily in the form of disused sealed radioactive sources which may have been used in radiotherapy or industry).

5.5 Radioactive waste management coordination function

It is the role of an appropriate radioactive waste management functional structure to clearly set expectations both domestically and internationally on Australia's approach to radioactive waste management. This includes defining practices and processes that establish and maintain a positive safety culture, and reflect international best practice. It provides Commonwealth, state and territory regulators with greater certainty around the Australian Government's long term outlook when assessing regulatory requirements and expectations for a NRWMF, and highlights the experience and knowledge necessary to ensure the effective and safe management of Australia's radioactive waste.

Attachment 2 outlines Australia's current institutional arrangements for managing radioactive waste. The department has policy responsibility for radioactive waste management, including this framework. The department, working closely with ANSTO (reflecting ANSTO's existing expertise in managing LLW and ILW storage facilities), is managing the site selection for, and design of, the NRWMF.

The Australian Government recognises that a radioactive waste management technical coordination function is a key role that will be performed by a Commonwealth entity. This function includes overseeing the long-term storage and disposal of legacy, current and future radioactive waste, and in the short to mid-term managing the research, development, construction and operation of the NRWMF. The organisation responsible for this technical coordination function may also be the operator of the NRWMF.

This approach is in line with international experience. The IAEA notes that in order to meet their obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (to which Australia is a party), many Member States have decided to create a Radioactive Waste Management Organisation (RWMO) or assign this function to an existing organisation, to develop and implement one or more facilities for the disposal of radioactive waste.

Australia's RWMO, with input from other agencies including waste holders and producers, as well as the department and regulators, will develop a comprehensive radioactive waste management strategy that aligns with this framework. The strategy will provide detailed, long-term management pathways for individual waste streams over their full life cycle, including disposal pathways for LLW and ILW. The strategy will prioritise radioactive waste management activities across the Commonwealth. It includes defining critical path research, practices and processes that reflect international best practice, and establishing and maintaining a positive radioactive waste management safety culture. The RWMO will also monitor and oversee radioactive waste disposal facilities; and maintain an accurate national radioactive waste inventory.

The Australian Government will establish arrangements for providing the resources (financial, technical and human) to sustain these coordination functions, and for the implementation of the radioactive waste management strategy.

5.6 National Radioactive Waste Management Facility

The NRWM Act provides for the siting, development and operation of the NRWMF by the Commonwealth. ARPANSA licensing and ASNO permit conditions require the NRWMF licensee to demonstrate its ability to deliver on policy commitments and to ensure funding requirements are in place.

Under the NRWM Act, a national facility will only be established where it is accepted by a willing host community. Community consultation is currently being undertaken through the NRWMF siting process to educate communities on what it would mean to host the NRWMF, to understand and address community concerns, and to determine community sentiment towards hosting the facility.

The Australian Government (as licensee for the NRWMF) will be responsible for the safe and secure management of radioactive waste intended for the NRWMF by taking all necessary steps towards achieving this aim, including:

- suitable design, operation and decommissioning of its facilities to keep the generation of both the activity and volume of radioactive waste to a practicable minimum
- ensuring that radioactive waste is appropriately managed through classification, separation, treatment, conditioning, storage, disposal, and maintaining records of these activities including an inventory of radioactive waste
- ensuring that disposal of radioactive waste is not unnecessarily delayed
- reporting to the relevant regulatory authorities with required information as specified in their licence.

The NRWMF will only receive Australian domestic radioactive waste (excluding mining waste), for disposal of LLW and interim storage of ILW. It will have the appropriate functionality for legacy LLW and future LLW disposal to cater for the volume of waste reasonably foreseeable for the next 100 years, with a sufficient period of institutional control, without undue reliance on future generations or harm to the environment.

As part of its commitment to the safe and secure, full life cycle management of all of Australia’s radioactive material, the Australian Government will develop a final disposal facility for Australia’s ILW in the coming years. The NRWMF will store as much ILW as possible for an interim period of time sufficient for the Australian Government to develop and establish a disposal facility for this waste.

The radioactive waste management practices of states and territories are outside the Australian Government’s control. The NRWMF will be open to accepting waste from states and territories, hospitals, universities and private industry, which would then pass to Commonwealth control, subject to satisfactory arrangements being agreed between the Commonwealth and the waste holder.

