Commonwealth of Australia

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

Australian National Report

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Australian Government
Australian Radiation Protection and Nuclear Safety Agency

CONTENTS

A INTRODUCTION

The responsibility for the governance of Australia is shared by the Australian government and the governments of the six states and two self governing territories. Responsibility for radiation health and safety in each State and Territory rests with the respective State/Territory government, unless the activity is carried out by an Australian government agency or a contractor to a Australian government agency; in those cases the activity is regulated by the Australian government.

In terms of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the Joint Convention) there are therefore nine jurisdictions to be considered. The legislative and regulatory requirements of these jurisdictions with respect to management of spent fuel and radioactive waste are not identical, but are often similar.

Australia has no nuclear power reactors. There is one operational research reactor High Flux Australian Reactor (HIFAR), one shut-down research reactor (MOATA) and one research reactor Open Pool Australian Light-water (OPAL) being constructed to replace HIFAR. The Australian government is the only jurisdiction with responsibility for the management of spent fuel.

Australia has several operational uranium mines, and several uranium mines that are non-operational but are still under regulatory control because of the presence of potentially hazardous waste materials.

The Commonwealth of Australia, and all of its constituent states and territories, have in place, within the framework of appropriate law, the legislative, regulatory, and administrative measures, including monitoring, inspection and auditing, necessary for implementing all obligations under this Convention.

B POLICIES AND PRACTICES

Article 32 (Reporting)

(1) In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(i) spent fuel management policy;

(ii) spent fuel management practices;

(iii) radioactive waste management policy;

(iv) radioactive waste management practices;

(v) criteria used to define and categorize radioactive waste.

(i) Spent fuel management policy

The Australian government is the only jurisdiction that has a requirement to manage spent fuel. A number of jurisdictions have prohibitions on activities related to spent fuel.

Australian Government

The Australian government's spent fuel management policy requires that all spent fuel is to be transported overseas for indefinite storage (in the case of US-obligated fuel), or to another country for reprocessing, in the latter case with an agreement that all resulting long-lived intermediate-level radioactive waste will be returned to Australia at a mutually agreeable time for storage.

New South Wales

In New South Wales, the *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* prohibits the construction or operation of nuclear reactors and other facilities in the nuclear fuel cycle.

Victoria

In Victoria, the *Nuclear Activities (Prohibitions) Act 1983* prohibits the construction or operation of a facility for reprocessing[1] spent fuel[2]. Such prohibitions are also reflected in the new Victorian Radiation Act 2005[3].

[1] "Reprocessing" is defined as “the chemical separation of spent fuel”: s.2 of the Nuclear Activities (Prohibitions) Act 1983 (Vic).

[2] Section 8(1)(e) of the *Nuclear Activities (Prohibitions) Act 1983* (Vic).

[3] Section 3(1) of the *Radiation Act 2005* (definition of “radiation facility”).

Western Australia

In Western Australia, the *Nuclear Waste Storage and Transportation (Prohibition) Act 1999* prohibits the disposal, storage or transportation of "nuclear waste" as defined in that Act, unless a consenting resolution from both houses of parliament is granted.

(ii) Spent fuel management practices

Australian Government

The Australian government is the only jurisdiction that has a requirement to manage spent fuel. The current and planned spent fuel management practices for the spent fuel arising from the HIFAR, MOATA and OPAL research reactors are described below.

1. Shut-down Reactor (MOATA)

MOATA was an ARGONAUT type reactor operated by the Australian Nuclear Science and Technology Organization (ANSTO) during the period April 1961 until May 1995, after which time the reactor was permanently shut down and the fuel dry-stored on site. The fuel is of US-origin, and it has been agreed that this fuel will be returned in the next shipment to the US under the Foreign Research Reactor Spent Nuclear Fuel (FRR-SNF) takeback program. Under the provisions of this program, no waste will be returned to Australia.

2. Operational Reactor (High Flux Australian Reactor - HIFAR)

HIFAR, a 10 MW research reactor, is the only operational reactor in Australia. Operating the reactor produces approximately 37 spent fuel elements each year. Once discharged from the reactor, the spent fuel elements are stored for several years under water, to allow much of the short-lived activity to decay. The fuel elements are then transferred to a dry storage facility, consisting of holes drilled into the bedrock and lined with stainless steel.

Spent fuel from HIFAR has been shipped to the United States, to the BNFL facility at Dounreay, United Kingdom and to the COGEMA facility at La Hague, France.

Spent fuel elements for shipment overseas are loaded into licensed transport casks. These casks are drained, vacuum dried and hermetically sealed, tied down in specially strengthened steel ISO containers, and transported by road to the port. Sea transportation is carried out on a dedicated INF-2 classification ship. The waste arising from reprocessing of spent fuel elements shipped to the US under the FRR-SNF program will not be returned to Australia. It is a contractual requirement with BNFL and COGEMA that waste arising from reprocessing of spent fuel elements at their plants will be returned to Australia as long-lived intermediate-level waste.

3. Reactor under Construction (OPAL)

The OPAL reactor, now under construction and scheduled to commence operation in 2006, is a 20MW thermal, open pool reactor designed for LEU[4] aluminium-clad fuel. The reactor will

[4] LEU – Low Enriched Uranium.

commence operation using uranium silicide fuel. It is anticipated that a transition will be made to uranium molybdenum fuel once that fuel is qualified.

Used uranium silicide fuel from the operation of OPAL discharged before 2016 will be returned to the US under the FRR-SNF program[5]. After that period, the spent fuel will be sent to COGEMA for reprocessing. In the unlikely event that uranium molybdenum fuel has not been qualified by 2016, arrangements are in place with COGEMA to process the silicide-type fuel.

As a further back-up option, INVAP (the Argentinian company supplying the reactor) has given a written guarantee to provide an alternative solution consistent with Australia's requirements, using proven technologies. Argentina has already developed and demonstrated a novel technology for processing aluminium-clad research reactor spent fuel, and has plans to use that technology for managing its own research reactor spent fuel. This option has been made available for the OPAL spent fuel (excluding the first 2 cores, comprising 32 fuel elements). An agreement with Argentina at inter-governmental level to support these arrangements has been ratified by both governments.

ANSTO therefore has in place firm plans for the management of spent fuel for OPAL's lifetime.

Spent fuel discharged from the reactor core will be moved a short distance under water into storage racks in the reactor service pool, adjacent to and connected with the main pool. These racks will have the capacity to store, under water, up to 10 years' arisings of spent fuel discharged from the reactor, while retaining sufficient spare space to unload the complete operating reactor core at any time should this be required. This arrangement has the advantages of minimising handling of the spent fuel, with no movement required outside the immediate vicinity of the reactor for storage purposes and convenient, continuous monitoring of the spent fuel storage conditions. The spent fuel will also be protected by the same structural features as the reactor itself. The spent fuel will be available at all times for visual inspection of its condition.

The reactor service pool will have a purpose-built stand to take a spent fuel transport cask. Using handling tools, spent fuel rods will be moved the short distance from the storage racks underwater and loaded into the transport cask for shipment.

The timing of spent fuel shipments overseas will be determined by a number of factors, including:

- the time required to accumulate a practicable sized shipment;
- the minimum cooling time required for the youngest elements in a shipment, to satisfy shipping cask regulatory criteria; and
- the benefit for radiological safety of minimising the number of such shipment operations.

[5] On 1 December 2004, the United States Department of Energy announced a revision of the record of decision (ROD) concerning Foreign Research Reactor Spent Nuclear Fuel (FRR-SNF). In the revised ROD, the DOE announced its decision to extend the FRR-SNF policy for ten years until May 12, 2016, for irradiation of eligible fuel, and until May 12, 2019, for fuel acceptance. The decision also states that the DOE will accept spent fuel from the OPAL reactor in the extension to this program.

On the basis of around 20 to 30 spent fuel elements arising per year, it is anticipated that there will be one overseas shipment of spent fuel every 5 or 6 years. The first such shipment would be approximately 8 years after commencement of reactor operation, given a minimum cooling period of 3 years and the above-mentioned 5 or 6 years to accumulate a sufficient quantity for shipping.

(iii) Radioactive waste management policy

In all jurisdictions, radioactive waste management policy is implemented by a government department (Australian government, New South Wales, Queensland, South Australia, Tasmania, Victoria, Northern Territory) or a statutory council (Radiation Council in the Australian Capital Territory; Radiological Council in Western Australia) through Regulations, with the aim of minimizing harm to people and the environment, in line with internationally accepted recommendations. In most jurisdictions, the policy is to apply the same legislative and regulatory requirements to both radioactive materials and radioactive wastes (including sealed and unsealed sources).

Aside from Western Australia, users of radioactive materials are encouraged to return disused sources to the supplier or, where appropriate and possible, arrange for the waste to be transferred to the relevant State or Territory waste store. If this is not possible, licence holders are expected to store their radioactive wastes until it decays to a point at which it is no longer radioactive, or to arrange for it to be lawfully disposed of overseas or at a national low-level and short-lived intermediate-level radioactive waste repository if one is operational. This practice is not followed in Western Australia, where users generating waste in the State are able to dispose of it at the Mount Walton East near-surface repository.

Australian Government

The Australian government radioactive waste management policy[6] requires that all radioactive waste originating within Australia be stored, or disposed of, in Australia at suitably-sited facilities after being categorised in accordance with agreed international practice.

At present low and intermediate level radioactive waste is stored by Australian government, State and Territory agencies at over one hundred locations around Australia in both rural areas and urban centres. Many individual waste producers currently have the responsibility of looking after their own radioactive waste.

In July 2004, the Prime Minister announced that the Australian government will construct co-located facilities on Australian government land for the management of low and intermediate level radioactive waste produced by Australian government agencies.

Each state and territory is responsible for the management of radioactive waste generated by government agencies, individuals and organisations within their jurisdiction.

[6] For more information please visit http://www.radioactivewaste.gov.au

Australia does not generate any high level waste. Successive Australian governments have made it very clear that they reject any proposal to import high level radioactive waste from overseas for storage in Australia.

Future Arrangements

The Australian Government will ensure that its radioactive waste is properly managed through establishment of the Commonwealth Radioactive Waste Management Facility. As the Prime Minister stated on 14 July 2004, State and Territory Governments are expected to adopt world's best practice in the management of radioactive wastes in their jurisdictions. This should include:

- undertaking an immediate and comprehensive inventory of all radioactive waste within their jurisdiction;
- establishing safe and secure storage facilities for this waste; and
- making appropriate arrangements for disposal of low level radioactive waste.

To ensure that this happens to an acceptable standard, the Australian government is considering various options to ensure that State and Territory arrangements are transparent, accord with world's best practice, and are consistent with our international obligations for safe radioactive waste management.

Commonwealth Radioactive Waste Management Facility

On July 15 2005 the Australian government announced three potential locations to be investigated for the Commonwealth Radioactive Waste Management Facility (CRWMF). The three locations are Department of Defence properties located near Katherine and Alice Springs in the Northern Territory.

Site Assessment Considerations

To determine the suitability of possible sites at the three locations, field assessment and community consultation will be undertaken. Issues which will be considered in assessing sites include:

- operational considerations, for example, access to roads and services;
- environmental and social impacts;
- security; and
- existing land use.

On-site field investigations will examine

- geology and groundwater;
- surface features, for example surface drainage;
- fauna and flora in the area; and
- heritage.

It is expected that field investigations and community consultation will take one year.

Regulatory approvals

Once a preferred site is selected, the proposal to construct the CRWMF at that site will be referred to the Minister for the Environment and Heritage for assessment under the *Environment Protection and Biodiversity Conservation Act 1999*. The assessment process, including the development of an environmental impact statement, is expected to take about two years.

Should the Minister for the Environment and Heritage approve its construction, licences for siting, construction and operation of the facility will then need to be obtained from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

Construction of the facility will also require approval by the Public Works Committee of the Commonwealth Parliament.

The environmental assessment, licensing and Public Works Committee inquiry processes will provide opportunities for public input.

Timeframe

It is estimated that, assuming all regulatory approvals are given, it will take six years before the CRWMF is ready to accept radioactive waste.

New South Wales

In New South Wales, the policy is for licensees to store their radioactive wastes until these wastes decay to the point at which they are no longer radioactive or until lawful disposal of the material by the manufacturer or other entity can be arranged.

The regulatory body in New South Wales, the Department of Environment and Conservation, conducts periodic inspections of licence holders' premises including radioactive waste inventories. In the event that an authorised possessor of radioactive material goes into bankruptcy, a State Trust will fund the continued storage of the material.

The radioactive waste store on New South Wales government-owned land continues to be the only radioactive waste management facility in New South Wales.

Northern Territory

The Northern Territory seeks to minimise the amount of radioactive waste that will be stored. Tailings from the mining and milling of uranium are treated with the best practicable technology and contained *in situ*.

Queensland

In Queensland, all applications to acquire radioactive substances must include details of the proposed disposal arrangements for when the source is no longer required. In addition to this, licence holders must apply for an approval to relocate their sources to other jurisdictions, thereby providing the ability to track sources at the end of their useful life.

There is also a policy requirement that radioactive waste must not be retained by licence holders. The regulatory authority is actively working with licence holders to assist them in appropriately dealing with their waste.

Queensland also promotes the practice of waste minimization, and encouraging the on-going use of sources that remain in sound physical condition.

To help smaller licence holders to acquire the necessary knowledge and skills to ensure good management of the radioactive wastes generated, Queensland encourages applicants to use private sector consultants who can assist them on the requirements to dispose of sources and on the preparation of radiation safety and protection plans.

Additionally, in Queensland, all possession licensees are required to have a radiation safety officer to advise on radiation safety for their practice. This person must have appropriate knowledge and skills in the principles of radiation protection, which includes radioactive waste management. People involved in the radiation practice must also have appropriate training commensurate with the practice being undertaken.

South Australia

South Australia is developing a strategy to promote its policy on the sustainable management of radioactive waste in the State. The strategy is based on the outcomes of the EPA's *Audit of Radioactive Material in South Australia.* The report on the audit was published in September 2003. The ultimate objective is to deal with radioactive waste in a manner that protects human health and the environment now and in the future without imposing undue burdens on future generations. It is intended that unnecessary costs and administration for users of radioactive materials and holders of radioactive waste should be minimised. Features of the strategy include:

- Progression of the outcomes of the feasibility study (completed in August 2005) into disposal of low-level radioactive wastes[7] in an appropriate repository, and interim storage of low and intermediate level radioactive wastes, pending future disposal options.
- Adoption of National Directory for Radiation Protection exemption levels.
- Adoption of IAEA principles, including those on sustainable management of radioactive waste.
- Providing effective regulation of and guidance to the holders of radioactive wastes.

Small users of radioactive material will be assisted in acquiring knowledge and skills to ensure good management of radioactive waste through the EPA providing guidance documents on the management of various types of radioactive waste. These will include guidance on management very low level radioactive wastes (VLLRW) generated in hospitals and laboratories, and low-level and intermediate level wastes resulting from industrial, scientific and medical uses of radioactive material.

[7] In this context 'low level' means 'low and short-lived intermediate level radioactive waste suitable for disposal in a near-surface repository'

Tasmania

Current requirements are to dispose of waste and unwanted sources as soon as possible. The proposed radiation protection legislation will make it an offence not to dispose of sealed sources as soon as is practicable after they are no longer required for use.

Authorised officers under the Radiation Control Act visit sites and discuss disposal requirements and options with small users. Licence conditions require that records of radioisotope use and disposal are maintained. The proposed legislation requires development of radiation management plans that will include waste disposal.

Victoria

Victoria encourages waste minimisation and ensures that waste generators manage their wastes responsibly. It is an offence to dispose of radioactive substances without authorisation. Radiation users are encouraged to return disused sources to the supplier and/or when possible dispose of them via commercially available disposal routes.

Western Australia

Western Australia does not have an implied policy requiring registrants to store waste – except for material being prepared for planned disposal operations. Users are encouraged to return disused sources to the supplier or, where appropriate, arrange for their disposal at the State's low and intermediate-level waste repository.

(iv) Radioactive waste management practices

There is no high level waste produced in Australia.

In all jurisdictions, waste management practices are implemented in such a way as to minimize the impact of any disposed or stored radioactive waste on people and the environment. In most cases the policies and regulations are based on the recommendations of the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA).

In all jurisdictions, radioactive waste must be managed in accordance with the relevant legislation and regulations promulgated within that jurisdiction. All stored and disposed radioactive wastes would be designated under the IAEA waste classification scheme[8] as low or intermediate level wastes. In most jurisdictions, disposal of small quantities of waste must be carried out in compliance with the *Code of Practice for the Disposal of Radioactive Wastes by the User* (NHMRC, 1985), and bulk wastes must be disposed in compliance with the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (NHMRC, 1992).

Some jurisdictions (Queensland & Western Australia) have specifically-designated waste storage and/or disposal facilities that are licensed and audited regularly. Other jurisdictions have a range of management requirements and practices depending on the type of waste

[8] International Atomic Energy Agency, *Classification of Radioactive Waste; A Safety Guide*, Safety Series No. 111-G-1.1, IAEA, Vienna, 1994.

(liquid or solid, mine waste, medical waste, research waste) and on the half-lives of the radionuclides in the waste. These include registration of storage sites, permits for disposal, etc.

Management of short-lived wastes in most jurisdictions is carried out by allowing the radionuclides to decay until the waste is no longer classified as radioactive, and then disposing of the waste under the appropriate regulations for disposal of non-radioactive waste.

In all jurisdictions re-entry or transit of sealed sources is permitted, for ultimate return to the manufacturer/supplier, and in certain instances for recycling or disposal to a licensed waste disposal facility. Currently, in most jurisdictions, any unwanted sealed radioactive source that has been used in industrial, scientific or medical applications remains the responsibility of the owner, who must store the unwanted source safely in accordance with legislative and regulatory requirements, pending its disposal.

There is no national standard on criteria for clearance in Australia. If solid waste falls below exemption criteria it can be cleared. Waste that falls within the requirements of the Code of Practice for the Disposal of Radioactive Waste by the User (1985)[9] can be disposed of with the approval of the regulatory authority.

Australian Government

Wastes arising from ANSTO's research reactor operation, radio-isotope production and research activities are managed on ANSTO's site in Southern Sydney according to nationally and internationally accepted criteria. In anticipation of the establishment of a Commonwealth Radioactive Waste Management Facility in 2011, ANSTO is taking steps to condition its waste and reduce volumes by releasing decayed material that is below exemption criteria and by super- compaction of some drummed low level waste.

Northern Territory

The Northern Territory has no spent fuel but does hold radioactive waste that is covered by the scope of the Joint Convention as Article 3 (2). Medical and industrial waste forms only a small component of this material but uranium mining produces large tonnages with relatively low activities of tailings.

Strategies for the management of radioactive waste are incorporated as provisions of the *Radiation Protection Act 2004*, which will commence early in 2006. A radiation protection plan is required for all licensees who possess radioactive waste. Storage and disposal of all radiation sources will form part of each radiation protection plan and assistance will be given to any operator to prepare the radiation protection plan through a series of guidelines and codes of practice.

Radioactive waste is to be retained by the licensee until it is practical to return to the supplier or the waste has decayed to an activity that is exempt from Regulatory Control. National Codes of Practice on radioactive waste form part of Regulatory Control in the Northern Territory and are classified according to criteria provided by the International Atomic Energy Agency.

[9] A copy of the Code is available at http://www.arpansa.gov.au/pubs/rhs/rhs13.pdf

Queensland

The disposal of radioactive material in Queensland must comply with the *Radiation Safety Act 1999* and the *Radiation Safety Regulation 1999*. The responsible person for the radioactive material is required to prepare a radiation safety and protection plan as part of the criteria for obtaining a licence. This plan must provide instructions on how the responsible person's waste is to be minimised and their disposal arrangements. Responsible persons are required to maintain a detailed inventory of the sources in their possession.

The Queensland store will only accept certain, specifically approved radioactive substances from within Queensland.

South Australia

Currently, unwanted radioactive material that has been used in industrial, scientific or medical applications remains the responsibility of the owner, who must store the material safely in accordance with requirements specified in regulations under the South Australian *Radiation Protection and Control Act 1982* pending disposal. Owners of waste sealed radioactive sources are encouraged to pursue disposal by returning them to the original supplier or utilizing the services of a company that can facilitate the disposal.

There are regulatory requirements for radioactive waste management plans. For example, uranium miners require such plans as part of mining licence conditions. To obtain the approval for disposal of very low level waste (VLLRW), an application in writing to the Environment Protection Authority's Radiation Protection Division must include a waste management plan.

Disposal of VLLRW is permitted in accordance with the *NHMRC Code of Practice for the Disposal of Radioactive Wastes by the User (1985)*. The methods of disposal include discharge through the sewer, incineration, and fume hoods. While there is currently no landfill burial option of VLLRW in South Australia the EPA is investigating options that may permit its disposal to approved landfill sites.

Radioactive wastes generated in the mining of radioactive ores are normally disposed of at the mine site. Radioactive wastes arising from mining or mineral processing activities in South Australia are subject to regulatory controls which are consistent with national Codes and standards.

In South Australia the disposal of unwanted sealed sources by utilizing the services of a company that can facilitate the disposal is encouraged.

Tasmania

Tasmania will be undertaking an audit of all radioactive waste, in accordance with the national protocol, in due course.

Victoria

Responsibility for proper management of radioactive wastes rests with the waste generator under current Victorian law. The ability of the operator to adequately manage the wastes is assessed at the time that the legal authorisation is sought to conduct the practice.

Companies/persons seeking legal authorisations for practices that will generate some radioactive wastes are assessed at the time of application by way of submitting to Department of Human Services (DHS) a clearly written proposal that details how the wastes from the practices are to be managed and disposed of. Approvals for such practices are not given unless the applicant has clearly demonstrated an understanding of the fundamentals of waste management applicable to its radiation practice. DHS, as the regulator, does not provide services to licensed operators by way of waste disposal advice. DHS will advise on the legislative requirements that need to be met and review proposals from waste generating proponents.

Small users who generate modest quantities of wastes are advised of the traditional options of:

(a) on-site storage allowing for in-situ decay and subsequent disposal when the waste is no longer of regulatory concern (ie exempted and no longer considered in law to be a radioactive substance) via the *Health Act 1958* and *Health (Radiation Safety) Regulations 1994*. This option works well for short lived unsealed medical wastes;

(b) on-site interim storage pending the availability of suitable disposal routes, either via return to the supplier in the case of sealed sources or the availability of commercial disposal services via return to the manufacturer.

All generators of wastes are expected to, and do, seek advice from their radiation safety officer and/or private sector consultants who have practical experience in waste management relevant to the practice.

Western Australia

Western Australia has its own approved facility for the disposal of radioactive waste. The Mt Walton East waste disposal facility can only take waste that has been generated in Western Australia, due to a licence condition put on the operation by the Western Australian Minister for the Environment.

(v) Criteria used to define and categorize radioactive waste

Most jurisdictions do not specifically define or categorize radioactive waste in legislation. In practice in most jurisdictions, any sealed or unsealed material containing radionuclides at levels above exemption and for which no further use is envisaged is regarded as radioactive waste. In most cases wastes are categorized, for management purposes, as long-lived or short-lived, liquid or solid, and sealed or unsealed. Further categorization is based on IAEA recommendations (New South Wales, Northern Territory), nuclide (Queensland), or, for small quantities of solid waste, on the *Code of Practice for the Disposal of Radioactive Wastes by the User* (NHMRC, 1985). Categorization is also based on the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (NHMRC, 1992).

During 2004, through the Radiation Health Committee, Australian regulators discussed the development of advice for the classification of radioactive waste in Australia. Specific advice for Australia's predisposal management of spent fuel was also discussed.

The Australian government regulator, ARPANSA accepted advice that in the case of spent fuel there was no need for further specific guidance document as there was adequate

international guidance and Australian research reactors have spent fuel management requirements consistent with international guidance.

For the classification of Australian radioactive waste, regulators agreed that the IAEA classification system as specified in Safety Guide 111-G-1.1 was appropriate for Australia with some modification for bulk waste together with supporting documentation, particularly in relation to the thresholds between classification levels. The system of waste classification would act as a policy document which would be supported by application of specific guidance provided through separate codes of practice.

Australia is currently commencing an audit of radioactive waste in each jurisdiction and categorising the waste into several streams. This will assist in the development of a broad plan for waste, which is relevant to Australia.

South Australia

South Australia requires uranium-mining operators to comply with the requirements and definitions of waste in the Code of Practice & Safety Guide on *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*, ARPANSA Radiation Protection Series no.9. (ARPANSA, Yallambie, 2005).

Similarly, under the present authorisation, uranium-mining operators in the Northern Territory are committed to comply with the *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores* (Commonwealth of Australia, 1982) [10]..

South Australia generally adopts the classifications of low level and intermediate level wastes (short and long lived), but also refers to the categories of waste specified in the *Code of practice for the near-surface disposal of radioactive waste in Australia (1992) NHMRC Radiation Health Series No. 35*. Radioactive waste that falls in a category that may be disposed in accordance with the *NHMRC Code of Practice for Safe Disposal of Radioactive Waste by the User (1985)* is referred to as very low level radioactive waste.

Tasmania

In practice, waste either comes under the Code of Practice for the Disposal of Radioactive Waste by the User or a licence is required for disposal.

Victoria

Victoria's legislation does not distinguish between "radioactive substances that are waste" and radioactive substances that are not waste. For instance, section 108AF(1) of the *Health Act* 1958 provides:

> "A person must not operate, use, manufacture, store, transport, sell, possess, install, service, maintain, repair, test, dispose of or otherwise deal with … [a] radio-active

[10] ARPANSA publication RPS9 (*Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*. ARPANSA Radiation Protection Series no.9. (ARPANSA, Yallambie, 2005) has recently replaced the Mining and Milling (1982) Code.

substance unless the person is the holder of a licence issued under this Part, or is exempt from the requirement to hold a licence under this Part."

In accordance with section 108AF(1), the storage, possessing, disposing and dealing with radioactive substances that are waste is subject to the *Health Act 1958* and the Health (Radiation Safety) Regulations 1994 (Vic).

There are two classes of radioactive substances whose status as "radioactive waste" is unclear within Victoria:

- Radioactive substances that have short half lives and, after a period of time, cease being "radioactive substances". Once this occurs, the material is no longer subject to the controls of the radiation regulatory regime. This class of material has been assumed not to be radioactive waste and is not part of the Inventory in Appendix E.
- Radioactive substances that are stored by users. There is difficulty in determining whether these materials are "radioactive waste" within the meaning of the Convention. Often the user (eg a University) will not have determined whether there will be a further use for the material, because this would generally not have an impact on how the user stores or deals with the material. Further, any decision that is made by the user is generally not communicated to the Secretary to Department of Human Services nor is such a decision "accepted" by the Secretary to DHS. This material is not included in the Inventory in Appendix E, but it is regulated in a manner which is consistent with the Convention's requirements regarding the regulation of radioactive waste management.

There are some radioactive substances that are stored by DHS in the Victorian Government Interim Storage. These materials were generally only gathered by DHS in extreme circumstances, and only if a clear potential for acute health risk was obvious. These materials are clearly radioactive waste within the meaning of the Convention.

Should there be a requirement to classify wastes into categories to define preferred management options, the IAEA Classification System would be used.

C SCOPE OF APPLICATION

Article 3 (Scope of Application)

(1) This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

(2) This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

(3) This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of 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.

(4) This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

As no reprocessing facilities exist, or are proposed, in Australia, the discussion of management of spent fuel in this report does not include reprocessing activities. Also, the *Australian Radiation Protection and Nuclear Safety Act 1998* (Commonwealth) prohibits ARPANSA from licensing the construction or operation of reprocessing facilities.

Waste containing only naturally-occurring radioactive materials that do not originate from the nuclear fuel cycle has not been declared as radioactive waste for the purposes of this Convention.

Australia has no spent fuel within military or defence programmes. Radioactive waste managed within military or defence programmes has not been declared as radioactive waste for the purposes of this Convention.

REHABILITATION OF URANIUM MINE WASTE SITES IN AUSTRALIA

Background

Australia has a number of contaminated sites resulting from past and present uranium mining activities. The extent and nature of the contamination varies from site to site. There are also a number of known deposits where no mining has taken place, but where there is some contamination resulting from exploration and from test programs in ore extraction and processing.

The wide range of climatic conditions, from tropical monsoon conditions in the far north to dry, arid conditions over much of the centre means that it is difficult to apply a uniform set of standards or waste management and rehabilitation requirements, across the whole country.

Significant uranium mining activity has occurred in Australia since the late 1940's and, as a consequence, wastes from these activities have been accumulating. This report presents the status of waste from previous activities, and the management and rehabilitation proposed for wastes from current activities. Only the Northern Territory, South Australia and Queensland are discussed, as no significant commercial uranium mining has occurred elsewhere in Australia.

Locations of past and present uranium mines and other deposits are shown on the accompanying figure[11].

Rehabilitation Standards

Australia is a federation, with jurisdiction resting with both the States and the Commonwealth of Australia. Generally mining, waste management and radiation protection are matters regulated by the States, but the Australian government has some powers in these areas.

The Australian government developed two Codes of Practice for uranium mining: the Radiation Protection (Mining and Milling) Code 1987, and the Management of Radioactive Waste (Mining and Milling) Code 1982. These Codes were originally developed under legislation giving the Australian government power to set standards for environmental protection in circumstances where Australian government action was required (for instance in the granting of export licences for uranium). The Codes are administered and enforced by the States. An updated and combined *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* was promulgated in August 2005[12].

The main provisions of the new Code are requirements for developing plans for radiation protection of both workers and members of the public, and for radioactive waste management. These plans must be consistent with the ALARA principle and, for waste management including decommissioning, use 'best practicable technology'. The plans must be submitted to the regulatory authority for approval, and then operations must be conducted

[11] Further details of former and current uranium mines in Australia are available from the Uranium Information Centre web sites: http://www.uic.com.au/fmine.htm and http://www.uic.com.au/emine.htm

[12] The Code is available at http://www.arpansa.gov.au/rps9.cfm

in accordance with those plans. The Code requires compliance with the recommended ICRP dose limits.

Under the new Code, a Radioactive Waste Management Plan (RWMP) must be developed to provide for the proper management of radioactive waste arising from the operations. The RWMP must include a plan for decommissioning the operation and the associated waste management facilities and rehabilitating the site.

The following guidance on cessation of operations is provided in the new Code and Safety Guide:

> The waste management plan should contain proposals for rehabilitation of the project as a whole and for individual components (for example tailings dams reaching their capacity). On decommissioning, these plans will need to be updated and engineering detail finalised.
>
> Inappropriate attempts at rehabilitation may prejudice the ability to attain an acceptable final state. For this reason, rehabilitation operations should not be attempted without authorisation.
>
> An application for authorisation to rehabilitate should include the following information:
>
> - the condition of the site to be rehabilitated, including the facilities and waste to be rehabilitated, levels of contamination, and quantities of waste;
> - details of rehabilitation measures to be undertaken;
> - management of waste generated during rehabilitation;
> - the anticipated final state of the site after rehabilitation, including estimates of the levels of residual contamination;
> - details on ongoing monitoring and surveillance that will be required after rehabilitation; and
> - contingency plans, and plans for remediation of any defects in the rehabilitation that may become apparent.
>
> At the conclusion of the rehabilitation, the operator may wish to relinquish responsibility for the site. Generally the requirements and conditions for this step will be set in legislation. However, in respect of matters covered by the Code, requirements and responsibilities for continuing monitoring and surveillance of the site, and of any remedial work that may become necessary, will need to be determined. Any land use restrictions that may be necessary, and the administrative mechanisms that will implement them, will also need to be determined.

Northern Territory

In the Northern Territory, the other main uranium-mining area in Australia, various Territory Acts govern the management and safety of current uranium-mining practices. Management of mining sites, and protection and safety of the environment, are administered under the Mining Management Act (2002) by the Territory Mines Division.

South Australia

Uranium mining in South Australia (SA) is controlled by a number of State legislative requirements. The most specific for uranium mining is the Radiation Protection and Control Act. This Act requires that uranium mining operations must hold a "licence to mine or mill", and the Code of Practice referred to above is routinely applied as a condition on such a licence. This is the main mechanism by which the Code is administered and enforced.

Victoria

There is no uranium mining or milling within Victoria.

Historical Mining and Milling Operations

Northern Territory

From 1956 to 1964 the upper **South Alligator Valley**, an area about 200 km south-east of Darwin in the Northern Territory, was the location for 13 operating uranium mines and a number of prospects. These "boutique" mines contained mostly high-grade ore, and were worked mainly to extract uranium for the British nuclear weapons programme. The mining operations were a combination of open cut and underground operations. Processing of ore was initially carried out at other locations, notably Rum Jungle.

Later, small-scale processing was undertaken within the valley including a battery and gravity separation plant, gold separation and a small mill and solvent extraction plant. When operations ceased in 1964 the proponents walked away from their sites with little attempt to remediate the environmental impacts they had caused. It must be emphasised that there were no rehabilitation requirements under the regulations in force at that time. The area lay within a pastoral lease and remained in private hands until the mid 1980's when it was determined that the valley would form part of the Kakadu National Park.

In 1986 a survey of abandoned mines was undertaken by the Australian government to establish the size and scope of a possible rehabilitation project. As the South Alligator Valley area lay within the proposed boundaries of Kakadu National Park, and visitor numbers were steadily increasing, it was decided that some form of works would be required to ensure the safety of visitors. In 1988, after discussions between the various agencies involved, it was agreed that a hazard-reduction program would be undertaken. This was to include reductions in physical as well as radiological hazards for visitors to the area.

As the main concern was to make the area as safe as possible for casual park visitors, the emphasis was on the reduction of physical hazards by fencing of open cuts, redirection of roads away from the edges of open cuts, collapsing of adits and shafts, and removal and burial of waste metal etc. At least two bat colonies were established in old workings, and consequently these adits and shafts were barred using heavy-duty grilles in such a way that the bats could still move in and out of the shafts whilst public access was barred.

The site of the abandoned South Alligator Uranium Mill had been subjected to an earlier radiological assessment. Apart from the residues in old reaction vessels and pipes, the main concern was tailings which had been deposited on flat ground on the banks of the South Alligator River. During monsoonal floods the tailings were often washed away by the runoff waters. In 1986 the bulk of the tailings were trucked elsewhere and reprocessed to extract

gold. However, there were small pockets of tailings left behind which represented a potential hazard to Park visitors. Although the mill was considered by some to be an important part of the region's mining heritage, it was determined that dismantling and burial was the only safe course to take and this was done as part of the hazard-reduction program.

The minimum depth of cover was 1.5 m. The area was left over-filled to allow for subsidence and in a suitable state for seeding in the following wet season. Before the hazard-reduction program was completed, a detailed radiological survey of other associated sites was undertaken to ensure that all potentially troublesome radioactive materials were identified and a program agreed with the contractor to ensure that such wastes were dealt with in a satisfactory manner.

Following the rehabilitation works, a monitoring program has been set up to ensure that the hazard reduction continues to be effective. Regular inspections for erosion and revegetation are supplemented with periodic radiation surveys.

Currently, some further relatively small-scale remedial works are in preparation. An upper estimate of 15,000 m^3 of radiologically active material has been made for the Gunlom Residue site, historic containment sites in the South Alligator Valley, the top of El Sherana Pit and minor works elsewhere. Materials which may require containment include uranium tailings residues, uraniferous ores exposed by mining/exploration activities, and material from areas impacted by handling or containment of uraniferous ores.

In summary, the environmental impact of historical uranium mining activities in the South Alligator Valley of the NT was relatively low. However, the sites were not rehabilitated at the end of operations and a variety of safety hazards resulted which became of concern when the area was opened up as part of the Kakadu National Park. Physical hazards were managed by a combination of fencing, barring tracks, filling of shafts and burial of waste and scrap. Radioactive hazards were managed by burial of identified wastes at specific locations in conjunction with gamma-radiation surveys and some radon measurements. On-going monitoring programs indicate that the aims of the program are still being met many years after the program began. Minor erosion at containment sites has been repaired and revegetation is proceeding in a generally satisfactory manner.

The **Rum Jungle** uranium deposit was discovered in 1949 and the site, some 64 km south of Darwin, became the major Northern Territory uranium mine in the 1950's. It opened in 1953, and continued producing uranium until 1963, although copper production continued for several more years. Main production was from three open pits, all in close proximity to the East Finniss River. Overall production was about 3500 t of uranium from 860,000 t of ore (that is, an average ore grade of about 0.4%).

Tailings management appears to have been minimal in the early years of operation, but later tailings were discharged into an abandoned open pit. Minimal rehabilitation was carried out on closure; on completion of mining in 1971 it was decided by the Australian government that funds should not be made available for any rehabilitation, so the area was simply abandoned.

Within a few years the Rum Jungle mine had become one of Australia's most notorious pollution problems, due to oxidation of sulphides by bacteria and the consequent release of acid and metals into the East Finniss River. Areas of the site were regularly flooded during the monsoonal wet season, with annual rainfall of 1500 mm.

In 1983 a program to reduce the environmental impacts was commenced, with principal aims of neutralising the tailings and reducing the associated heavy metal pollution. Most of the tailings and other waste areas were capped, and erosion control measures introduced. Further rehabilitation work was performed in 1990-91.

Nabarlek was a small high-grade uranium deposit some 350 km east of Darwin. The ore body (600,000 tonnes with average grade of 2%) was mined in four months in 1979, and the stockpiled ore was treated in subsequent years, production finishing in 1988. All tailings were returned to the pit. Following completion of processing, the tailings were allowed to drain, and then covered with below ore-grade material and allowed to consolidate. Plant and equipment that could not be decontaminated and salvaged were also buried in the pit.

Final capping was carried out in 1995 and the area subsequently revegetated with a mixture of grasses and native species. Vegetation is now well established and there has been little erosion. Monitoring and research will continue, as Nabarlek represents the first rehabilitation of a uranium mine according to current principles and practice.

South Australia

The main historical operation in SA was at **Radium Hill** in a remote, arid area in the east of the State. It operated from 1954 to 1961 (that is, long before the Codes discussed above were developed) and approximately one million tonnes of ore averaging 0.13% U_3O_8 were mined. A physical (heavy media) concentration process was conducted at Radium Hill, and the resulting concentrate railed to Port Pirie on the coast for conventional chemical extraction of the uranium.

The wastes that remain at Radium Hill are estimated to be some 225,000 t of heavy media tailings and in addition around 75,000 t of waste rock. In contrast to the chemical extraction of uranium, the physical concentration process removed a large proportion of the elements of the uranium decay chain, and so the concentrations of radium-226, thorium-230 and other radionuclides are low. The heavy media tailings were contained in two above-ground tailings storage dams, with little containment, and were subject to both wind and water erosion.