6 Core elements of radioactive waste management

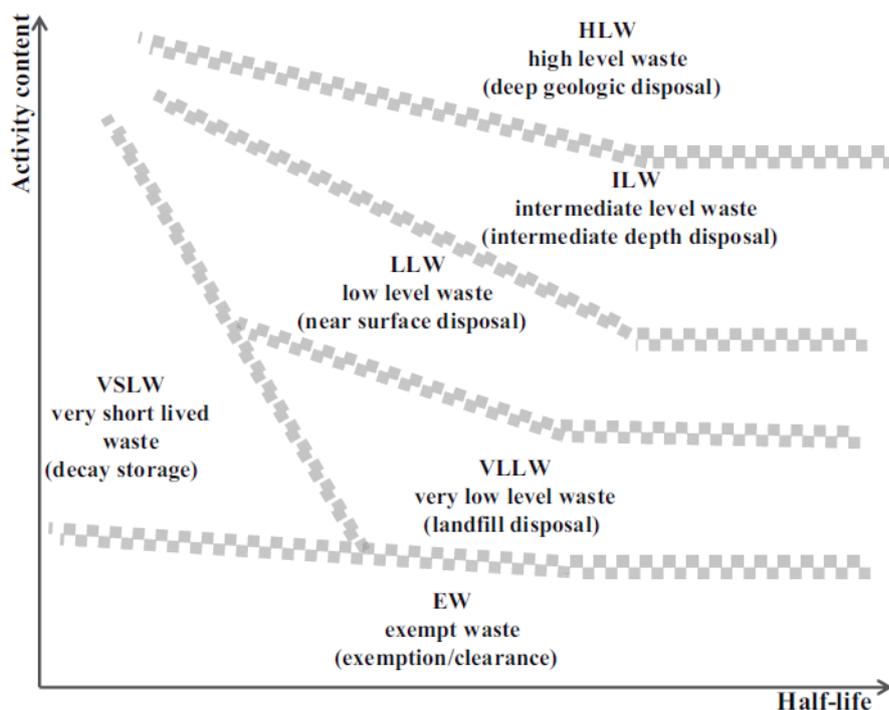
6.1 National inventory and classification system

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. Radioactive waste holders and producers currently manage their waste on a medium-term safety and security basis, consistent with their organisational mandates.

Australia has a uniform national radioactive waste classification system which harmonises the principles and practices for management of radioactive waste across the states and territories². It is based on the IAEA³ guidelines, adapted for the Australian situation. While the guidance is advisory, all jurisdictions in Australia have indicated their intention to adopt the scheme. It also forms the basis for the NRWMF’s Waste Acceptance Criteria (WAC).

Having a common inventory baseline, consistent with this classification system (Figure 2), across Commonwealth agencies provides the basis for a whole of government approach on how best to treat, condition and package legacy waste holdings. This allows the Australian Government to make informed decisions on future radioactive waste management activities and key design arrangements prior to waste being accepted by the NRWMF. The government has established a national inventory working group who continually refine and update estimates of Australia’s radioactive waste holdings, including those under the control of states and territories as well as the Commonwealth.

Figure 2: IAEA radioactive waste classification scheme⁴



2 RPS20 Safety Guide for Classification of Radioactive Waste (2010)

3 General Safety Guide: Classification of Radioactive Waste, No. GSG-1, IAEA, Vienna 2009.

4 Policies and Strategies for Radioactive Waste Management, No. NW-G-1, IAEA, Vienna 2009.

6.2 Australia's radioactive waste types

6.2.1 Exempt waste

Exempt waste contains levels of radioactivity below those required for regulatory control as specified by the relevant authority. Uniform provisions for exemption, based on international guidance from the IAEA, have been agreed by all federal, state and territory jurisdictions as part of the National Directory for Radiation Protection (NDRP)^{5,6} through ARPANSA.

Exempt waste materials are managed as general, restricted or hazardous waste according to the specific chemical or radiochemical characteristics of the waste and will not be sent to the NRWMF. As a first step in radioactive waste management, waste producers will be required to arrange characterisation and assessment of their waste to determine if it meets the requirements for clearance from regulatory control as radioactive material. The RWMO may assist in characterisation and assessment of waste holdings on a cost recovery basis.