In 1981-2, the tailings dams were rehabilitated by cover with local clay soil: the cover thickness was approximately 3 m on the sides and 1m on the top. No rock armouring to control water erosion was incorporated. At a later stage, some drummed residues from test work on uranium ores were buried in the top of the cover. The site is inspected regularly, and repairs made as required.

Approximately 200,000 t of conventional uranium mill tailings remain in clay-lined basins on the edge of the city of **Port Pirie**, where extraction of uranium occurred. The site is far from ideal, being on tidal mudflats, and was subject to flooding at extreme high tides. No significant rehabilitation work was carried out until the 1980's, when the tailings were covered by about 1.5 m thickness of granulated smelter slag from an adjacent lead smelter, some topsoil (up to 1 m), and revegetated. Subsequently a large quantity of slag was placed on the seaward side of the tailings dams, effectively eliminating the risk of flooding (under current conditions). Additional slag was used to cover contaminated areas of the processing plant, contaminated tanks and other equipment debris.

Queensland

The **Mary Kathleen** uranium deposit in far north-west Queensland was discovered in 1954. Mining commenced at the end of 1956 and the treatment plant was commissioned in June 1958. Tailings were emplaced in a 12 hectare tailings dam in a small valley west of the plant. This overflowed into an evaporation pond of some 60 hectares.

At the end of 1982 the mine was depleted and finally closed down after 8880 tonnes of uranium oxide concentrate had been produced. During 12 years of operations (in two phases) about 9 million tonnes of ore was mined.

Notwithstanding the minimal conditions imposed on the original (1954) leases, the company took the view that it should conform to relevant current environmental and occupational health standards. Consequently, before the recommissioning for the second phase of operations in 1976, a full environmental impact study was undertaken and this incorporated a rehabilitation plan for the 64 hectares of waste dumps, 29 hectares of tailings dam and 60 hectares of evaporation ponds. Mary Kathleen then became the site of Australia's first major rehabilitation project of a uranium mine, which was completed at the end of 1985 at a cost of some A$19 million. In 1986 this work won an award from the Institution of Engineers Australia for environmental excellence[13].

Current Uranium Mining Operations

Ranger (Northern Territory)

Ranger is a large open-pit mine, situated in the catchment area of the East Alligator River approximately 250 km east of Darwin. The mine is on a 7860 hectare lease which is surrounded by the World Heritage listed Kakadu National Park of 1.98 million hectares. The mine is in a monsoonal part of Australia, with pronounced wet season from December to April (an average 1540 mm of rain falls in the wet season). Operation commenced in 1980 at a rate of about 3300 tonnes per year of uranium oxide concentrate. Processing is carried out on site. The ore is crushed, ground, and leached with sulphuric acid to dissolve the uranium. The liquid is then separated from the solid tailings and passed through a solvent extraction plant where the uranium is removed, in a standard uranium-extraction process.

There is a large tailings dam on the site. As this is a high-rainfall area, there is considerable public concern about contamination of surface and ground water. The Australian government, through the Office of the Supervising Scientist (OSS), conducts a number of monitoring and research programs to monitor and assess the impact of the Ranger mine on the surrounding environment.

Until 1996 tailings from the treatment plant were emplaced in the engineered dam on the lease, but they are now being deposited into the worked-out #1 pit. No process or other contaminated water is released from the site, under normal operations.

The vegetation at Ranger is tropical open eucalypt forest, similar to much of the Kakadu National Park, and the Company operating the mine has a substantial environmental division. Current environmental projects include maintenance of biodiversity, fire management

[13] Further information on the rehabilitation can be found at http://www.uic.com.au/mku.htm

including control burning, terrestrial and aquatic weed control, feral animal control and rehabilitation of disturbed areas (including rock waste dumps, etc). Issues being studied include artificial wetland filters, soil formation from waste rock, and hydrology.

The project area is leased from the Aboriginal traditional owners, and among Ranger's long-term research priorities are projects which are relevant to eventual use of the land by its Aboriginal owners. As a guarantee of successful rehabilitation of the Ranger site, even if the operation were to close prematurely, the Company has lodged some A$31 million in a trust fund administered by the Australian government; an amount which covers all existing liabilities.

Olympic Dam (South Australia)

The Olympic Dam project is a large copper/uranium mine, with associated processing plant and smelter, in an arid area of central South Australia. It has operated since 1988, and currently about 10 million tonnes are mined per annum, producing 230,000 t of copper and 4200 t of uranium. The uranium ore grade is low (approximately 650 ppm), but it is the world's largest known uranium deposit (and sixth largest copper deposit).

The tailings are stored in two large "sub aerial" tailings retention structures. These have a total area of 360 hectares, and a design height of 30 m and currently hold over 74 Mt of tailings. The ore reserves will support mining at the current rate for at least another 70 years, and so a considerable extension of the tailings area is to be expected.

Final rehabilitation plans for the tailings dams have not been completed. Research is to be undertaken to determine optimum wall slopes, cover thicknesses, armouring options, and revegetation techniques. Using this information, a rehabilitation plan will be developed, which must be approved by the regulatory authorities.

Approaches to decommissioning and rehabilitation being considered include the implementation of long-term closure measures, necessitating sufficient expenditure to relinquish the lease and leave the community no on-going liability (a "sustainable" solution that does not bequeath a problem to future generations), or to allow for indefinite on-going maintenance. The difficulty with the latter is how to ensure that any future maintenance organisation, and its funding, could endure for as long as maintenance is reasonably required.

Beverley (South Australia)

Beverley is an *in-situ* uranium mine, which has been operating since 2001, and currently producing approximately 1000 t of uranium per annum. Reserves are approximately 21 000 tonnes, with ore grade of 0.18%U. As an *in-situ* mine, there are no conventional 'tailings', waste rock or similar wastes. Small quantities (approximately 100 t per annum) of solid wastes accumulate in lined below-grade evaporation ponds. Other wastes, of the order of 100 cubic metres per annum, include contaminated filter media and similar material.

Upon decommissioning a wellfield, wells are sealed and capped, pipes are removed and the surface revegetated progressively. Again final disposal and rehabilitation plans have not been finalised, but it is expected that the wastes will remain in the retention pond, which will then be backfilled to grade, armoured and revegetated. These plans must be approved before they can be implemented. At the end of the mine's life, process facilities will be removed and after discussion with the stakeholders the land can revert to its previous uses. The operating

Company has provided financial guarantees to the SA government in respect to ongoing mine site rehabilitation up to the final completion of mining.

Honeymoon (South Australia)

Honeymoon is a small uranium deposit in the east of the state, with reserves of approximately 4200 t. It is currently in care and maintenance following a pilot scale operation, but options for bringing the project into commercial operation are being actively pursued.

Again, final waste management and rehabilitation plans have not been developed, but are expected to be similar to those in the case of Beverley, and will also require regulatory approval.

Conclusions

In common with many other parts of the world, uranium mining, and in particular the management of wastes, was not well controlled in the middle of last century. In many cases management of tailings and other wastes was minimal or non-existent, or wastes were sited in inappropriate areas, and generally no rehabilitation was carried out on closure. In some cases, notably Rum Jungle, there were serious detrimental effects on the environment, both from radiological and non-radiological contaminants.

As the consequences and potential consequences of this attitude were recognised, attempts were made to manage the wastes and rehabilitate the abandoned sites. These have generally been successful, but in a number of cases continuing remedial actions will be required for the foreseeable future.

It is now recognised that waste management is an integral part of any uranium mining operation, and regulatory requirements are currently in place for all Australian uranium mining operations to ensure that wastes are managed in accordance with current best practice, and that long term rehabilitation measures will be taken as currently operating facilities are closed. Final rehabilitation plans consistent with these regulatory requirements are being developed for wastes generated by current operations. Nabarlek in the Northern Territory was the first Australian uranium mine for which this regime was in place, and the successful rehabilitation that has been achieved there indicates the effectiveness of this approach.

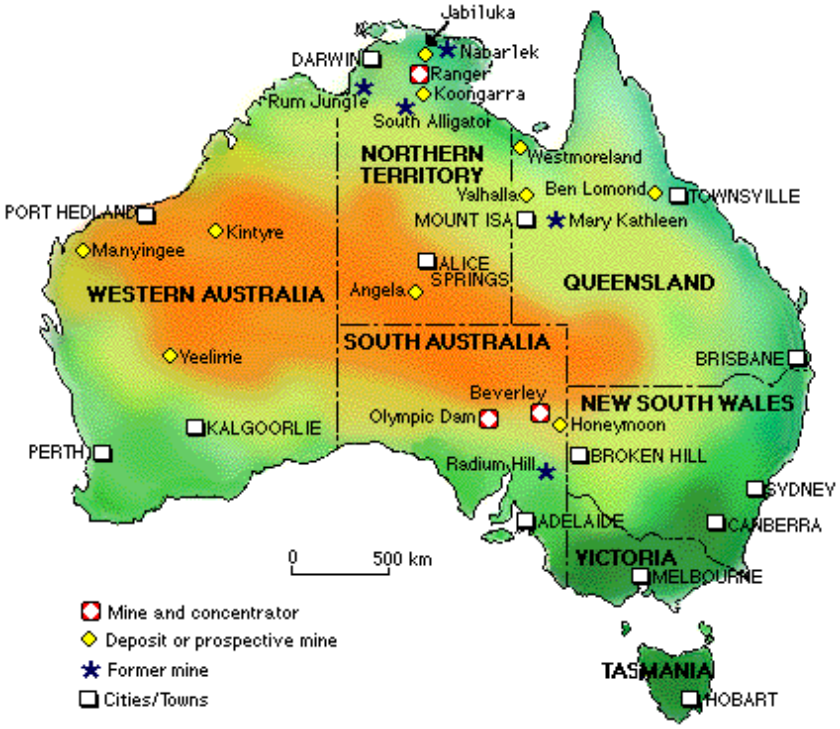


Figure showing locations of past, present and future uranium mines and deposits in Australia.

D INVENTORIES AND LISTS

Article 32 (Reporting)

(2) The report shall also include:

(i) a list of spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(iv) an inventory of radioactive waste that is subject to the Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has been disposed of; or

(c) has resulted from past practices.

(v) A list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

(i) A list of spent fuel management facilities subject to this Convention and their details is attached as Annex A of this report.

The Australian government is the only jurisdiction with a requirement to manage spent fuel resulting from the research reactor operations at Lucas Heights (ANSTO).

Spent fuel is subject to a period of interim storage at ANSTO's facilities near Sydney. Those facilities consist of:

- An inspection and loading pond for spent fuel;
- Ponds for cropping and wet storage of spent fuel (used for long term cooling of fresh spent fuel); and
- A dry storage facility, comprised of 50 storage holes with capacity for 1100 spent fuel elements.

The dry storage facility was built in 1968. An improvement in the 1980's was the construction of a building completely enclosing the facility. The condition of the spent fuel is monitored by measurements of krypton-85, relative humidity, and oxygen concentration in each tube. In addition, spent fuel elements have been removed from the dry store on occasions for examination in a hot cell on site. Spent fuel is stored in tubes in an atmosphere of dry nitrogen. There is no intention to use the dry store facility for spent fuel after 2007/8. The licence issued by the Australian government regulatory body, the Australian Radiation Protection and Nuclear Safety Agency, for the Australian Nuclear Science and Technology

Organisation's fuel operations division requires monitoring and inspection of all spent fuel storage.

(ii) An inventory of spent fuel that is subject to this Convention is attached as Annex D of this report.

(iii) A list of radioactive waste management facilities subject to this Convention and their details is attached as Annex B of this report.

(iv) In the form of conditioned waste requiring disposal, Australia has approximately 3500 m^3 of low-level and short-lived intermediate-level radioactive waste within civilian programmes. This total is made up of the following volume approximations[14]

- 2010 m^3 of slightly contaminated soil from ore-processing research;
- 1320 m^3 of operational waste stored at the ANSTO site;
- 160 m^3 of miscellaneous waste including spent sealed sources used in gauges, smoke detectors, medical equipment and luminous signs; and
- 20 m^3 of miscellaneous waste in interim storage at Woomera.

It should be noted that these figures are estimates of waste volumes for disposal. Waste already disposed of at the Mt Walton East facility in Western Australia is not included in the above volume estimates.

The current estimated inventory of long-lived intermediate-level radioactive waste in the jurisdiction of the Australian government consists of an approximate waste volume of 500 m^3. Approximately 200 m^3 of this is in the form of reactor target cans, ion-exchange columns, used control arms, aluminium end pieces and some solidified liquid waste. Approximately 165 m^3 is historical waste in the form of thorium and uranium residues arising from mineral sands processing, and approximately 35 m^3 is disused sources from medical and research equipment[15].

Refer to Annex E for tables of the total activity of each radionuclide in waste stored in radioactive waste management facilities in Australia and waste disposed of in Western Australia's Mt Walton East facility. It should be noted that these tables have not incorporated sources of unknown activity, sources of unknown radionuclide and sources for which a range of activities was recorded. Where the activities of waste with mixed radionuclides could be attributed to each individual nuclide, this was undertaken. Inventories of radioactive waste in storage at ANSTO's radioactive waste management facility and of wastes from the mining and milling of radioactive ores are also supplied.

(v) A list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities is attached as Annex C of this report.

[14] Department of Education, Science and Training, *National Radioactive Waste Repository Draft EIS*, PPK Environment & Infrastructure, Adelaide, 2002.

[15] Department of Industry, Science and Resources, *Safe Storage of Radioactive Waste, The National Store Project: Methods for choosing the right site*, A public discussion paper, Canberra, 2001.

Nuclear facilities under decommissioning

The 100 kW MOATA research reactor was shut down in 1995, and fuel and cooling water were removed in 1996. It is presently awaiting decommissioning. Three stages of decommissioning are envisaged: post-operational care with fuel removed (current status), partial dismantling with continuing care, and complete dismantling. Decommissioning to "green field" is under planning.

E LEGISLATIVE AND REGULATORY SYSTEM

Article 18 (Implementing Measures)*: Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.*

Article 19 (Legislative and Regulatory Framework)

(1) Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

(2) The legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations for radiation safety;

(ii) a system of licensing of spent fuel and radioactive waste management activities;

(iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

(iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;

(v) the enforcement of applicable regulations and of the terms of the licences;

(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

(3) When considering whether to regulate radioactive materials as radioactive wastes, Contracting Parties shall take due account of the objectives of the Convention.

Article 20 (Regulatory Body)

(1) Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

(2) Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organisations are involved in both spent fuel or radioactive waste management and in their regulation.

Article 18 (Implementing Measures)

Australia is a federation of 6 States and 2 self-governing Territories. The Constitution of Australia unites the States and Territories in a federal Commonwealth under the name of the Commonwealth of Australia (also known, and referred to in this National Report as, the Australian Government) which forms the 9th jurisdiction.

Each jurisdiction has in force an Act of Parliament establishing a framework for regulating the safety of radioactive waste management and, in the case of the Australian government, the safety of spent fuel management. Each Act establishes a licensing system for the

management of radioactive material and, in the case of the Australian government, spent fuel, a regulatory authority, inspection and enforcement provisions and authorises the making of safety standards in the jurisdiction that enacted the legislation.

Each jurisdiction has taken the necessary administrative steps to enable the regulatory body to achieve functions allocated to it under the enabling legislation.

Further details of the legislative and regulatory framework and regulatory body for each jurisdiction are contained below. Annex F contains a list of the statutory instruments currently in force with the principal instruments appearing in bold.

While Australia consists of 9 legally separate jurisdictions for the purposes of regulating the safety of radioactive waste and spent fuel management, the jurisdictions are working together to develop and implement a uniform national set of policies and practices in radiation protection and nuclear safety. Specifically, under Section 15 of the *Australian Radiation Protection and Nuclear Safety Act 1998*, the CEO of ARPANSA is responsible for promoting uniformity of radiation protection and nuclear safety policy and practices across the jurisdictions of the Australian government and the States and Territories. The Radiation Health Committee established under the Act includes representatives of all jurisdictions and develops Codes and Standards for national adoption. During 2004 Edition 1 of the National Directory for Radiation Protection was published.

The aim of the National Directory is to provide nationally uniform requirements for the protection of people and the environment against exposure or potential exposure to ionizing and non-ionizing radiation and for the safety of radiation sources, including provision for the national adoption of codes and standards. The National Directory has been developed to address the needs of radiation protection regulators but it will also benefit other sectors involved in implementing radiation controls, such as mine operators and occupational health and safety regulators.

Development of Edition 2 has commenced to cover additional material, including application of the National Directory to mining and mineral processing.

Article 19 (Legislative and Regulatory Framework)

The legislative framework established by the States and Territories prohibits the use of non-exempt radioactive material (including radioactive waste) and ionizing/non-ionizing apparatus without a licence and requires the material/apparatus and premises to be registered.

The Australian government's framework prohibits dealing with controlled material or conduct relating to a control facility without a licence. Controlled facilities are subdivided into nuclear installations and prescribed radiation facilities. A nuclear installation includes a nuclear research reactor, a plant for preparing or storing fuel for use in a nuclear research reactor, a nuclear waste storage and a nuclear waste disposal facility with an activity at or above the level prescribed in the legislation. A prescribed radiation facility includes a facility (other than a nuclear installation) used for the production, processing, use, storage, management or disposal of non-exempt sealed or unsealed radioactive sources. Controlled facilities are licensed by activity stage eg siting, construction, possession and operation and decommissioning. The licensing process for a nuclear installation includes a public consultation process. Controlled material and controlled apparatus includes non-exempt

sealed and unsealed sources. A person is licensed to deal with controlled material or controlled apparatus.

The legislation passed in each jurisdiction:

- establishes a regulatory body;
- includes requirements to comply with nationally accepted standards for occupational exposure limits, dose limits, disposal of radioactive waste, transport of radioactive material and air and waterborne discharge limits;
- requires reporting of incidents and exposures; and
- gives the regulatory body powers to monitor and enforce compliance with legislative requirements.

The standards mentioned above are usually imposed in each jurisdiction by Regulations made under the Act that established the jurisdiction's regulatory framework but may also be imposed as specific conditions of licence or registration. Below is a schedule identifying the standard by subject and the IAEA or ICRP equivalent where applicable.

Occupational exposure and dose limits

Australian code or standard: *Recommendations for Limiting Exposure to Ionizing Radiation, National Standard for Limiting Occupational Exposure to Ionizing Radiation (Printed 1995 - Republished 2002)*

International equivalent: *ICRP 60* and *BSS 115.*

Transport of radioactive material

ARPANSA: *Code of Practice for the Safe Transport of Radioactive Material (2001)*

International equivalent: IAEA *Regulations for the Safe Transport of Radioactive Material 1996 Edition (Revised 2000)*

Mining and milling of radioactive ores

Commonwealth of Australia: *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores (1982), Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores (1987)*

International equivalents: the Codes reflect internationally accepted practice at the time of publication and considered the following international documents, the *Manual on Radiological Safety in Uranium and Thorium Mines and Mills*, Safety Series 43 (1976) and the *Management of Wastes from the Milling and Milling of Uranium and Thorium Ores, A Code of Practice and Guide to the Code*, Safety Series 44 (1976).

An updated and combined ARPANSA *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* was promulgated in August 2005.

Disposal of radioactive waste

NHMRC: *Code of Practice for the Disposal of Radioactive Waste by the User (1985), Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (1992)[16]

International equivalents: IAEA *Near Surface Disposal of Radioactive Waste Requirements, Safety Standards Series No. WS-R-1.*

The *Code of Practice for Disposal of Radioactive Wastes by the User* was promulgated by the National Health and Medical Research Council of Australia in 1985 and is used as guidance by all jurisdictions for disposal by air, water, landfill and by incineration. An updated Code of Practice and Safety Guide is currently in preparation.

ARPANSA's *National Directory for Radiation Protection* (Edition 1 2004) provides the framework for the national adoption of ARPANSA's Codes and Standards.

Australian Government

The *Australian Radiation Protection and Nuclear Safety Act 1998* (the ARPANS Act) and its regulations, the Australian Radiation Protection and Nuclear Safety Regulations 1999, prescribe the framework for the Australian government.

The Australian government framework divides licensing into 2 parts, controlled facilities and controlled materials and apparatus. Controlled facilities are subdivided into nuclear installations and prescribed radiation facilities. A nuclear installation includes a nuclear research reactor, a plant for preparing or storing fuel for use in a nuclear research reactor and a nuclear waste storage or disposal facility with an activity at or above the level prescribed in the legislation. A prescribed radiation facility includes a nuclear waste storage or disposal facility that has a lower activity level. Controlled facilities are licensed by activity stage eg siting, construction, possession and operation and decommissioning. The licensing process for a nuclear installation includes a public consultation process. Controlled material and controlled apparatus include sealed and unsealed sources as well as ionising and non-ionising apparatus. A user is licensed to deal with the material or the apparatus.

The following information is provided on the licensing process undertaken by the Australian government regulatory body, the Australian Radiation Protection and Nuclear Safety Agency.

Section 30 of the *ARPANS Act* prohibits any part of the Australian government from undertaking the following conduct unless the person is authorised under a facility licence issued by the CEO of the Australian Radiation Protection and Nuclear Safety Agency to:

(i) prepare a site for a controlled facility;

(ii) construct a controlled facility;

(iii) have possession or control of a controlled facility;

(iv) operate a controlled facility;

[16] Copies of the Australian codes and standards are available at http://www.arpansa.gov.au/codes.htm

(v) decommission, dispose of or abandon a controlled facility.

A controlled facility includes a plant for preparing or storing fuel for use in a nuclear reactor, a nuclear waste storage or disposal facility and a nuclear reactor for research or production of nuclear materials for industrial or medical use (including critical and sub-critical assemblies).

An applicant for a licence must submit the information set out in Part 1 of Schedule 3 of the Regulations which includes the applicant's plans and arrangements for maintaining effective control of the facility; the safety management plan for the controlled facility; the radiation protection plan for the controlled facility; the radioactive waste management plan for the controlled facility; the security plan for the controlled facility; and the emergency plan for the controlled facility. For an application to decommission a nuclear installation, an applicant also needs to provide a decommissioning plan and schedule.

In accordance with Regulation 40, ARPANSA is required to invite public submissions on any application involving a nuclear installation such as the OPAL reactor[17,18]. Paragraph 41(3)(g) of the Regulations requires ARPANSA to take into account the content of any public submissions in deciding whether or not to issue a licence. In the past, public submissions have been invited as part of the licensing process to decommission the Australian Nuclear Science and Technology Organisation's MOATA nuclear research reactor[19] and to licence operation of ANSTO's waste and spent fuel management facilities.

ARPANSA's Regulatory Branch assesses all licence applications against accepted standards for radiation protection and nuclear safety. The assessment and subsequent licensing recommendations (including non-statutory conditions of licence) are recorded in a report to the CEO of ARPANSA called the 'Regulatory Assessment Report'. All licences issued by the CEO are subject to the statutory conditions of licence, that is, the conditions mentioned either in the Act or Regulations, and any further conditions applied by the CEO. Licence conditions enforcing accepted standards in areas such as occupational exposure, disposal of radioactive waste and dose limits are found in Part 4, Division 4 and Part 5 of the Regulations.

In deciding whether or not to issue a licence, the CEO of ARPANSA must take into account the following significant matters:

(i) international best practice in relation to radiation protection and nuclear safety as it relates to the licence application;

(ii) whether the information establishes that the proposed conduct can be carried out without undue risk to the health and safety of people, and to the environment;

(iii) whether the applicant has shown that there is a net benefit from carrying out the conduct relating to the controlled facility;

[17] A copy of the licences authorising siting and construction of the OPAL reactor can be found at http://www.arpansa.gov.au/rrrp.htm.

[18] Further details of the OPAL reactor project can be found on the licence holder's website at http://www.ansto.gov.au/ansto/RRR/index.html

[19] A copy of the licence authorising the decommissioning of the MOATA nuclear research reactor can be found at: http://www.arpansa.gov.au/pubs/moata_dec_lic.pdf

(iv) whether the applicant has shown that the magnitude of individual doses, the number of people exposed, and the likelihood that exposure will happen, are as low as reasonably achievable, having regard to economic and social factors;

(v) whether the applicant has shown a capacity for complying with these regulations and the licence conditions; and

(vi) the content of any submissions made by members of the public about the application.

Compliance is assessed by site inspections, 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.

A licence holder under the *Australian Radiation Protection and Nuclear Safety Act 1998* must comply with the following statutory conditions set out in the Regulations to the Act:

(i) 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.

(ii) The licence holder must take all reasonably 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 reasonably 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.

In accordance with Regulation 63, ARPANSA has published guidelines[20] on how licence holders will report their compliance with the Act, the Regulations and licence conditions.

Part 7 of the ARPANS Act prescribed powers available to the agency to conduct inspections[21] to monitor and enforce compliance with the Act, its Regulations[22] and licence conditions.

Pursuant to Regulation 50 of the Australian Radiation Protection and Nuclear Safety Regulations 1999, the holder of a licence must, at least once every 12 months, review and update any plans and arrangements for managing the controlled facility, controlled material or controlled apparatus to ensure the health and safety of people and protection of the environment. Section 36 of the *Australian Radiation Protection and Nuclear Safety Act 1998* allows the CEO of ARPANSA to impose addition or vary existing licence conditions.

[20] These guidelines, although currently being updated, can be found on the web at http://www.arpansa.gov.au/reg63_1b.pdf

[21] A copy of ARPANSA's inspection policy is also available for viewing on the web at http://www.arpansa.gov.au/inspect.htm

[22] A copy of the Act and Regulations is available at http://www.arpansa.gov.au/legframe.htm

There is an additional national regulatory framework for environment protection established under the *Environment Protection and Biodiversity Conservation Act 1999*[23].

Australian Capital Territory

In the ACT the regulatory authority is a 5–person Radiation Council established under the *Radiation Act 1983*. In the area of radioactive waste management, the Council issues Disposal Permits for disposal of small quantities of radioactive waste which are either amenable for disposal into the ground or into air or water. That disposal conforms to the principles of the *Code of Practice for the Disposal of Radioactive Wastes by the User* (NHMRC, 1985) and the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (NHMRC, 1992). Solid waste is disposed of into the ground on designated sites of a municipal rubbish tip and each disposal campaign – which takes place quarterly – is directly supervised by the radiation control authority as to its conformance with the conditions of the respective Disposal Permit. Irrespective of all other conditions in the Disposal Permit, a waste can only be disposed of if the locations of radioactive waste disposal sites for each disposal campaign are registered on the site plans of the waste tip by the operators of the tip. From the perspective of the municipal rubbish tip operator, the disposal of radioactive waste has been governed by the same rules as that of designated non-radioactive hazardous waste.

New South Wales

The Department of Environment and Conservation has supplemented its legislative and regulatory framework by commencing premises based registration. In September 2003, the Radiation Control Regulation 2003 (NSW) was gazetted. It requires the registration of premises on which a radioactive source is kept or used pursuant to Section 8 of the *Radiation Control Act 1990* (NSW). The NSW store is now a registered premise under these provisions.

Northern Territory

The *Radiation Protection Act 2004* will come into effect in 2006. This Act is based on the National Framework for Radiation Protection as contained in the *National Directory for Radiation Protection, Edition 1*. Until the start of the new Act, the legislative and regulatory system is unchanged from the previous report and is covered by four Acts as follows:

I. *Radiation (Safety Control) Act*;

II. *Mining Management Act 2001*;

III. *Dangerous Goods Act*; and

IV. *Radioactive Ores and Concentrates (Packaging and Transport) Act.*

The Radiation Protection Section of the Department of Health and Community Services administers the *Radiation (Safety Control) Act* on behalf of the Chief Health Officer. The Act

[23] Further information on this framework is available at http://www.ea.gov.au/epbc/index.html

relates to the control, regulation, possession, use and transport of radioactive material and irradiating apparatus.

The *Mining Management Act 2001* is administered by the Department of Primary Industry, Fisheries and Mines. This Act provides for the authorisation of mining activities, management of mining sites and the protection of the environment, safety and health of people on mining sites.

The *Dangerous Goods Act* and the *Radioactive Ores and Concentrates (Packaging and Transport) Act* are administered by Northern Territory Worksafe, which is a branch of the Department of Employment, Education and Training. These Acts control the safe handling, storage and movement of dangerous goods and the packaging and transport of radioactive ores and concentrates.

Queensland

Queensland is amending its legislation to ensure that it is consistent with the regulatory elements of the ARPANSA *National Directory for Radiation Protection*.

Queensland also adopts the various ARPANSA codes of practice into its legislation, thereby making it a requirement that each responsible person and persons involved in their radiation practices comply with the requirements specified in the codes. Adopting such codes of practice assists in ensuring that there is a greater degree of uniformity of requirements across each jurisdiction.

South Australia

The principal legislation in South Australia relevant to the Joint Convention is the *Radiation Protection and Control Act 1982 (RPC Act)*. The *RPC Act* provides the legislative and regulatory framework contemplated in Article 19 of the Joint Convention.

The South Australian *RPC Act* and *Radiation Protection and Control (Ionising Radiation) Regulations 2000* (IR Regulations) under the *RPC Act* provide for controls for the safety of radioactive waste management. The *RPC Act* and *IR Regulations* are currently being reviewed with the intention to adopt the provisions of the *National Directory for Radiation Protection* and to facilitate the implementation and maintenance of the requirements of the Joint Convention.

The *RPC Act* requires people who handle radioactive substances to be licensed, and operations for mining and milling of radioactive ores to be licensed. Sealed radioactive sources and premises where unsealed radioactive substances are used, handled or stored must be registered under the *RPC Act*. Licences and registrations are subject to specific conditions that promote safe practices.

Specific requirements relating to the registration of radioactive sources and premises are contained in the IR Regulations. The transport of all radioactive material must be carried out in accordance with the *Radiation Protection and Control (Transport of Radioactive Substances) Regulations 2003*, under the *RPC Act*.

The *IR Regulations* currently apply to any radioactive substance that has a specific activity greater than 35 kBq/kg, and in the case of radioactive ores, material containing greater than

.002% uranium or 0.005% thorium. In general, waste material would not be considered radioactive waste unless these limits were exceeded. It is proposed that, in the revision of the regulations, these limits will be replaced with the radionuclide exemption limits listed in the *National Directory for Radiation Protection.*

In the case of solid wastes originating within the supervised area of uranium mining or milling operations, the material is designated as radioactive waste unless clearly demonstrated otherwise. That is, for the waste material to be released from the site (e.g. for recycling), it must be shown to have a specific activity no greater than 35 kBq/kg, and have alpha surface contamination levels below an approved value. Any waste material not meeting these criteria, are disposed of on-site according to the approved Radioactive Waste Management Program.

Any disposal of radioactive waste requires approval of the Minister for Environment and Conservation, or his delegate. Organisations that produce unsealed radioactive wastes are required to submit to the EPA for approval, an annual waste management plan which details the quantities of waste that will be produced, and proposals for any disposal of very low level radioactive waste.

The mining or milling of radioactive ores in South Australia is subject to regulatory control via a licence issued under the *RPC Act*. Conditions attached to the licence require uranium mining operators to comply with the requirements of the Australian government *Code of Practice & Safety Guide on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* ARPANSA (2005) and the ARPANSA *Recommendations for Limiting Exposure to Ionizing Radiation.*

Companies that hold licences to mine or mill radioactive ores are required, under conditions on the licences, to report annually on radioactive waste production and management. The operation of mines and management of radioactive wastes on site also involve approvals of facilities such as tailings dams and evaporation ponds, waste management plans, and releases of radionuclides to the environment. The Radiation Protection Division of the EPA is responsible for granting approvals under the above Mining and Mineral Processing Code. In its assessment of applications for approval of waste management plans and waste disposal facilities, the EPA consults with the Department of Primary Industries and Resources South Australia (PIRSA) that issues a mining lease under *Mining Act 1971*. Mining operations are periodically inspected by the EPA and quarterly meetings are held to review safety of operations, including radioactive waste management.

In the case of radioactive wastes remaining from mining or processing of radioactive ores which ceased prior to the introduction of the *RPC Act*, legislative control is achieved via registration of the sites as premises under the *RPC Act*.

Tasmania

The *Radiation Control Act 1977* prohibits any dealing with radioactive material otherwise than in accordance with an authority granted by a licence or permit. A licence or permit is subject to statutory conditions including those relating to requirements for storage accommodation for radioactive material, radiation exposure and disposal (each subject being consistent, where appropriate, with the national standards mentioned previously).

Victoria

The *Health Act 1958* prohibits a sealed source or apparatus from being used or handled unless the substance or apparatus is registered or exempted from registration under the Act. The Act prohibits a person from dealing with an ionizing radiation apparatus or non-ionizing radiation apparatus of a prescribed class or radio-active substance unless the person is the holder of a licence issued under the Act or is exempt from the requirement to hold a licence under the Act. Statutory conditions of licence have been made with respect to the safety standards to be followed by the person holding the licence (consistent with those standards mentioned in the introduction to this Article) and appropriate methods of disposal of radioactive material (again consistent with the standards mentioned above) amongst other matters.

Victoria has recently passed new radiation protection legislation (Radiation Act 2005) and is currently working on drafting of accompanying regulations. The new Radiation Act 2005 is consistent with the regulatory elements of the ARPANSA *National Directory for Radiation Protection*. Victoria is committed to increased regulatory consistency and adopts the nationally developed ARPANSA codes of practice as conditions of legislative authorisations.

Western Australia

The Radiation Safety Act 1975 prohibits a person from dealing with radioactive substances, irradiating apparatus or electronic products for particular purposes without a licence. The owner of any premises, or any part of any premises — (i) in which any radioactive substance is manufactured, used or stored; (ii) in which any irradiating apparatus or electronic product is used or operated; or (iii) which is likely to be affected by the passage of waste from, or otherwise by the use of, any radioactive substance, irradiating apparatus or electronic produce must apply for registration of those premises or that apparatus or product or for the grant of an exemption from registration. In determining grounds for refusing or granting a registration, the Council may have regard to the recommendations, guidelines, or practices of the bodies known as the International Commission on Radiological Protection, the United Nations Organisation for Economic Co-operation and Development, the National Health and Medical Research Committee, and such other bodies possessing relevant expertise as the Council may think appropriate. Activities involving radioactive substances are subject to statutory conditions including dose limits, storage, release or disposal including near-surface disposal and transport (wherein these conditions following accepted national standards).

Article 20 (Regulatory Body)

Generally it is expected that the appropriate regulatory authority already established in each jurisdiction for the purpose of implementing Australian government, State or Territory radiation safety regulations will also be designated with implementation and maintenance of the requirements of this Convention. These appropriate authorities will be adequately resourced for this role. The staffing of radiation protection regulators in each jurisdiction varies from 3 up to about 20 staff. The staff possess the experience, skills and knowledge needed to undertake their regulatory activities.

Within all jurisdictions in Australia, there is currently an effective independence between the appropriate regulatory authorities for radiation safety and other areas within organisations dealing with spent fuel or radioactive waste management.

There are nine radiation protection regulatory bodies within Australia, as follows:

- Australian government: the Australian Radiation Protection and Nuclear Safety Agency;
- New South Wales: the Department of Environment and Conservation, previously known as the Environment Protection Authority;
- Queensland: Department of Health;
- South Australia: Environment Protection Authority;
- Tasmania: Department of Health and Human Services;
- Victoria: Department of Human Services;
- Western Australia: Radiological Council;
- Australian Capital Territory: Australian Capital Territory Radiation Council; and
- Northern Territory: Department of Health and Community Services

Australian Government

ARPANSA Regulatory Branch comprises approximately 20 people, about three-quarters being regulatory scientists and engineers. There is an 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.

New South Wales

Information regarding New South Wales resources is available from the Department of Environment and Conservation.

Northern Territory

Information regarding Northern Territory resources is available from the Department of Health and Community Services.

Queensland

There is currently an effective independence between the appropriate regulatory authorities for radiation safety and other areas within organisation dealing with radioactive waste management.

It is the regulatory authority which operates Queensland's radioactive waste store on behalf of the State. However, the Store is operated under the scrutiny of the independent Radiation Advisory Council which is required to seek, obtain and consider a report from an external technical auditor at least every two years to review all actions of the regulatory authority in managing the facility. Additionally, there is a Management Advisory Committee, which represents the State and the Esk Shire Council (where the facility is located), which advises the Minister on the management of the facility based on the review of records, audit reports, and any other inspection of the facility by the Committee.

South Australia

The South Australian regulatory body is the Radiation Protection Division of the Environment Protection Authority. The Division comprises 15 people; 13 scientific and technical staff and 2 administrative and clerical staff.

The Division is effectively independent of its licence holders and owners of radioactive waste, with the exception that the Division stores a small quantity of radioactive waste.

Tasmania

Information regarding Tasmanian resources is available from the Department of Health and Human Services.

Victoria

If there were a proposal to have a radioactive waste management facility in Victoria, the appropriate steps would be taken to ensure that procedures are established and implemented for a proposed radioactive waste management facility in such a way as to ensure appropriate separation of the regulated practice from the regulatory body.

Western Australia

Information regarding Western Australian resources is available from the Radiological Council.

F OTHER GENERAL SAFETY PROVISIONS

Article 21 (Responsibility of the licence holder)

(1) Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

(2) If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

Article 22 (Human and financial resources)

Each Contracting Party shall take the appropriate steps to ensure that:

(i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

(ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

(iii) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

***Article 23 (Quality Assurance**) - Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.*

Article 24 (Operational radiation protection)

(1) Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

(i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

(ii) no individual shall be exposed, in normal situations, to radiation doses, which exceed national prescriptions for dose limitation, which have due regard to internationally endorsed standards or radiation protection; and

(iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

(2) Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

(i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

(ii) so that no individual shall be exposed, in normal situations, to radiation doses, which exceed national prescriptions, which have due regard to internationally endorsed standards on radiation protection.

(3) Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

Article 25 (Emergency preparedness)

(1) Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

(2) Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

Article 26 (Decommissioning)

Each Contracting Party shall take appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(i) qualified staff and adequate financial resources are available;

(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

(iii) the provisions of Article 25 with respect to emergency preparedness are applied; and

(iv) records of information important to decommissioning are kept.

Each jurisdiction has detailed management plans in place for their radioactive waste management facilities, including licensing requirements, clear delineation of responsibility for management and safety, human and financial resources, auditing and quality control, operational radiation protection, and provision and testing of emergency preparedness plans.