6.2.2 Low Level Waste (LLW)

The majority of radioactive waste by volume held in Australia is classified as LLW. LLW generally comprises laboratory wastes (cloths, paper, plastic and glassware), equipment (metal and plastic) and bulk materials (concrete from decommissioning or soil) with minor levels of contamination from contact with radioactive materials. Disused sealed radioactive sources which have low activity and/or contain short-lived radionuclides can be considered LLW for the purpose of disposal. The precise classification criteria for LLW to be disposed of at the NRWMF will be determined by the WAC for the NRWMF. Very Short Lived Waste and Very Low Level Waste are disposed of by other methods and will not need to be sent to the NRWMF.

Processing of LLW consists of treatment and conditioning to prepare for transport, storage and disposal. The treatment and conditioning options chosen are determined by taking into account the planned storage and/or disposal method used.

Options for the disposal of LLW include:

- Near surface disposal facilities: These are in the form of simple or engineered trenches or concrete vaults in which containerised waste is placed. An engineered or earthen cap is placed over the waste containers to further isolate the waste and to minimise water infiltration. The facilities are subject to surveillance until the hazard associated with the waste has declined to acceptable levels, as determined by safety regulators.
- Subsurface disposal facilities: disposing of LLW in subsurface facilities or co-locating LLW with ILW in deeper facilities.

6.2.3 Intermediate Level Waste (ILW)

ILW has a higher concentration of radionuclides, especially long-lived radionuclides, than LLW. As a result, ILW management typically requires increased shielding through appropriate containers or buildings to provide adequate protection for workers and greater provisions to ensure its isolation.⁶

Examples of ILW include waste from the production of nuclear medicines, residual waste from the reprocessing of spent fuel used in research reactors, and disused radioactive sources from industry and medicine.

In principle, all processing methods used for LLW are also acceptable for ILW as determined by the WAC.

The disposal of ILW requires different technical requirements to that for LLW disposal, and consequently a separate project will be required for the siting, design and construction of an ILWDF. A range of technical solutions exist for geological disposal of ILW within an engineered structure, including two main types of disposal systems:

- Shallow depth facilities consisting of engineered disposal units (caverns, vaults, tunnels or silos) that are located below the original ground surface, greater than about 30 metres deep.
- Facilities in which the waste is emplaced in greater depth geological formations or boreholes intended for waste, from a few tens of metres to hundreds of metres deep.

The IAEA have recognised the challenges for countries with small volumes of ILW, and appropriate means of disposal are being actively looked into. It is possible that further options for disposal of ILW may be identified that may be appropriate for Australia.

⁵ The NDRP is the principal means for addressing inconsistencies in radiation protection regulation across the various Australian jurisdictions.

⁶ Williams, G. and Woollett, S., *Managing Radioactive Waste in Australia*, ARPANSA, Issues Volume 92, September 2010, p 9-13

6.2.4 Spent nuclear fuel reprocessing

Nuclear fuel which has depleted to a level where it no longer powers a reactor efficiently is said to be 'spent'. Usable nuclear material typically remains in spent fuel, which can be separated from waste products through reprocessing.

In Australia, the Commonwealth is the only jurisdiction in which spent fuel is managed. Australia's spent fuel comes from ANSTO's research reactors. Unlike some other countries, Australia has no spent fuel arising from nuclear power, military or defence programmes. No spent fuel reprocessing facilities exist in, or are proposed for, Australia. It is the policy of the Australian Government that spent fuel is sent overseas for reprocessing, which entails the extraction of useful fissile materials remaining in the spent fuel, and the conditioning of residual waste materials into a durable form such as glass. The resulting long-lived ILW will be returned to Australia for storage and in accordance with contractual obligations. Ultimately, this waste will be disposed of at an ILWDF.

6.2.5 Material subject to Safeguards Act

As noted in section 6.2.4, any radioactive waste that is nuclear material is subject to additional regulatory requirements. ASNO regulates nuclear material for nuclear security and nuclear safeguards purposes, in accordance with treaty-level agreements with the IAEA and bilateral partners.

Through these agreements, safeguarded material must be physically protected, be accounted for and be available for inspection and verification by ASNO and the IAEA unless rendered inaccessible in accordance with IAEA requirements and prior approval has been given.

6.2.6 Disused sealed radioactive sources

Sealed radioactive sources have been in use for many decades for medical, industrial, agriculture, military and defence, and research applications. The IAEA defines a sealed source as "a radioactive material that is permanently sealed in a capsule, or closely bonded, and in a solid form".⁷ Safety requirements for disused sealed sources are presented in IAEA Safety Standards publications.