Article 21 (Responsibility of the Licence Holder)

Australian Government

ANSTO Waste Operations and Fuel Management practices are licensed by ARPANSA and operate under a certified QA system. Within this structured system, staff are appropriately trained and are qualified to carry out their tasks using defined procedures and instructions. The adequacy of human and financial resources is reviewed on an ongoing basis to ensure that operations are safe and there is little likelihood of unplanned or uncontrolled releases of radioactive material into the environment. ANSTO operations are designed to respect the ALARA principle: workers' radiation doses are routinely monitored, as are environmental releases. Aggregated worker dose data and environmental release information are reported to ARPANSA and are publicly available in ANSTO reports.

Australia's research reactors are owned and funded, and the liability for them is carried, by the Australian government represented by the operator of the facilities, the Australian Nuclear Science and Technology Organisation.

Australian Capital Territory

In the Australian Capital Territory responsibility for the safety of radioactive waste rests with the holder of a licence for radioactive material which may later become a radioactive waste. The waste may be disposed of only under a separate Disposal Permit if granted to the licence holder by the Australian Capital Territory Radiation Council. Otherwise, the licence holder must keep the waste under their control.

New South Wales

In New South Wales, the requirement is for licensees to store their radioactive wastes until these wastes decay to the point at which they are no longer radioactive or until lawful disposal of the material by the manufacturer or other entity can be arranged.

Northern Territory

The safe keeping and management of radioactive waste being held in the Northern Territory rests with the holder of the relevant licence issued under the *Radiation (Safety Control) Act.* Provisions of the new *Radiation Protection Act 2004* will require a radiation protection plan in which storage and disposal arrangements will form part of the plan. Development of the plan and compliance with the plan are responsibilities defined under the Act.

The uranium mines and milling facilities in the Northern Territory are privately owned and any liability would be carried by the owner. The Northern Territory regulatory body requires a bank guarantee or cash deposit before operations can commence.

Queensland

Under Queensland's *Radiation Safety Act 1999*, any person who possesses a prescribed radiation source must hold an appropriate licence issued under the Act. This person is responsible for the management of its radioactive waste. The responsible person is required to prepare a radiation safety and protection plan as part of the criteria for obtaining a licence. This plan must be approved by the chief executive of Queensland Health, and must include details of how the responsible person will manage its radioactive waste.

The regulatory authority conducts a risk based routine program of radiation monitoring to assess a licensee's compliance with the legislation, their radiation safety and protection plan, and their level of radiation safety. These activities may lead to enforcement activities where breaches of the Act have been identified.

South Australia

South Australia currently does not have facilities for disposal of radioactive wastes or centralised storage of radioactive wastes, with the exception of those at mining operations where wastes are disposed on site.

Owners of radioactive waste are required to register sealed radioactive sources that contain prescribed quantities of radioactive material and register premises where unsealed radioactive wastes are stored. The owners must safely store the waste in accordance with the requirements of the *RPC Act* and regulations. Officers of the EPA inspected storage of radioactive waste to enforce compliance with the legislation.

In the case of disposal of VLLRW, the EPA requires organisations that use unsealed radioactive material to submit annual radioactive waste management plans. The plans provide information on the radionuclides used by the organisation, the provisions for storage and disposal of radioactive waste.

Conditions attached to the licence to mine or mill radioactive ores issued under the *RPC Act* require uranium mining operators to comply with the requirements of the Code of Practice & Safety Guide on *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* ARPANSA (2005). The Code requires an approved Radioactive Waste Management Program (RWMP) be developed. The RWMPs are site specific and include contingency plans for unplanned events in which radioactive wastes might be released to the environment.

The uranium mines and milling facilities in South Australia are privately owned and any liability would be carried by the owner. The South Australian Department of Primary Industries and Resources requires a bank guarantee or cash deposit before operations can commence.

Tasmania

The safe keeping and management of radioactive waste being held in Tasmania rests with the holder of the relevant licence issued under the *Radiation Control Act 1977.* This must be done in accordance with the Regulations and any conditions or limitations imposed on their licence. Provisions of the proposed *Radiation Protection Act* will require a radiation management plan in which storage and disposal arrangements will form part of the plan. Development of the plan and compliance with the plan are responsibilities defined under the proposed Act.

Victoria

Although there are no facilities within the meaning of the Joint Convention within Victoria, the Department of Human Services ensures that the responsibility for the safety of radioactive wastes generated by radiation practices conducted within Victoria rests with the licence holder.

Western Australia

Under the Radiation Safety Act both the registrant and licensee have legal obligations to deal with any radioactive materials in accordance with the Regulations and any conditions or limitations imposed on either their Registration or Licence. Compliance is usually assessed by inspections, independent monitoring and sampling, audits and reviewing documents, such as annual reports the radiation management plan and records, including the review of personal monitoring results.

Article 22 (Human and Financial Resources)

Australian Government

ANSTO retains staff with the necessary skills, knowledge and expertise to undertake its licensed activities[24].

ANSTO also co-operates with the Australian Institute of Nuclear Science and Engineering[25] to promote education and co-operation in the fields of nuclear science and engineering.

Similarly, Australian universities provide a broad program of undergraduate and postgraduate education in the field of mining engineering.

ARPANSA staff members possess the essential skills, knowledge and expertise to assess the safety in operating the spent fuel management and radioactive waste management facilities at ANSTO and to conduct the inspection to these facilities for regulatory compliance monitoring.

ARPANSA maintains a staff development program through ARPANSA Performance Development System (APDS) to further enhance and update the skills and knowledge to carry out the regulatory and technical assessment related to the operation of spent fuel management and radioactive waste management facilities.

Australian Capital Territory

There is no radioactive waste management facility, as such, in the ACT. Due to the small scale of operations, resources are provided from within general radiation protection functions.

New South Wales

Information regarding New South Wales resources is available from the Department of Environment and Conservation.

Northern Territory

General safety of radioactive waste management is ensured through a program of inspections, where qualified staff and financial resources are provided by the Northern Territory government. This will be extended to cover decommissioning and monitoring post-closure of operations where appropriate.

Queensland

Queensland's radioactive waste store is owned by the State. The regulatory authority operates Queensland's radiation waste management facility on behalf of the State. Adequate resources and qualified staff are provided by the State to support the facility.

[24] For further information visit http://www.ansto.gov.au/info/reports/ar0102/anstoar0102s2.pdf

[25] For information about AINSE visit http://www.ansto.gov.au/ainse/index.html

South Australia

Radioactive waste managed in South Australia includes both large quantities of uranium tailings and small quantities of radioactive waste in the form of sealed radioactive sources and unsealed radioactive wastes held by numerous owners including hospitals, universities, research organisations, industrial companies and government departments. Owners of radioactive waste are responsible for providing qualified staff and financial resources to enable appropriate controls and monitoring of radioactive wastes to effect compliance with the provisions of the *RPC Act* and its regulations.

Tasmania

Tasmania only comprises small users of radioisotopes or sealed sources and so compliance with requirements is not onerous. Environmental protection legislation also applies to industrial sites.

Victoria

While there is no facility within the meaning of the Joint Convention within Victoria, authorised practices that generate radioactive wastes are advised to access commercially available health physics support to assist with waste management.

Western Australia

The funding and staffing of facilities are left to the discretion of the registrants. The onus is on the registrant to do what is necessary to comply with legislative requirements.

Article 23 (Quality Assurance)

Australian Government

ARPANSA ensures that the spent fuel operations and radioactive waste management facilities of ANSTO are covered by the certification to ISO 9001. Validity of such certification is examined during regular regulatory compliance monitoring inspection. The procedures and arrangements for operating and maintaining these facilities are available in an appropriate quality format. The review and upgrading of arrangements for the safe operation of these facilities are performed in accordance with the ARPANSA regulatory requirements.

Australian Capital Territory

This issue is taken care of under the conditions placed on a licence holder (see earlier).

Northern Territory

Periodic audits and inspections by the Northern Territory government Radiation Safety Services are conducted. Under the new Act, this will be extended to audits based on a sound knowledge of radiation risk and quality assurance of procedures that are controlled by the licence holder. Periodic inspections and audits form part of the regime for mining operations.

Queensland

The responsible person is required to prepare a radiation safety and protection plan as part of the criteria for obtaining a licence. This plan must include details of the quality assurance programmes that are to be established and conducted by the responsible person.

Tasmania

Site visits by authorised officers are undertaken on a regular basis. In addition annual returns are required with licence renewals.

Auditing is conducted against licence conditions and will, in future, be conducted against radiation management plans.

Victoria

Victoria shall be examining options for increased surveillance of radioactive waste management.

Western Australia

For the Mt Walton East facility, conditions of registration require compliance with the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia (1992)* and *Quality Assurance for Radioactive Waste Packages*, IAEA Technical Reports Series No. 376, IAEA Vienna 1995.

Article 24 (Operational Radiation Protection)

Although there are nine jurisdictions for radiation protection regulation the same dose limits to workers and the public apply across all jurisdictions.

Australian Government

ARPANSA's Regulatory Branch assesses all licence applications against accepted standards for radiation protection and nuclear safety. The assessment and subsequent licensing recommendations (including non-statutory conditions of licence) are recorded in a report to the CEO of ARPANSA called the 'Regulatory Assessment Report'. All licences issued by the CEO are subject to the statutory conditions of licence, that is, the conditions mentioned either in the Act or Regulations. Licence conditions enforcing accepted standards in areas such as occupational exposure, disposal of radioactive waste and dose limits are found in Part 4, Division 4 and Part 5 of the Regulations.

Regulatory requirements mentioned above include a requirement that workers who receive radiation exposure are required to wear personal radiation monitors. Environmental monitoring in the vicinity of facilities ensures that doses to members of the public are below dose limits.

The following additional information is provided in relation to the policy and practices of the principal Australian government entity, the Australian Nuclear Science and Technology Organisation that possesses and operates radioactive waste and spent fuel facilities.

The ANSTO Health, Safety and Environment Policy contains principles that commit ANSTO to undertake its functions in a manner that protects human health and the environment and is consistent with national and international standards. ANSTO undertakes regular and continuous monitoring of staff and of all emissions from its functions. That monitoring shows that members of the public resident in areas surrounding the site receive less than 1% of the public dose limit of 1 mSv per year. Public health studies have confirmed that the operation of ANSTO's facilities has had no negative impact upon the health of nearby residents. Exposure limits for occupationally exposed workers are set under the *National Standard for Limiting Occupational Exposure to Ionising Radiation* [NOHSC: 1013 (1995)] (republished by ARPANSA 2002). The effective dose limit is 20 mSv per year, 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 1mSv to the foetus for the remainder of the pregnancy.

ANSTO has an internal ALARA trigger that requires investigations for annual worker doses greater than 2 mSv. The system of radiation protection employed is considered adequate for protection of the foetus prior to declaration of pregnancy so there are no special limits for women of child-bearing age. Occupationally exposed workers are routinely monitored for external exposure (and internal exposure if required). Comprehensive records are maintained.

In respect of spent fuel management facilities, dose constraints are imposed usually at one-third of the public dose limits i.e. 0.3 mSv per annum from any airborne or liquid discharge plus ALARA requirements (eg for ANSTO airborne discharges the ALARA objective is 0.02 mSv to a member of the public from all authorised airborne discharges).

Emissions from radioactive waste management facilities are regulated to levels set out in legislation or where this is not appropriate to specific licence conditions. Most radiation waste management facilities are storage facilities or the on-site near surface disposal facility.

Australian Capital Territory

Adherence to the national waste codes ensures these requirements.

Northern Territory

Due to the inactive status of the Northern Territory government's Interim Storage Facility (no new waste has been received since 1996), the operational radiation protection is limited to periodic audits and to maintaining security of the store. The storage facility wall thickness and location prevent hazardous emissions of radiation to the environment. The contents of the store are such that people outside the store receive a negligible exposure.

The Mt Todd Mine rehabilitation site in the Katherine region is not operational. It stores only the radiation gauges from the previous mining operation.

Queensland

Queensland has a purpose-built waste management facility. The regulatory authority operates the radiation waste management facility on behalf of the State. The foundation for the management of the Store is provided by two documents:

- The 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

(Agreement). This Agreement is the basis of understanding between the State and the Shire Council in relation to management and use of the facility.

- The *Operational Management Plan* (OMP). The OMP is a public document which identifies how the regulatory authority is to manage the operation of the Store. It establishes the operating procedures, contingency plans, maintenance requirements, training programs and auditing systems necessary to ensure that the facility is operated safely, consistent with current national and international radiation protection standards, legislative requirements and the Agreement. It also contains the remediation procedures that will be taken in the event of a radiation incident.

Through the Agreement, the State has given an undertaking to ensure that all necessary resources are provided to manage and, when necessary, decommission the facility.

It is also a requirement under the Agreement that an external audit be conducted once every two years. The Radiation Advisory Council appoints the persons who are to conduct this audit. The purpose of this audit is to provide an independent assessment of the extent to which the State is safeguarding the public health of all Queenslanders (including the persons involved in the operation of the facility) and ensuring openness and accountability in respect of the management of the radioactive waste store. The audit is required to review all actions of the regulatory authority in managing the Store as required by the OMP. The audit report is required to be provided to the Minister, and is a publicly available document.

South Australia

The Code of Practice & Safety Guide on *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* ARPANSA (2005) provides for a waste management program for the life of the particular operation and more short-term waste management programs for such periods as designated by the appropriate authority. These include programs for the decommissioning and rehabilitation of the mine, mill and associated waste management facilities.

The Code of Practice & Safety Guide on *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* ARPANSA (2005) can be applied to all phases of mining or milling operations as designated by the regulatory authority. The Radium Hill and Port Pirie sites that contain radioactive wastes from past mining and mineral processing practices are subject to the requirements of this Code. The sites are now registered premises under the RPC Act, and conditions of registration currently require site characterisation studies to aid the development of a Radioactive Waste Management Program.

Tasmania

Discharges must be in accordance with the requirements of the *Code of Practice for the Disposal of Radioactive Waste by the User* prior to approval. Waste generators are required to keep detailed records that are available for auditing.

Victoria

Authorised practices that generate radioactive wastes are advised to get commercially available health physics support to assist with waste management.

Article 25 (Emergency Preparedness)

Australian Government

A licence application in relation to a nuclear installation must include the following information:

- the applicant's plans and arrangements for maintaining effective control of the facility;
- the safety management plan for the controlled facility;
- the radiation protection plan for the controlled facility;
- the radioactive waste management plan for the controlled facility;
- the security plan for the controlled facility; and the emergency plan for the controlled facility.

ANSTO's *Response Plan for Accidents and Incidents at ANSTO/LHSTC,* developed in close consultation with the emergency services agencies, covers all possible events at the ANSTO facility, including spent fuel and radioactive waste management facilities.

ANSTO measures to prevent nuclear emergency situations include:

- plant design;
- operating procedures and limits;
- site safety culture;
- ARPANSA regulation;
- formal processes for approval of modifications or changes to procedures.

Australian Capital Territory

Due to the small scale of operations and small amounts of waste for storage, there are no specific emergency response plans related to the waste holdings.

Northern Territory

Emergency preparedness forms part of the overall emergency plan for the Royal Darwin Hospital site where the facility is located. Royal Darwin Hospital is staffed by experienced and well trained personnel.

Each radiation protection plan will include emergency response and this requirement will form part of proposed regulations.

Queensland

As previously stated, the Operational Management Plan (OMP) includes the remediation procedures that are required to be undertaken in the event of a radiation incident. The OMP requires that incident response exercises be conducted on an 'as needs' basis and at least once every two years. The exercises are to reinforce training topics and procedures during credible incidents. Any deficiencies identified by the exercises are recorded and appropriate action taken to rectify them.

South Australia

Apart from the facilities containing radioactive waste resulting from mining and mineral processing, most facilities where radioactive waste is stored contain no more than a few sealed sources or small volumes of unsealed low-level radioactive waste. A few hospitals and other government institutions, including the EPA have greater quantities of radioactive waste than the norm. While there is currently no specific legislative requirement, it is expected that each facility has on-site plans to deal with emergencies.

The locations of radioactive materials are made known to emergency services, principally the Fire Services that would activate the State's emergency response plan for incidents involving radioactive material. The frequency of testing these plans has been ad hoc in the past. Significant work and planning is currently being undertaken by South Australian State emergency responders (and also the Australian government) to deal with potential radiation incidents. This includes training of staff and allocation of resources.

Tasmania

Approved working rules and emergency procedures are currently required. There is no current requirement in radiation protection legislation for these plans to be exercised.

Victoria

Victoria has substantially increased efforts to deal with large scale radiation emergencies. The use of a model reference incident for response planning purposes is of a scale that can be applied directly to an emergency involving radioactive materials. Increased physical resources, by way of radiation monitoring equipment for the first responders (health, fire, police and ambulance agencies) and enhanced equipment and training for hospitals have placed Victoria at a well advanced stage of response preparedness to be able to deal with large-scale radiation emergencies. Large scale field exercises have been conducted involving all agencies, and resultant improvements post-exercise are being addressed by all agencies. Standard Operating Procedures are developed to enable first responders to know (a) their roles, functions and responsibilities, and (b) the roles, functions and responsibilities of other responding agencies.

Western Australia

Prior to a campaign burial at Mt Walton East, an emergency response/contingency plan is developed for the burial and forms part of the documentation requiring approval prior to site mobilisation.

Emergency response for all sites is part of Western Australia's standard Hazardous Material Management Plans. The coordinator for these plans is the State's Fire and Emergency Services Authority of Western Australia (FESA). FESA have a list of sites that contain significant amounts of radioactive substances and have 24 hour contact with the Radiation Health Branch.

Article 26 (Decommissioning)

Australian Government

The Australian government general regulatory framework and licensing process has already been described. In relation to dismantling projects, information concerning decommissioning is set out in Items 1-4, 20 (decommissioning plan) and 21 (decommission schedule) in Division 1, Part 4 of the Australian Radiation Protection and Nuclear Safety Regulations 1999[26].

Decommissioning was considered in the Preliminary Safety Analysis Report submitted with the licence application to construct the new OPAL Research Reactor, which includes a spent fuel facility. This included the choice of materials to minimise activation, space for access and minimisation of the radioactive waste that will be produced during commissioning. A preliminary decommissioning plan will be established during the construction of the reactor. The regulatory body, ARPANSA, must be satisfied that the applicant has plans and arrangements to satisfy decommissioning requirements before it will issue a licence to operate the replacement reactor and spent fuel facility.

ANSTO's 100 kW MOATA reactor was shut down and the fuel removed in 1995. ANSTO is undertaking a programme for the decommissioning of the MOATA nuclear research reactor. The 1999 MOATA Decommissioning Study identified options and a decision was taken to adopt a Long Term Storage option. The Decommissioning Study also identified ANSTO staff with relevant experience and identified similar reactors in other countries that have been or are planning to be dismantled. Stage I, including the removal of fuel and coolant from the reactor, has been completed. The main reactor structure is now in Stage II (Care and Maintenance) for a period presently estimated at 30 years. The MOATA facility is licensed by ARPANSA, and a qualified Facility Officer and Licensing Officer are nominated. Adequate financial provisions for the current stages of decommissioning are identified in ANSTO's budget. The reactor structure is enclosed and unauthorised access is prevented. The area is regularly surveyed for radiation. MOATA records, including reactor operation history, fuel irradiation records, radioactive inventory lists, manuals and drawings, are held in safe storage. The timing of dismantling will depend on many factors including: use of the reactor site; physical condition of facilities; status of radioactive materials; regulatory requirements; availability of a waste repository; overseas experience and cost estimates.