In addition, Article 28 of the Joint Convention states that parties to the Convention must take appropriate steps to ensure that the possession, manufacturing or disposal of disused sealed sources takes place in a safe manner.

The focus of Australia's current regulatory 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. However, there were many sources brought into Australia – or manufactured in Australia – before these requirements came into effect. The pathway for sealed sources destined for disposal or storage at the NRWMF, including Australian legacy or orphan sources, will be determined in accordance with the NRWMF WAC.

6.2.7 Naturally Occurring Radioactive Material

Naturally Occurring Radioactive Material (NORM) arises from various mining and mineral processing industries as a by-product, residue or waste. A vast majority of this waste is generated and held by the mining sector, with smaller amounts resulting from research work currently held by the Commonwealth and state and territory governments. Currently there is no IAEA standard of what NORM means and it is up to each country to determine a definition.

The Australian Government's position is that NORM held by Commonwealth agencies will be managed by the NRWMF in a way that is safe, secure and meets the requirements of the WAC. Waste arising from uranium mining and mineral sands operations are excluded from acceptance at the NRWMF, as these miners have their own waste disposal operations regulated by state and territory governments, generally involving disposal at the mine site. Other NORM not generated by the mining sector could be considered for acceptance by the NRWMF on a case-by-case basis.

⁷ Management of Disused Sealed Radioactive Sources, No. NW-T-1.3, IAEA, Vienna 2014.

6.3 Waste Acceptance Criteria

Waste Acceptance Criteria (WAC) are requirements by which the acceptability of waste for storage or disposal can be judged in relation to the specific conditions of a given waste management facility. The WAC plays a key role in the management of interfaces between waste generators, waste processing, storage, and importantly, disposal facilities. Setting appropriate limits and specifications for acceptable waste packages that will ensure the safety objectives of the repository or store are met is an important part of the facility design and safety case development.

The objective of the WAC is to serve as a benchmark for facility operators who accept radioactive waste for disposal or storage, and processors who accept waste for processing (pre-treatment, treatment or conditioning). Using the WAC, the acceptability of waste can be assessed against the specific conditions of a given waste management step and the licensing conditions of the involved facility to ensure that the overall safety case for the facility is maintained. The WAC for the NRWMF will need to be approved by ARPANSA as part of the licensing of the facility.

The WAC for the NRWMF will specify that only radioactively contaminated or activated waste will be accepted for disposal or storage at the NRWMF. Waste must have been treated or packaged in such a way as to render it physically and chemically stable, immobile and resistant to degradation. Liquid wastes will not be accepted at the NRWMF. The NRWMF will only dispose of LLW and provide interim storage of ILW. The WAC also ensures that the NRWMF is able to be operated safely and in accordance with regulatory requirements throughout its life cycle (including post closure).

The WAC for the NRWMF will identify the requirements for ILW to be stored at the facility. A separate WAC for ILW disposal will be prepared as part of planning and development of an ILW disposal facility.

6.4 Research and development (R&D) requirements

In line with international best practice and IAEA guidelines, R&D will be integral to developing facilities to manage Australia's radioactive waste. International experience shows R&D will be required on waste classification standards, disposal concept development, site characterisation and safety assessment. As the NRWMF development progresses through site characterisation, design, safety assessment and community engagement, knowledge gaps will inevitably be identified. To ensure such gaps are addressed, the radioactive waste management strategy developed by the RWMO will incorporate a life-time R&D plan, flexible enough to be updated as planning and implementation of waste facilities proceeds and new information comes to light.

R&D prioritisation will be guided by NRWMF safety assessments, to inform effective use of R&D to ensure safety. A continued research programme is an important element of the safety strategy. The balance between the level of confidence at any point and additional insights from a continued research and monitoring programme will be a central element in interactions between the RWMO, the NRWMF operators and regulators.

The RWMO, as the organisation with overall technical responsibility for radioactive waste management functions, will have primary responsibility for ensuring that all necessary investigations of sites and materials are carried out, assessed for suitability and that all data necessary for safety assessment has been obtained. The RWMO will also ensure that necessary R&D is carried out so that planned NRWMF technical operations can be practically and safely accomplished, and demonstrated; as well as to understand and support the processes on which safe disposal depends. A collaborative approach will be taken with Australian and international expertise.