ANSTO's HIFAR reactor is scheduled to shut down in late 2006. Decommissioning planning is well advanced, and is currently expected to follow the pattern established for MOATA. However, the nomination of HIFAR for heritage listing may impact upon planning. The plans have yet to be submitted for consideration by ARPANSA. We will report in detail on this issue in our next national report.

Northern Territory

Decommissioning of the store will form part of the applicable radiation protection plan as required in the *Radiation Protection Act 2004*.

[26] The ARPANSA Regulations can be found at http://scaleplus.law.gov.au/html/pastereg/3/1509/top.htm

Queensland

While Queensland does not have decommissioning plans in place for its purpose-built waste store, it should be noted that the store is simply a store for sealed radioactive sources. Decommissioning the store will simply be a matter of relocating the sources, and checking for radioactive contamination. Contamination checks are already conducted as an on-going measure during the use of the facility. Any contamination discovered during these checks would be removed promptly.

South Australia

In the decommissioning of uranium mining facilities, it is expected that a mining or milling company will provide appropriate technical expertise and resources for this purpose. Provisions of the South Australia radiation protection legislation could be applied to require a company to provide appropriate resources and personnel for decommissioning. Under the *Mining Act 1971* a bond may be set by the Minister (to whom the Act is committed) to recover costs of rehabilitation of mining sites. At present the Beverley uranium project is subject to a bond that is revised periodically. The bond is set at a level to cover the estimated cost for rehabilitation of the mine and milling site to current standards. In the case of the Olympic Dam project the *Roxby Downs (Indenture Ratification) Act 1982* (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.

Victoria

Victoria has no facilities within the meaning of the Joint Convention.

Western Australia

Western Australia do not have decommissioning plans in place for their purpose-built facilities. There is provision for decommissioning plans to be developed when the need arises.

G SAFETY OF SPENT FUEL MANAGEMENT

Article 4 (General safety requirements) *- Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards. In so doing, each Contracting Party shall take the appropriate steps to:*

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

(iii) take into account interdependencies among the different steps in spent fuel management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

Article 5 (Existing facilities) *- Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.*

Article 6 (Siting of proposed facilities)

(1) Each Contracting Party shall take the appropriate steps to ensure that procedures are established for a proposed spent fuel management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

(2) In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4

Article 7 (Design and construction of facilities) *- Each Contracting Party shall take appropriate steps to ensure that:*

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

Article 8 (Assessment of safety facilities) *- Each Contracting Party shall take the appropriate steps to ensure that:*

(i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

Article 9 (Operation of facilities) *- Each Contracting Party shall take the appropriate steps to ensure that:*

(i) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

(v) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vi) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

Article 10 (Disposal of spent fuel) *– If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.*

Within the Australian government, none of the states or territories has responsibility for the management of spent fuel. Thus this Section is only applicable to the Australian government, which has jurisdiction over management of spent nuclear fuel.

ANSTO possesses the only facilities in Australia for managing spent fuel, as all the spent fuel produced in Australia comes from research reactors once operated, or currently operated, by ANSTO,. The relevant regulatory authority, ARPANSA, has issued an operating licence to ANSTO for their spent fuel management facilities. A condition of licence is that the safety of these facilities must conform with ARPANSA's Regulatory Assessment Principles[27], which specify how individuals, society and the environment are to be protected against radiological hazards.

At ANSTO spent fuel is stored in several wet-store facilities for various periods after discharge from the reactor. One large dry store is also used for the interim storage of spent fuel prior to further handling, such as transport offshore for long-term storage or reprocessing, depending on its destination. See Appendix A for further detail.

As noted above, the spent fuel management facilities for OPAL form part of the reactor facility. As such, their compliance with the requirements of Chapter 2 of the Convention has been examined in detail as part of the consideration of applications to site, design and construct and operate the facility.

Article 4 (General safety requirements)

ARPANSA requires that facilities for the storage of spent fuel at ANSTO adequately address criticality and heat generation issues as part of their licence conditions. Both the wet and dry storage facilities currently in use for spent fuel adequately address criticality as well as the removal of any decay heat generated during the storage period. The generation of radioactive waste from spent fuel storage is kept to a minimum and consists largely of water filters and ion-exchange resins. The spent fuel handling equipment takes into account the interdependencies among the different steps in spent fuel management.

ARPANSA's Commonwealth nuclear safety legislation, the *Australian Radiation Protection and Nuclear Safety Act 1998*, accompanying regulations and subsidiary regulatory documents, such as ARPANSA's Regulatory Assessment Principles, provide for effective protection of individuals, society and the environment. These are based on internationally endorsed criteria and standards. The existing spent fuel management facilities will cease to be used within the next few years.

'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. For example, the CEO of ARPANSA must consider:

(i) whether the information establishes that the proposed conduct can be carried out without undue risk to the health and safety of people, and to the environment; and

(ii) whether the applicant has shown that there is a net benefit from carrying out the conduct relating to the controlled facility; and

[27] ARPANSA, *Regulatory Assessment Principles for Controlled Facilities*, Commonwealth of Australia, 2001.

(iii) whether the applicant has shown that the magnitude of individual doses, the number of people exposed, and the likelihood that exposure will happen, are as low as reasonably achievable, having regard to economic and social factors.

Results of inspections conducted by ARPANSA indicate that licence holders, in most instances, met licence conditions thereby achieving outcomes that are consistent with international best practice.

Article 5 (Existing facilities)

Australian government legislation and ARPANSA's licensing system require that appropriate steps be taken to review the safety of any existing spent fuel management facility and ensure that all reasonably practical improvements are made to upgrade facility safety. As part of its regulatory activities, ARPANSA routinely inspects the Fuel Management facilities at ANSTO. In addition, the safety of these facilities is reviewed through ANSTO's internal review processes including inspections, evaluation of performance and criticality certification systems.

Article 6 (Siting of proposed facilities)

The Australian government is the only jurisdiction with facilities related to the nuclear fuel cycle (aside from uranium mines).

In accordance with Regulation 40, under the Australian Radiation Protection and Nuclear Safety Regulations 1999, the Australian government regulatory body, the Australian Radiation Protection and Nuclear Safety Agency, is required to invite public submissions on any application involving a nuclear installation. Paragraph 41(3)(g) of the Regulations requires ARPANSA to take into account the content of any public submissions in deciding whether or not to issue a licence. In the past, public submissions have been invited as part of the assessing the application for a licence to construct the Australian Nuclear Science and Technology Organisation's OPAL research reactor[28].

Australian government legislation and ARPANSA's licensing system require that, for any proposed facility, an environmental assessment is undertaken and information on the safety of the facility is made available for public scrutiny. As noted above, the safety of OPAL's spent fuel management facilities was subject to examination during the siting licence process.

Article 7 (Design and construction of facilities)

Australian government legislation and ARPANSA's licensing system require that 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. In addition, at the design stage, plans and other provisions for decommissioning of a facility are to be developed. The technologies incorporated in the design and construction of a spent fuel management facility must be supported by experience, testing and analysis.

[28] Information about the submission process and a copy of the public consultation report can be found at http://www.arpansa.gov.au/rrrp.htm

Article 8 (Assessment of safety of facilities)

Australian government legislation and ARPANSA's licensing system require that, before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility, and covering its operating lifetime, must be carried out. Before operation of a spent fuel management facility, updated and detailed versions of the safety and environmental assessments must be prepared. As noted above, the safety and environmental impact of OPAL's spent fuel management facilities was subject to examination during the construction licence process, and is being examined again as part of the current consideration of ANSTO's application for an operating licence for OPAL[29,30].

Article 9 (Operation of facilities)

Australian government legislation and ARPANSA's licensing system require that the grant of a licence to operate is based on appropriate 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. Operation, maintenance, monitoring and inspection 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. Collection and analysis of relevant operating experience is required and the results must be acted upon, where appropriate. Decommissioning plans must be prepared, and updated, by means of information obtained during the operating life of the spent fuel management facility. Such plans are subject to review by the regulatory authority. As noted above, the issues surrounding the operation of OPAL's spent fuel management facilities are currently being examined as part of the consideration of ANSTO's application for an operating licence for OPAL and will be subject to ANSTO's ongoing internal review processes.

Article 10 (Disposal of spent fuel)

Australian government legislation and ARPANSA's licensing system require that where spent fuel has been designated for disposal, it will be handled as radioactive waste from the point in the nuclear fuel cycle where it is no longer regarded as spent fuel. Currently it is anticipated that all spent fuel managed in Australia by ANSTO will be transported overseas for either reprocessing or long-term storage and/or disposal, and thus will be regarded as spent fuel until it enters the off-shore jurisdiction.

The fuel elements are held in the dry store pending shipment abroad. In preparation for a shipment, fuel elements are transferred to a cooling pond for loading into an irradiated fuel

[29] For information on the licensing action undertaken under the *Australian Radiation Protection and Nuclear Safety Act 1998* please visit http://www.arpansa.gov.au/rrrp.htm

[30] For information on the separate environmental impact assessment carried out under the *Environment Protection and Biodiversity Conservation Act 1999* please visit http://www.ea.gov.au/epbc/index.html and, for a copy of the assessment, please visit http://www.ea.gov.au/assessments/epip/notifications/lucas/pubs/assessmentreport.doc

transport cask underwater. There is no intention to leave the fuel in dry store indefinitely. All spent fuel will be sent abroad in planned shipments to the USA and France.

The Australian Nuclear Science and Technology Organisation has a long-term contract with COGEMA, France for the reprocessing of fuel from research reactors, including the research reactor under construction. Waste from spent fuel sent to France for reprocessing will be returned to Australia as category S waste, equivalent to the IAEA classification of long-lived intermediate-level waste. The contract for spent fuel sent to COGEMA specifies the return of waste from the basic quantity of fuel (1304 fuel elements) by the end of 2015. The waste from spent fuel sent to Dounreay, UK will be returned in the period 2011-2022.

ANSTO also returns US-origin fuel to the USA under the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program. No waste sent to the USA for reprocessing will be returned to Australia.

H SAFETY OF RADIOACTIVE WASTE MANAGEMENT

***Article 11 (General Safety Requirements**): Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards. In doing so, each Contracting Party shall take the appropriate steps to:*

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(ii) ensure that the generation of radioactive waste is kept to the minimum practicable;

(iii) take into account interdependencies among the different steps in radioactive waste management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

***Article 12 (Existing facilities and past practices**): Each Contracting Party shall in due course take the appropriate steps to review:*

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

***Article 13 (Siting of proposed facilities**)*

(1) Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

(iii) to make information on the safety of such a facility available to members of the public;

(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

(2) In so doing each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

***Article 14 (Design and construction of facilities**): Each Contracting Party shall take the appropriate steps to ensure that:*

(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

***Article 15 (Assessment of safety facilities**): Each Contracting Party shall take the appropriate steps to ensure that:*

(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

***Article 16 (Operation of facilities**): Each Contracting Party shall take the appropriate steps to ensure that:*

(i) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and segregation of radioactive waste are applied;

(vi) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vii) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

***Article 17 (Institutional measures after closure**): Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:*

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

Article 11 (General Safety Requirements)

There are no uniform definitions of waste categories across Australian jurisdictions. The *Code Of Practice For The Disposal Or Radioactive Wastes By The User* (1985) and the *Code Of Practice For The Near Surface Disposal Of Radioactive Waste In Australia* (1992) of the Radiation Health Series of the National Health & Medical Research Council have been adopted by various jurisdictions in Australia. Between them these codes define waste that can be disposed of at urban landfill and therefore what needs to go to a near surface disposal facility. The Near Surface Disposal Code defines three categories of waste that can be disposed of by near surface disposal:

- Lightly contaminated items such as protective clothing, laboratory equipment, plastic etc.;
- Shielded sources and small items of contaminated equipment; and
- Bulk materials such as contaminated soils or large individual items of contaminated plant.

Waste that is unsuitable for near surface disposal must be stored pending deep geological disposal or disposal following a suitable period of decay.

Discharge of radioactive waste to the air or sewer usually takes place as part of an on-line operation such as in the preparation and dispensing of radionuclides. Once material has been collected and classified as radioactive waste it is rarely disposed of by this method.

The regulatory requirements vary between jurisdictions. In some jurisdictions discharge limits for airborne and waterborne radionuclides are given in schedules in regulations; in other jurisdictions specific conditions of licence are used to regulate these emissions. The schedules are usually based on the criteria that the dose to any member of the public at the point of discharge should not exceed the dose limit for members of the public. Some of the regulations, however, predate the ICRP 60 recommendations, which were adopted in Australia in 1995, and the ICRP Lung Model described in ICRP 66, and as such are not current with respect to current dose conversion factors and public dose limits.

A *Code of Practice for Disposal of Radioactive Wastes by the User* was promulgated by the National Health and Medical Research Council of Australia in 1985 and is used as guidance by all jurisdictions for disposal by air, water, landfill and by incineration. Recommendations are given for radionuclide activities for disposal by landfill. Incineration is not commonly used in Australia and is usually reserved for biological waste, such as animal carcases contaminated to low levels with radionuclides of low radio-toxicity. Little radioactive residue is usually left in the ash, which is monitored and disposed of according to licence conditions[31].

The legislative systems in place in Australia, described in *Section E: Legislative and Regulatory System*, underpin the process of minimizing the risk of harm to individuals, society and the environment from exposures to ionizing radiation that result from the management of radioactive waste. These systems are based on the documents *Recommendations for Limiting Exposure to Ionizing Radiation* and the *National Standard for Limiting Occupational Exposure to Ionizing Radiation (ARPANSA, 1995 - republished 2002).*

Protection from non-radiological hazards is included in the process for ensuring the safety of radioactive waste management.

Details of the processes by which the generation of radioactive waste is minimized are to be supplied by the licensee in their plan for operation of the practice generating waste.

[31] A copy of the Code is available at http://www.arpansa.gov.au/pubs/rhs/rhs13.pdf

Each jurisdiction's legislation relating to the safety requirements for the management of radioactive waste are based on the national standards, codes of practice and safety guides which in turn are consistent with internationally endorsed criteria and standards.

Radioactive waste of sufficiently low-level is currently discharged into the air or sewer, incinerated, or disposed of as landfill. The national guideline for the disposal of such wastes is the *Code of Practice for the Disposal of Radioactive Wastes by the User* (NHMRC, 1985), which is currently under revision. Waste disposal via these methods is controlled by the regulatory authority in the jurisdiction in which the waste is produced.

Australian Government

As part of its regulatory activities, ARPANSA licenses and routinely inspects the Waste Management operations at ANSTO. In addition, the safety of these facilities is reviewed through ANSTO's internal review processes including inspections, evaluation of performance and criticality certification systems.

Waste minimisation practices currently in place at ANSTO include segregation of wastes at the source (radioactive from non-radioactive) to reduce the potential for cross-contamination and to separate short-lived from long-lived waste, waste exemption process to allow for free-release of exempt level waste and the separation of short-lived from long-lived wastes to allow for delay and decay.

In addition to complying with exemption limits specified in the *Australian Radiation Protection and Nuclear Safety Regulations 1999* and the *Radiation Control Regulation 2003 (NSW)*, ANSTO has adopted the more restrictive free release limits specified in IAEA Safety Standards Series RS-G-1.7, *Application of the Concepts of Exclusion, Exemption and Clearance* as the primary criteria for exemption and clearance of all of its bulk waste.

'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.

Results of inspections conducted by ARPANSA indicate that licence holders, in most instances, met licence conditions thereby achieving outcomes that are consistent with international best practice.

Australian Capital Territory

This Article is applicable in the Australian Capital Territory to the extent dictated by the negligible amount of the wastes produced and their low-level nature and characteristics.

Northern Territory

A radiation protection plan will be required for each operator as stated in Section F. The plan will cover means to limit the production of waste for all aspects of a practice.

Interim storage facilities controlled by the Northern Territory government are not operational and the content has not changed.

Queensland

In Queensland, there are regulatory processes in place to ensure that a responsible person had adequate measures in place before the person acquires a radioactive source. This includes ensuring that the person has an appropriate facility to store the radioactive sources and measures in place to relocate or dispose of the radioactive source when it is no longer required. This requirement should assist in ensuring that any impact on future generations is minimised.

The vast majority of radioactive wastes in Queensland's Radioactive Waste Store, as a direct result of implementing its regulatory processes, is legacy waste. Consequently, the inventory is not likely to increase.

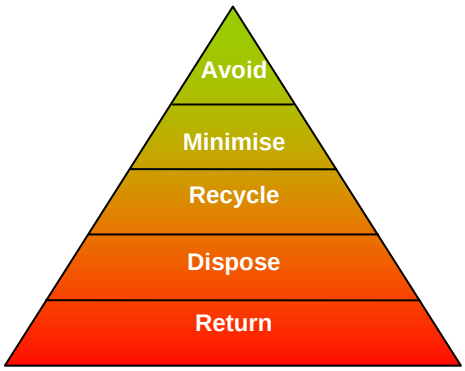
South Australia

While compliance in South Australia with the general safety requirements of Article 11 of the Joint Convention is satisfied by enforcement of the *RPC Act* and regulations under the Act, the safety of radioactive waste management is under review.

As previously noted, VLLRW is currently disposed of in South Australia via methods including discharge through the sewer, incineration and fume hoods. Landfill burial is currently not possible due to conditions on licences issued to these facilities under the *Environment Protection Act 1993* which ban the acceptance of radioactive waste. The EPA is working toward a resolution of this issue. Organisations that generate VLLRW are required to submit annual waste disposal plans to the EPA for assessment and approval.

The EPA completed a comprehensive audit of the storage and management of radioactive material in South Australia in September 2003. The report on the audit contained recommendations for improvements in the storage and management of radioactive waste. Many of the recommendations related to the safe storage and containment of radioactive material and are being addressed in the normal course of regulatory operations. To address recommendations on the management of waste that is currently being stored by its owners, excluding mining wastes, the Government of requested the EPA to conduct a feasibility study into interim storage and disposal of low-level waste. This study has been completed and the EPA proposes to follow-up on the recommendations, subject to endorsement by Government.

With regard to Article 11(ii) and (vii), it was previously noted in Section B, that the EPA is developing a strategy for the sustainable management of radioactive waste in the State. Key elements of the strategy are to ensure the burden on future generations is not greater than currently is the case, and to promote the minimisation of radioactive waste. It is proposed that minimisation can be achieved through employing a *hierarchy for radioactive waste minimisation* which has the preferred controls at the top as outlined below.



Avoid

- Investigate alternatives to radioactive sources and demonstrate overall net benefit of using radioactive materials.
- Include the risks and detriments of alternatives and of not using radioactive materials, social and economic benefits should be taken into account when assessing the justification.

Minimise

- Use the smallest, fewest, lowest category, shortest half life, most easily conditioned/packaged sources that are suitable for purpose.

Recycle

- Query whether existing sources could be recalibrated or refurbished, or whether 'pre-owned' sources can be obtained from within the organisation or from other organisations.

Return

- Establish a return arrangement with the supplier. This should be done when the source is purchased.

Disposal

- The disposal plan / route should be identified when a source is obtained.

Tasmania

Return of sealed sources to the supplier is now a condition on the purchase of sealed sources. Also, sealed sources are to be disposed of (via return to supplier if possible) as soon as is practicable. This avoids any issues with stored items in the future. There is no mechanism for disposal for much of the legacy waste, e.g. radium needles and these are stored safely for the present. Longer term arrangements will be reviewed once a complete audit of waste has been conducted.