6.5 Radioactive waste management obligations and liability prior to acceptance

Waste producers have an obligation to manage waste produced and the costs of such obligations. Waste must be appropriately characterised, conditioned, and packaged to make it suitable for storage and ultimately for disposal.

Further consideration is required on the issue of where the obligations of waste producers will cease once the waste has been accepted by the NRWMF. Factors to be taken into account include when and where acceptance of the waste occurs (prior to the waste being transported to the NRWMF, or at the NRWMF gates), what that means for the transfer of liabilities, and implications for planning transport of the waste. The RWMO and/or the operator of the NRWMF will need to work with other government bodies and waste holders and producers in considering this issue.

6.6 Transportation of radioactive waste material

In transporting radioactive material, operators are required to protect the community and environment in accordance with transport regulations.

The transport of radioactive material and radioactive waste is governed by ARPANSA's *Code for the Safe Transport of Radioactive Material*. It is based on internationally accepted standards set by the IAEA⁸ and has been adopted in legislation by all states and territories in Australia. The Code provides for:

- limits on the contents of individual containers of radioactive waste according to its radiation characteristics
- standards for the design, construction and testing of packages or containers to be used in the transport of radioactive materials
- accepted levels of radiation, temperature and pressure for such packages
- labelling requirements for containers of radioactive waste
- handling and storage conditions during transport.

ASNO also regulates transport security of nuclear material through the *Nuclear Non-Proliferation (Safeguards) Act 1987*, for quantities of nuclear material above the thresholds set in the Safeguards Regulations.

International experience demonstrates that the transport of radioactive material in accordance with the internationally accepted standards is safe. Development of a plan for transport of Australia's radioactive waste to the NRWMF will be led by the RWMO. This includes detailed planning of transport routes to the NRWMF and will commence following site selection and will form part of the full environmental and nuclear regulatory assessments undertaken prior to operation of the NRWMF.

6.7 Financial arrangements for radioactive waste management

Under the terms of the Joint Convention, Australia is required to ensure that adequate financial resources are available to support the safety of facilities for radioactive waste management. It is implicit in these requirements that appropriate steps are put in place to ensure that the required financial resources are available to the organisation responsible for oversight of Australia's radioactive waste management.

The Australian Government recognises the need for long term funding and provisions for decommissioning activities, predisposal and disposal of radioactive waste. Waste producers and owners are currently responsible for providing financing arrangements for developing and implementing acceptable radioactive waste management solutions, including identifying who will be responsible for the cost. Arrangements will ensure that adequate financial resources are available to support the safety of the NRWMF for long-term radioactive waste management including the institutional control period.

The Australian Government is considering appropriate funding arrangements (including costing and charging models) to provide a sustainable, cost effective final disposal pathway for the full life-cycle waste management of LLW and ILW.

The Australian Government recognises that the optimal outcome is one under which as much as possible of Australia's LLW and ILW is sent to the NRWMF for disposal or storage, and that the charging model that is adopted should reflect this.

It is anticipated that waste producers will need to factor the costs of long-term storage and disposal into consideration of new waste producing activities.

8 Regulations for the Safe Transport of Radioactive Materials, No. SSR-6, IAEA, Vienna 2012.

6.8 International engagement and reporting on radioactive waste

As outlined in Section 5.1, Australia is committed to meeting its international obligations for radioactive waste management.

Australia actively participates in the development, and domestic adoption, of international standards in nuclear safety and security (including transportation), radiation protection and radioactive waste management. This is through various engagement mechanisms, including: representation at the IAEA standards setting committees; participation in international technical meetings and conferences, and the sharing of knowledge and expertise with international operators.

Australia reports to the IAEA on radioactive waste management issues. An Australian National Report is coordinated and prepared by ARPANSA for the three yearly Review Meeting of the Joint Convention. The report provides an update on all relevant issues under the terms of the Joint Convention, including Australia's waste inventory.

While ARPANSA has ultimate responsibility for Australia meeting its reporting obligations under the Joint Convention, the RWMO in its role as responsible for the overall waste management function will be a key contributor to the Australian National Report, and any other international reporting requirements.

For the proportion of waste that is also nuclear material subject to the Safeguards Act, Australia has treaty-level obligations under the Comprehensive Safeguards Agreement with the IAEA to provide regular reports on all nuclear material inventory and inventory changes, including any that will be held in the NRWMF in the future. The government will also have to report design features of the NRWMF relevant to how the IAEA would conduct any required inspections.