Victoria

Victoria applies the optimisation principle when assessing applications for the conduct of radiation practices that will generate radioactive wastes. Practices are only approved when the proposed practice involving the use of radioactive material has demonstrated that the amount of radioactive material used is the minimum required to achieve the benefits of the practice.

Victoria is planning to conduct an audit of wastes presently held in interim storage to ensure full knowledge of the status of radioactive waste management. Once this information is available it can inform options for future management of such wastes.

Western Australia

The site for the Mt Walton East facility was chosen based on criteria detailed in the report *Site Investigations for Repositories for Solid Radioactive Waste in Shallow Ground, Technical Report Series No 216, International Atomic Energy Agency (1982)*. The site met such requirements as:

- An arid climate
- No ground water or a deep ground water table, where the groundwater is not suitable for human consumption
- The geology which retards radionuclide migration
- A simple geologic structure to permit modelling of groundwater and radionuclide migrating patterns if required
- Suitable geotechnical properties
- An area free from flooding
- An area with a slow rate of erosion
- No potentially valuable mineral deposits
- A topography suitable for easy movement of heavy machinery
- An area of low population
- No potential for agriculture
- No special attractive environmental features
- No known rare species of flora and fauna or restricted ecosystems
- No special cultural or historical significance
- A convenient distance from a major highway/railway siding or shipping terminal and not too remote from a population centre with accommodation, workshops and supplies.

All aspects of the design, operational requirements, duties and responsibilities must comply with the Radiation Safety (General) Regulations and the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (1992).

As the waste in Western Australia is disposed of, this minimises the risk for the potential for orphan sources for future generations.

Article 12 (Existing facilities and past practices)

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 this review of safety reveal that a facility requires upgrading, then licence conditions may be amended to instigate facility improvements.

Australian Government

From 1960 to 1968, ANSTO operated a near-surface disposal site for radioactive waste (Little Forest Burial Ground) near the boundary of the site. Since closure in 1968, this site has been continuously under care and maintenance, inspection and monitoring. Monitoring results continue to demonstrate the adequacy of the facility; however, its eventual decommissioning is being considered as part of the overall decommissioning strategy for the ANSTO facilities and operations. Monitoring results are provided to ARPANSA and published annually.

Australia has taken the term 'past practices' in the Joint Convention to refer to radioactive waste management facilities that did not exist or were not under general regulatory control at the time the Joint Convention entered into force on 18 June 2001. In this regard, Australia has identified the site known as the British Atomic Weapons Test Site at Maralinga[32] in South Australia as a past practice.

Australian Capital Territory

This Article is not applicable to the Australian Capital Territory.

Northern Territory

There is one operating uranium mine in the Northern Territory. Regulatory control of radioactive waste from this mine is carried out by the Department of Primary Industries, Fisheries and Mines (DPIFM). Storage of waste forms part of the authorisation to operate this mine. The *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores* (1982) continues to form part of general requirements to operate for the existing uranium mine.

A number of abandoned uranium mines are within the jurisdiction of the Australian government Department of Environment and Heritage.

Queensland

In Queensland, legislation allows for the issuing of Improvement Notices or Prohibition Notices by inspectors appointed under the Act to require any deficient radiation safety matters to be addressed.

A proposal to remediate and permanently close the uranium mine at Mt Ben Lomond has been made.

South Australia

There are three main sites in South Australia containing radioactive wastes from past practices. These are the Maralinga lands (the site of former British nuclear tests) that are currently owned by the Australian government and under Australian government jurisdiction, and the former Radium Hill Uranium Mine and Port Pirie Treatment Plant sites that are under

[32] Further information on the regulatory oversight and rehabilitation of Maralinga can be found at http://www.arpansa.gov.au/licon.htm

South Australian jurisdiction and owned by the South Australian Department of Primary Industries and Resources.

Tasmania

There are no uranium mines in Tasmania. Places where radioactive materials are used or stored are required to meet specific standards, specified in the regulations.

Western Australia

All radiation monitoring for the Mt Walton East disposal facility is carried out in accordance with the commitments given in:

(i) *The Monitoring Program (December 1991)*, as approved at the 78th meeting of the Radiological Council and as amended from time to time;

(ii) *The Packaging Procedures (January 1992)*, as approved at the 79th meeting of the Radiological Council.

The monitoring is undertaken by an approved Radiation Safety Officer (RSO) who has qualifications and experience in health physics. The RSO reports in writing to the Radiological Council the results of monitoring and other factors relating to radiation health after any site changes, including the receipt of material for disposal and sealing of the storage chamber. This monitoring includes, absorbed dose rates in air above the disposal sites, radon monitoring, water monitoring (although there has been an absence of sufficient water to measure to date) and pre and post disposal monitoring (as above). Personnel monitoring is carried out during a disposal campaign.

In Western Australia, legislation also allows inspectors to issue directions for any deficient radiation safety matters to be addressed.

Uranium has not been mined in Western Australia.

Article 13 (Siting of proposed facilities)

For radioactive waste management facilities where a significant potential risk of harm exists, an environmental impact assessment/statement may be required. There is a separate national regulatory framework[33] for environment protection established under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which is binding on all jurisdictions. The actions taken that might affect the environment include nuclear actions (as defined in this Act). If a person has referred a proposed nuclear action to the Australian government Minister for Environment and Heritage, and the Minister has decided that the proposed action requires approval, an environmental assessment must be carried out. Environmental impact assessments/statements are released for public comment as part of the public consultation process.

The purpose of an environmental assessment is to bring together all the information on the impacts that a proposed action would have on matters protected by the EPBC Act, to ensure

[33] Further information on this framework is available at http://www.ea.gov.au/epbc/index.html

that the Minister makes an informed decision on whether or not to approve the action. As indicated above, the regulatory framework established under the Act is distinct from that established under the *Australian Radiation Protection and Nuclear Safety Act 1998* in that the former is limited to assessing and authorising the impact of an action on the environment (the latter covers people **and** the environment).

Proposed radioactive waste management facilities require approval for siting according to the legislative and regulatory systems of the jurisdiction in which the facility is to be located. Legislative requirements in the selection of a site for a proposed facility are based on the national *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (NHMRC, 1992). This code of practice details the general characteristics of a site suitable for the establishment of a radioactive waste management facility, the criteria for site-selection and the need for a public consultation process.

As indicated in Annex B, ANSTO has a large radioactive waste management facility. Although that facility has been in operation for many years, new components are subject to separate environmental impact and regulatory processes. For example, the waste treatment and packaging facility was subject to environmental impact assessment under the *Environment Protection and Biodiversity Conservation Act 1999* and to safety assessment processes under the *Australian Radiation Protection and Nuclear Safety Act 1998*.

Australian Capital Territory

Article 13 is not currently applicable, but would be addressed if the construction of such a facility in the Australian Capital Territory were to be considered.

Northern Territory

Interim storage facilities are located in the Northern Territory at Royal Darwin Hospital and in a secure location at the Mt Todd Mine rehabilitation site near Katherine. Both sites are actively supervised by employees of the Northern Territory government. The interim storage facility at Royal Darwin Hospital is permanently lit and well separated from all hospital facilities. A permanent police presence is stationed at the Hospital.

Under the present authorisation, uranium-mining operators in the Northern Territory are committed to comply with the *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores*. (Commonwealth of Australia, 1982)[34] for all phases of mining and milling activities.

South Australia

Conditions attached to a licence to mine or mill radioactive ores issued under the *RPC Act*, require uranium mining operators to comply with the requirements of the Code of Practice & Safety Guide on *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* ,ARPANSA (2005) The requirements of the Code and the associated Radioactive Waste Management Program, apply to all phases of mining and milling activities including construction, operation, decommissioning and rehabilitation.

[34] ARPANSA publication RPS 9 (2005) has recently replaced the 1982 Mining and Milling Code.

Information on the safety of mining and milling waste management facilities may be obtained through publicly available operator annual reports on environmental management programs, government agency web sites listing incidents of environmental significance, or through Freedom Of Information requests to government agencies.

Tasmania

There are no current plans for major waste management facilities in Tasmania.

Victoria

Victoria does not have any waste management facilities within the meaning of the Convention.

If there were a proposal to have a radioactive waste management facility in Victoria, the Secretary to the Department of Human Services (Vic) would take the appropriate steps consistent with this Convention.

In so doing Victoria would take the appropriate steps to ensure that such facilities will not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

Western Australia

There are no new radioactive waste management facilities currently proposed for Western Australia.

Article 14 (Design and construction of facilities)

The design and construction of a radioactive waste management facility are examined as part of the licensing process for the jurisdiction in which the facility is to be located. For a proposed facility, all design and construction-related, legislated, technical and safety requirements need to be met. Under the legislative system, conditions can be imposed to require, for instance, the use of 'best practicable technology' and the preparation of technical provisions for the closure of the facility. As indicated above, ANSTO facilities are subject to licensing processes under the *Australian Radiation Protection and Nuclear Safety Act 1998* at the time of design and construction.

Australian Capital Territory

Article 14 is not currently applicable, but would be addressed if the construction of such a facility in the Australian Capital Territory were to be considered.

Queensland

In Queensland, any disposal of radioactive waste, including discharge, must comply with the requirements detailed in the *Radiation Safety Act 1999*. The Act requires that a person must not dispose of radioactive material unless the activity concentration is not more than an amount prescribed in the *Radiation Safety Regulation 1999*, or unless a specific approval for disposal has been granted by the chief executive of Queensland Health.

If a person wished to construct a radiation waste management facility, the person responsible for the proposed facility would need to demonstrate that its design and construction would meet Queensland's regulatory requirements, as well as those of the Commonwealth EPBC Act.

South Australia

With regard to Article 14(i) all radioactive discharges to the environment are subject to controls under the *RPC Act*. Discharges of radioactive waste require approval of the EPA. The EPA requires facilities to be conform with requirements consistent with those of this Article.

In the regulation of uranium mining operations, the Code of Practice & Safety Guide on *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* ARPANSA (2005), requires the use of 'best practicable technology' as part of the 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 of the associated mining and milling operations.

Tasmania

There are no major waste management facilities in Tasmania but both radiation protection and environmental legislation would be invoked should one be proposed.

Victoria

There are no facilities within the meaning of the Joint Convention within Victoria.

The controlled discharge of wastes to the environment must comply with the requirements of the *Health Act 1958* and *Health (Radiation Safety) Regulations 1994*. The legislation contains both public radiation dose limits and specific discharge limits for disposal to air and water. Regulatory practice is such that all proposed disposals are confirmed to be less than 10 µSv per annum for a member of the public with respect to the most restrictive scenario concerning the critical group. Different critical groups may be assessed for different pathways in relation to any proposed discharge. Material which has been held until it is below regulatory concern (ie not, in law, radioactive) can be discharged provided the requirements of other relevant waste control legislation is met. Improvements by way of consistent definitions for radioactive materials are being delivered via the new *Radiation Act 2005*, which adopts the IAEA BSS 115 definitions.

Western Australia

The safety of the Mt Walton East Intractable Waste Disposal Facility is assessed regularly, as required by the conditions of registration, in particular the requirements for a technical auditor and the ongoing requirement for monitoring. Before the Mt Walton East facility was selected, extensive testing of the site was carried out to determine its suitability against the criteria listed in the report *Site Investigations for Repositories for Solid Radioactive Waste in Shallow Ground, Technical Report Series No 216, International Atomic Energy Agency (1982).* The Mt Walton East site met all of the specified criteria. Regular monitoring of the site is continuing as are regular technical audits of the entire operation. The conditions of

registration for the site also require compliance with the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia (NHMRC, 1992).*

The Regulations dictate the requirements for stores containing radioactive substances. The compliance of the Radiation Health Branch store is assessed through an independent, qualified Radiation Safety Officer. Further information on the construction of the facilities in Western Australia is provided (see Annex B).

Article 15 (Assessment of safety of facilities)

Australian Government

As part of legislative and regulatory requirements, an assessment of safety and environmental impact of a proposed radioactive waste management facility is required for approval before construction of the facility can commence. If deemed necessary by the appropriate regulatory authority the assessment of safety and environmental impact may be reviewed and updated prior to the operation of the facility. As indicated earlier, ANSTO facilities are subject to licensing processes under the *Australian Radiation Protection and Nuclear Safety Act 1998* and to internal safety review in accordance with the requirements of the ANSTO safety system.

Australian Capital Territory

Article 15 is not currently applicable, but would be addressed if such a facility was operating in the Australian Capital Territory.

Queensland

Security of such a facility will be considered in addition to safety matters from now on. However, there are no changes to Queensland's approval processes, per se.

Tasmania

New radiation protection legislation has enhanced powers of inspection compared with the current Radiation Control Act. All places where radioactive materials are to be stored or used require registration under the proposed legislation. A radiation management plan is required for all practices under the proposed legislation.

Victoria

There are no facilities within the meaning of the Joint Convention within Victoria.

Western Australia

There are no new radioactive waste management facilities currently proposed for Western Australia; no changes have been made to the radiological approval process.

Article 16 (Operation of facilities)

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 source of radiation, loss or theft of a source of radiation, contamination by a

radioactive substance, unintentional or accidental release of a radioactive substance, and corrective actions taken.

Uranium mines and production facilities are required to submit a mine management plan or equivalent addressing all facets of mine management including decommissioning and site rehabilitation. The facility owner is required to provide a bank guarantee or cash deposit before authorisation is given to operate the facilities. In the instance of Ranger, an open-cut uranium mine in the Northern Territory, the owner has deposited AUD$30m with the Northern Territory regulator.

There are former uranium mining facilities at Rum Jungle and Nabarlek (Northern Territory), Radium Hill (South Australia), and Mary Kathleen (Queensland). Each are decommissioned and the site rehabilitated to the extent possible at the time – Nabarlek has been fully rehabilitated.

Australian Government

A licence to operate a radioactive waste management facility is required prior to operation of such a facility. The regulatory authority would not grant the licence until, amongst other requirements, it had been demonstrated that the facility meets the requirements for design and construction, and an assessment of safety and environmental impact had been made for the proposed facility. Additional licence conditions can be imposed as required. For instance, conditions could 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 *Australian Radiation Protection and Nuclear Safety Act 1998* and to internal safety review in accordance with the requirements of the ANSTO safety system. Those processes take into account the factors addressed in this Article.

A licence holder under the *Australian Radiation Protection and Nuclear Safety Act 1998* must comply with the following statutory conditions set out in the Regulations to the Act:

(i) 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 of ARPANSA about the breach as soon as reasonably practicable.

(ii) The licence holder must take all reasonably 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 reasonably 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.

In accordance with Regulation 63, ARPANSA has published guidelines on how licence holders will report their compliance with the Act, the Regulations and licence conditions.

In accordance with the Act and Regulations, past incidents have been reported[35] to the Parliament in ARPANSA's quarterly reports.

[35] These reports are available on the web at http://www.arpansa.gov.au/qtrlyrpts.htm

Australian Capital Territory

This Article is not currently applicable, but would be addressed if such a facility were operating in the Australian Capital Territory.

Queensland

Queensland's *Radiation Safety Act 1999* establishes a legislative framework within which compliance monitoring, and investigative and enforcement activities, may be undertaken.

The regulatory authority conducts a risk based routine program of radiation safety monitoring to assess a person's compliance with the legislation and their level of radiation safety. These monitoring activities may lead directly to investigations and inspections and consequent enforcement activities when breaches of the Radiation Safety Act 1999 have been identified.

Inspections and investigations are formal regulatory functions which may only be conducted by an inspector appointed under the Act. The regulatory authority has a number of Inspectors appointed under the Act. Inspectors also have a number of powers prescribed under the Act, e.g. issue of prohibition notices and improvement notices, seizure of radiation sources and the ability to take emergency actions.

Tasmania

Both radiation and environmental protection legislation allow for site audits should a radioactive waste management facility be operated in Tasmania.

Victoria

There are no facilities within the meaning of the Joint Convention within Victoria.

Western Australia

There are no new radioactive waste management facilities currently proposed for Western Australia. The safety of the Mt Walton East Intractable Waste Disposal Facility is assessed regularly, as required by the conditions of registration, in particular the requirements for a technical auditor and the ongoing requirement for monitoring. The safety of the Radiation Health Branch store is assessed by a Radiation Safety Officer, independent of the Branch.

In Western Australia, appropriate safety measures must be outlined in the radiation management plan.

Article 17 (Institutional measures after closure)

After closure of a radioactive waste repository the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia (1992)* requires that the operator maintain the security of the site and restrict access and also ensure a program of surveillance involving site inspections and environmental monitoring. This is required during the institutional control period, which might last up to 200 years. The institutional control period can only end with the approval of the appropriate authority. After this time no further controls are required.

Apart from the above there are no generalised regulatory guidelines. Licence conditions may be imposed in certain instances. For example, licence conditions requiring post-closure

environmental monitoring were imposed in the licence to authorise rehabilitation of the Maralinga atomic weapons test site[36].

The relevant regulatory body requires preservation of records of the location, design and inventory of radioactive waste management facilities in their jurisdiction. Post-closure recommendations are detailed in the national *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (NHMRC, 1992)[37]. These recommendations address site rehabilitation and security, and the need for an appropriate environmental monitoring program. All jurisdictions base their post-closure requirements on these recommendations.

Australian Government

As discussed under Article 12 above, ANSTO has one closed facility (Little Forest Burial Ground) that was used for disposal of radioactive material between 1960 and 1968. This facility is secure and is routinely monitored for ground waters and airborne and surface contamination. The results are publicly available in the annual ANSTO Environmental and Effluent Monitoring report.

Northern Territory

Under the *Radiation Protection Act 2004*, registration is an authorization to occupy a radiation place. Conditions will be placed on registration of any waste facility to provide for the post operational period of all facilities. Further details will be required in all applicable radiation protection plans. Record preservation will form part of the conditions of an authorization under the *Radiation Protection Act 2004.*

Queensland

In Queensland, radioactivity is recognised as a *"hazardous contaminant"*, and land contaminated by radioactive materials is regulated under the *Environmental Protection Act 1994*. The details of land affected by elevated levels of radioactivity are recorded on the Environmental Protection Agency's Contaminated Land Register or its Environmental Management Register depending on the public health risk. Radiation Health, Queensland's radiation regulator, undertakes these functions under a Memorandum of Understanding.

Additionally, the *Radiation Safety Act 1999* imposes significant penalties on any breaches to the radioactive material disposal requirements prescribed in the Act.

South Australia

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 EPA and the owner of the sites, the SA Department of Primary Industries and Resources. The EPA will ensure that the records relating any other such facilities in the State are preserved.

[36] A copy of the licence with the relevant conditions is available on the web at http://www.arpansa.gov.au/licon.htm#disr

[37] The *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (1992) may be viewed on (and downloaded from) ARPANSA'website at: http://www.arpansa.gov.au/pubs/rhs/rhs35.pdf

Regulatory controls over the Radium Hill and Port Pirie sites, and any other facilities after closure, will require appropriate monitoring and access restrictions to be maintained, and intervention measures to be undertaken if unplanned releases of material to the environment are detected.

Tasmania

No such situation has arisen in Tasmania but radiation protection legislation requires retention of records of disposal of sources.

In the case of Tasmania legislation[38] regarding contaminated sites is also relevant.

Victoria

There are no facilities within the meaning of the Joint Convention within Victoria.