Attachment 1. Key international treaties and Commonwealth legislation relevant to radioactive waste management

Abbreviation	Full title	Brief description
<i>International treaties and agreements</i>		
Non-Proliferation Treaty (NPT)	Treaty on the Non-Proliferation of Nuclear Weapons	An international treaty whose objective is to prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament. A key condition in the NPT is the requirement to conclude a safeguards agreement with the IAEA, which gives the IAEA access to information and to do inspections to verify that each country is abiding by its NPT commitments.
Physical Protection Convention (CPPNM)	Convention on the Physical Protection of Nuclear Material (and its 2005 amendment)	The only international legally binding undertaking specific to the physical security of nuclear material. It establishes measures related to the prevention, detection and punishment of offences relating to nuclear material. The Amendment to the Convention on the Physical Protection of Nuclear Material, which entered into force in 2016, makes it legally binding for States Parties to protect nuclear facilities and material in peaceful domestic use, storage as well as transport. It also provides for expanded cooperation between and among States regarding rapid measures to locate and recover stolen or smuggled nuclear material, mitigate any radiological consequences of sabotage, and prevent and combat related offences.
Joint Convention	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear reactors and applications and to spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes, or when declared as spent fuel or radioactive waste for the purpose of the Convention. The obligations of the Contracting Parties with respect to the safety of spent fuel and radioactive waste management include, in particular, the obligation to establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management and the obligation to ensure that individuals, society and the environment are adequately protected against radiological and other hazards, inter alia, by appropriate siting, design and construction of facilities and by making provisions for ensuring the safety of facilities both during their operation and after their closure.
Comprehensive Safeguards Agreement (CSA)	Agreement between Australia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons	Agreement between a state and the IAEA for the application of safeguards to all of the state's current and future nuclear material and activities, based on IAEA document INFCIRC/153. The measures in the CSA are designed to enable the IAEA to verify that NPT commitments to not use nuclear material and facilities for military purposes are being upheld. Under the CSA, states are required to maintain a system to account for and control all nuclear material. The CSA also requires states to report to the IAEA on all nuclear material inventory (with limited exceptions) and on design features of nuclear facilities, and to allow IAEA inspectors to inspect nuclear material and facilities.

Additional Protocol	Protocol Additional to the Agreement between Australia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons	An agreement designed to complement a state's safeguards agreement with the IAEA in order to strengthen the effectiveness and improve the efficiency of the safeguards system. The model text of the Additional Protocol is set out in IAEA document INFCIRC/540. The Additional Protocol gives the IAEA inspection access to a broader range of locations than under the CSA, and requires reporting to the IAEA on additional information about nuclear-related locations and activities not covered in the CSA.
Commonwealth legislation		
Safeguards Act	<i>Nuclear Non-Proliferation (Safeguards) Act 1987</i>	The principal object of this Act is to give effect to Australia's obligations under the NPT, Australia's Comprehensive Safeguards Agreement and Additional Protocol with the IAEA, the Convention on the Physical Protection of Nuclear Material (and its 2005 amendment); and agreements with various countries on the transfer of nuclear material, equipment and technology. Commitments under these international treaties are managed through a system of permits issued by ASNO for the possession of nuclear material, equipment and technology.
ARPANS Act	<i>Australian Radiation Protection and Nuclear Safety Act 1998</i>	The object of this Act is to protect the health and safety of people, and to protect the environment, from the harmful effects of radiation. The Act also gives effect to certain obligations that Australia has under the Joint Convention.
NRWM Act	<i>National Radioactive Waste Management Act 2012</i>	The object of this Act is to provide for: (a) the selection of a site for a radioactive waste management facility on voluntarily nominated land in Australia; and (b) the establishment and operation of such a facility on the selected site; to ensure that radioactive waste generated, possessed or controlled by the Commonwealth or a Commonwealth entity is safely and securely managed.
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the Act as matters of national environmental significance. Several aspects of the NRWMF make it a 'controlled action', requiring assessment and approval under the EPBC Act. The NRWMF is likely to meet the definition of a nuclear action under section 22 of the EPBC Act because it involves establishing a large-scale disposal facility for radioactive waste. Consideration of impacts to the 'environment' are also required because the NRWMF is being proposed by the Commonwealth.

Attachment 2. Australia's current institutional arrangements for managing radioactive waste