Western Australia

Requirements are determined by compliance with the *Radiation Safety Act*, the *Radiation Safety (General) Regulations* and the relevant Codes and standards that are applied to facilities.

The safety of the Mt Walton East Intractable Waste Disposal Facility is assessed regularly, as required, by the conditions of registration. In particular, there are requirements for a technical auditor and a requirement for ongoing monitoring.

In Western Australia, new contaminated sites legislation may be relevant.

[38] Environmental Management and Pollution Control Amendment Act 2001 (No. 88 of 2001)

I TRANSBOUNDARY MOVEMENT

Article 27 (Transboundary movement)

(1) Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments. In so doing:

(i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

(ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

(iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

(iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

(v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

(2) A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

(3) Nothing in this Convention prejudices or affects:

(i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

(ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

(iii) the right of a Contracting Party to export its spent fuel for reprocessing;

(iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

International transboundary movement is covered by the IAEA Regulations for the Safe Transport of Radioactive Material, TS-R-1, 2005.

Within Australia, the Australian government, state and territory jurisdictions allow the movement of disused sealed sources across jurisdictional boundaries for return to the manufacturer, and the transboundary movement of radioactive materials. These movements must comply with all relevant legislative and regulatory requirements, and are covered by either the IAEA Transport Regulations or the *Code of Practice for the Safe Transport of Radioactive Material* (ARPANSA, 2001). In most cases a license is needed to transport radioactive material within and across jurisdictional boundaries.

Australian Government

Australia prohibits the import of radioactive substances including radioactive waste unless permission in writing to import the substance has been granted by the Minister for Health and Ageing or an authorised officer within ARPANSA. The Regulation defines 'radioactive substance' as any radioactive material or substance, including radium, any radioactive isotope or any article containing any radioactive material or substance.

Australia prohibits the export of radioactive waste to the Pacific Island Developing Countries specified 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 for Industry, Tourism and Resources. 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 Becquerel per gram or an activity below 1000 Becquerel. The Regulations also prohibit the export of 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 for Industry, Science and Resources (note that the title of the Minister referred to in the Regulation has changed since the making of the Regulations, the current title of the Minister referred to in the Regulation is the 'Minister for Industry, Tourism and Resources'). The Australian Government is working to incorporate the existing regional radioactive waste export control into a new control which will have a global application.

Australian Capital Territory

The Australian Capital Territory notifies other Australian jurisdictions of transboundary movements of radioactive material into their jurisdictions, but does not notify other countries.

There is currently no prohibition of transport or storage in Australian Capital Territory law. However, as there is no waste disposal facility in the Australian Capital Territory, such prohibition would not be justified.

Northern Territory

The Northern Territory notifies other Australian jurisdictions of transboundary movements of radioactive material into their jurisdictions, but does not notify other countries.

Queensland

Queensland requires the approval of other jurisdictions, including other countries, before sources are permanently relocated to that other jurisdiction.

Subject to certain conditions, Queensland may allow re-entry into its jurisdiction if a transboundary movement of a radiation source, for which an approval to relocate has been granted, is not or cannot be completed in conformity with Queensland's legislative requirements or the accepting jurisdiction's conditions of acceptance.

South Australia

South Australia allows the transport of radioactive material across the state, but the *Nuclear Waste Storage Facility (Prohibition) Act 2000* (SA) prohibits transport of radioactive waste, other than Category A, B or C wastes (as defined in the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (NHMRC, 1992), to a storage facility in South Australia.

The South Australian *RPC Act* and regulations are under review, but currently do not require trans-boundary movement of radioactive waste out of the State to be authorised. Trans-boundary movement of radioactive waste is permitted for transport of radioactive waste from other jurisdictions through the State, but the *Nuclear Waste Storage Facility (Prohibition) Act 2000* prohibits a person from bringing radioactive waste into South Australia or transporting radioactive waste within the State for delivery to a nuclear waste storage facility in the State.

Tasmania

Tasmania notifies other Australian jurisdictions of transboundary movements of radioactive material into their jurisdictions, but does not notify other countries.

Victoria

Importation into Australia is approved by Customs. ARPANSA acts as a clearing house for Customs and Victoria regularly gets asked if importation of specific materials into Victoria is acceptable. "Transboundary" in this case means international. There are few international transactions; mostly imports and few exports, other than core samples for mineral analysis.

Western Australia

Western Australia notifies other Australian jurisdictions of transboundary movements of radioactive material into their jurisdictions, but does not notify other countries.

The *Nuclear Waste Storage and Transportation (Prohibition) Act 1999* (WA) (*NWSTPA*) prevents the importation of "nuclear waste", as defined in the *NWSTPA*, into Western Australia unless a consenting resolution from both houses of parliament is granted.

J DISUSED SEALED SOURCES

Article 28 (Disused sealed sources)

(1) Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

(2) A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

Australia operates a radioactive material import control scheme under the Customs (Prohibited Imports) Regulations 1958[39]. The scheme is operated by ARPANSA in conjunction with the Australian Customs Service and State and Territory radiation protection regulators. The Regulations allow ARPANSA to attach conditions to an authorisation given to import a radioactive material. In addition to other conditions that might be placed on the permission, the person importing the material must undertake to inform the appropriate State or Territory radiation protection regulatory (in the State or Territory that the imported material will reside) of the possession or intent to possess the material; and undertake not to resell or lease or hire or otherwise part with the possession or custody of the material without prior notification of the appropriate statutory authorities.[40]

Australia is currently working to develop an export control scheme consistent with the Code of Conduct on the Safety and Security of Radioactive Sources. Australia does have in place export controls prohibiting the export of material that could be used in a WMD program and controls in place prohibiting the export of radioactive waste to Pacific Island Developing Countries.

The Australian Customs Service operates radiation monitors at various entry points into Australia. Monitors are also maintained at the Lucas Heights Science and Technology Centre (which houses ANSTO, one of the major producers of sources in Australia), and some scrap metal merchants.

New South Wales and Queensland are the only jurisdictions within which sealed radioactive sources are manufactured. In South Australia devices containing sealed radioactive sources are manufactured and exported to other states 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 disposal of sealed sources that are returned to them.

[39] A copy of the Regulations may be downloaded at http://scaleplus.law.gov.au/html/pastereg/0/140/top.htm

[40] Further information on the import control schemes can be found at http://www.arpansa.gov.au/med_permit.htm and http://www.arpansa.gov.au/imp_perm.htm

Northern Territory

Storage and disposal of all radiation sources will form part of each radiation protection plan that is approved.

Queensland

Queensland maintains an accurate record of all radioactive sources in its jurisdiction. All persons acquiring a radioactive source must obtain prior approval to acquire the source. As part of the application for an approval to acquire, the licensee must advise on what is proposed to be done with the source being replaced.

A manufacturer would be required to obtain the specific approval from the regulatory authority prior to accepting the return of a particular radioactive source. As part of the application, the manufacturer would need to:

- have an appropriate licence;
- demonstrate that the source was manufactured by them;
- ensure that the source is transported in accordance with the ARPANSA *Code Of Practice For The Safe Transport Of Radioactive Material (2001);*
- ensure that a source leakage test of the source is conducted in accordance with the applicable standards; and
- have appropriate facilities to safely and securely store the source.

Additionally, Queensland will be conducting an audit in 2005 to re-assess and check all records in relation to sources to establish whether or not the source is being used, and what action licensees are taking to dispose of any unused sources.

South Australia

The EPA takes appropriate steps to ensure that management of disused sealed sources takes place in a safe manner, through administration and enforcement of the RPC Act and IR Regulations.

While there are no manufacturers of sealed radioactive sources in South Australia, at least two companies produce devices containing sealed radioactive sources that are exported interstate or overseas. The return of these devices containing unwanted sources is permitted, but it is preferred that appropriate arrangements are in place to return disused sealed sources to the manufacturer.

Tasmania

Sealed sources must be returned to supplier as soon as possible after they are no longer required for use. This is currently a condition of licence but will be a regulation in the new legislation. Sources for which the supplier is no longer available are disposed of on a case by case basis when a suitable disposal pathway becomes available.

Victoria

Abandoned sources are retrieved by the Department of Human Services and stored for public safety purposes. Radiation practices with unwanted sealed sources that cannot be returned to the supplier or for which no disposal route is available via commercial means, are required to store such disused sources. Sealed sources are registered within Victoria, irrespective of whether they are in use or not.

Western Australia

Western Australia may, under specific circumstances, prevent the entry of sealed sources for disposal, depending on whether they were legally used within Western Australia.

K PLANNED ACTIVITIES TO IMPROVE SAFETY

Australian Government

Planned future actions to improve safety include the siting, construction and operation of a Commonwealth Radioactive Waste Management Facility at one of three nominated sites in the Northern Territory for radioactive waste produced by Australian Government agencies. Long-lived intermediate level radioactive waste will be stored at this Facility. Low level and short-lived radioactive waste will be either stored or disposed of, depending on the characteristics of the selected Facility site. All spent fuel from current and future reactor operations at Lucas Heights will eventually be shipped overseas for long-term storage or reprocessing. It is anticipated that wastes arising from the reprocessing will be repatriated to Australia and stored in the Commonwealth Radioactive Waste Management Facility.

One of the roles of ARPANSA is to promote uniformity of radiation protection and nuclear safety policy and practices across all jurisdictions in Australia.

Current planning includes a complete revision of the *Code of Practice for the Disposal of Radioactive Wastes by the User* (NHMRC, 1985), plus the development of a Code of Practice for the pre-disposal management of radioactive waste.

Australia is currently developing a strategy for each jurisdiction to manage its radioactive waste in a nationally consistent manner and consistent with international best practice in radiation protection and nuclear safety.

An essential adjunct to this strategy and vital to the subsequent development of action plans by each jurisdiction is a precise and up to date inventory of waste holdings within each jurisdiction, based upon an audit of radioactive waste within each jurisdiction. The inventory is to be established with nationally consistent definitions and in an agreed format.

To be of greatest practical value, the strategy will address the different forms of radioactive waste that exist in each jurisdiction.

The aim is to develop an agreed pathway for the management of each of these waste forms. The principles applied to consideration of each category are to be risk-based and consistent, but the particular pathway is likely to differ for the different forms of waste. Relevant guidance publications will need to be identified to cover the different stages of the process for different types of waste. In some cases, this guidance may already exist or be in development. In other cases, it may require new guidance being developed.

The strategy will take into account:

- the quantities of the different forms of waste in Australia in the different jurisdictions;
- conditioning options (to be consistent with transport requirements, disposal options and any requirements for temporary storage) ;
- approaches to storage, pending disposal;
- disposal options (discharge, disposal to controlled landfill, near-surface repository, borehole disposal, geological repository);

- Australia's obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management; and
- international best practice in relation to the management of radioactive waste.

At the operational level, ANSTO has for some years been undertaking a process to calcine intermediate level liquid wastes arising from radiopharmaceutical production, thereby reducing the possibility of leakage into the environment. ANSTO is currently developing a further step in this waste treatment process, which will immobilise the calcined intermediate level waste within a ceramic titanite mixture (Synroc). The final waste form will provide a stable long term disposal option for the waste, and is equally suitable for HLW. The Synroc process is based on a ceramic matrix made from several natural minerals, which together incorporate into their crystal structures the elements contained in the ILW.

Under Section 15 of the Australian Radiation Protection and *Nuclear Safety Act* 1998, the CEO of ARPANSA is responsible for promoting uniformity of radiation protection and nuclear safety policy and practices across jurisdictions of the Australian government, the States and the Territories. This responsibility reflects the fact that Australia is a federation of States and Territories, with each jurisdiction having its radiation protection and nuclear safety regulatory framework. The first edition of the *National Directory for Radiation Protection* was published in 2004. A second edition is currently in preparation. This will include application of the National Directory to mining and mineral processing.

Australia has given a commitment to the Director-General of the IAEA that it will comply with the IAEA's Code of Conduct for the Safety and Security of Radioactive Sources. The Radiation Health Committee is in the process of developing an Australian Code of Practice on this issue.

Australian Capital Territory

Planned activities to improve safety include:

- Drafting of new radiation protection legislation (conforming to the National Directory principles) has commenced and the new legislation is envisaged to be in place from the 4-th quarter of 2006. This new legislation puts emphasis on both strengthening of radiation safety and security of radioactive materials (including sources);
- An audit of radioactive waste is planned, using the uniform national RHC-recommended audit pattern.

New South Wales

New South Wales plans the following actions:

- Implementation of a site audit program, which would include verification of safe use, and inventory, of radioactive substances.
- Implementation of site registration for premises where unsealed radioactive substances are kept or used.
- Implementation of a registry of sealed radioactive sources above guideline levels.

Northern Territory

The *Radiation Protection Act 2004* has been promulgated but has yet to come into effect. The objectives of this Act are the radiation protection of people and the environment. There is a written plan for the commencement of this Act.

Queensland

Queensland will continue to support the implementation of national uniformity radiation safety and protection measures. It is continually reviewing its standards and policies to ensure that any adverse health effects which may arise from exposure to ionizing radiation are prevented or minimised.

Queensland does not have a decommissioning plan for its radioactive waste management facility. This would be prepared if the need arises.

As stated previously, Queensland will be conducting an audit in 2005 to confirm the details of sources that are not being used. Queensland will be actively working with the licensees who are simply storing sources so that these sources are disposed of (e.g. returned to the manufacturer). This will further strive to minimise the amount of waste held in this State.

South Australia

An audit of all radioactive material stored in South Australia under South Australian jurisdiction has been completed and, following on from the audit, a feasibility study into the establishment of an interim store for radioactive waste and a repository for disposal of low-level radioactive waste has been completed. The EPA proposes to follow-up on the outcome of the feasibility study.

Radium Hill and Port Pirie sites containing radioactive wastes from past practices are currently subject to registration under the *RPC Act*. The conditions on registration of these sites require a characterisation of the sites and development of plans for improvements that should be made in the standards of management of radioactive wastes. The sites were registered in order to effect compliance with Article 12 of the Joint Convention.

The Australian government and South Australian Governments are considering a proposal to transfer of ownership of the Maralinga lands to the South Australian Government and the traditional owners (Maralinga Tjarutja). It is proposed that at the point of transfer, the Maralinga land will be registered under the *RPC Act*, and appropriate conditions applied to the registration that would achieve compliance with the Joint Convention.

Tasmania

New legislation continues to permit disposal in accordance with the *Code of Practice for the Disposal of Radioactive Waste by the User (1985)* and/or a licence. An audit of all radioactive waste will be conducted in due course. The storage location for radioactive materials under government control has been upgraded and now complies with relevant requirements.

Victoria

Victoria has recently enacted the *Radiation Act 2005*[41] in accordance with the National Directory on Radiation Protection (2004). The Act enables the making of regulations and the imposition of licence conditions, which relate to the security of radiation sources.

Western Australia

The inspection programme has been reviewed and continues, commensurate with the resources available.

It is anticipated that the system of notification of the movement of radioactive substances will be further developed within the scope of the Security Code in development by ARPANSA.

[41] The *Radiation Act 2005* (Vic) will come into force on 1 September 2007.

L ANNEXES

(a) List of spent fuel management facilities;

(b) List of radioactive waste management facilities;

(c) List of nuclear facilities in the process of being decommissioned;

(d) Inventory of spent fuel;

(e) Inventory of radioactive waste;

(f) References to national laws, regulations, requirements, guides, etc.;

(g) References to official national and international reports related to safety;

(h) References to reports on international review missions performed at the request of a Contracting Party; and

(i) Other relevant material.

Annex A - List of spent fuel management facilities

Australian Government

ANSTO facilities for the storage of spent fuel from the HIFAR reactor consist of:

- An inspection and loading pond for spent fuel;
- Ponds for cropping and wet storage of spent fuel (used for long term cooling of fresh spent fuel); and
- A dry storage facility, comprised of 50 storage holes with capacity for 1100 spent fuel elements.

The spent fuel management facilities for the OPAL reactor have been described earlier in this report.

Annex B - List of radioactive waste management facilities

Australian Government

ANSTO operates several facilities for managing liquid and solid radioactive waste arising from its routine operations. Different facilities are used depending on radiation levels and the method of ultimate disposal, where this can be anticipated. ANSTO's storage facilities are considered to be for medium-term storage. Some higher-activity waste undergoes treatment and conditioning during its period of management; for example, intermediate-level liquid waste is treated and solidified for interim storage.

ANSTO has a facility for the management of radioactive waste originating from its activities. The process components of that facility are:

- Low level solid waste store;
- Decontamination centre;
- Low level solid waste compaction facility;
- Low level liquid waste treatment facility;
- Intermediate level liquid waste storage and treatment facility;
- Hot Cells facility;
- Intermediate level solid waste store facility; and
- Waste treatment and packaging facility.

ANSTO also has responsibility for a disposal facility called the Little Forest Burial Ground, which is a secure, shallow land burial site used by the former Australian Atomic Energy Commission for the disposal of some wastes up until 1968.

Other Australian government radioactive waste management facilities

The Australian Radiation Protection and Nuclear Safety Agency has a small waste store located at its Yallambie, Victoria premises.

The Commonwealth Scientific and Industrial Research Organisation has a number of small stores for waste at its laboratories around Australia (Black Mountain, TFT Belmont, Clayton, North Ryde, University of Queensland - Gatton, Armidale - NSW, Rockhampton, Parkville, Aspendale, Pullenvale, Lucas Heights, Gungahlin Site, Woodville).

The radioactive waste stores in the Woomera Prohibited Area, Evatts Field, Woomera, South Australia, are used to store large quantities of low-level and some intermediate-level waste on a temporary basis. Some of the waste is stored in a concrete bunker. This waste is predominantly disused watches, compasses, old medical sources and irradiation sources. The concrete bunker has concrete blast walls on 3 sides with raised earthen mounds on 2 of these sides. Other wastes, contaminated soil and treated ore wastes, are stored in drums in a large hangar.

Australian Capital Territory

There is a small store for waste (mostly disused sealed radioactive sources) generated in the Australian Capital Territory. This store is owned and operated by ACT Health, the government agency responsible for implementation of radiation safety legislation in the Australian Capital Territory.

The store has not been accepting new waste. However sources would be accepted in an emergency, to prevent generation of orphan sources in the Australian Capital Territory.

New South Wales

There is a non-operational store for waste generated in New South Wales. Security arrangements at this store have been significantly upgraded over the last two years. The store is now a registered premise under the provisions of the Radiation Control Regulation 2003 (NSW), pursuant to Section 8 of the Radiation Control Act 1990 (NSW).

Northern Territory

The current storage facilities for radioactive waste are a secure room at Royal Darwin Hospital and a secure compound at Mt Todd Mine rehabilitation site, which are for the storage of waste generated in the Northern Territory.

Waste storage facilities at the ERA Ranger Mine are a tailings dam, evaporation ponds, and solid waste disposal stockpiles.

Queensland

The purpose-built radioactive waste facility owned by the Queensland State Government is a store only – it is not a disposal facility.

Queensland's radioactive waste store is operated by Queensland's radiation regulatory authority under the scrutiny of the Radiation Advisory Council, an independent Ministerial Advisory Body, and the Management Advisory Committee, a public interface Committee which advises the Minister. The purpose of the store is to provide safe and secure storage for radioactive substances which have outlived their useful service and which are not able to be disposed of at this time. The facility is located in South East Queensland, in the Shire of Esk.

Certain requirements must be met before radioactive material may be accepted for storage. Only those materials which are acceptable for storage may be accepted by the regulatory body for storage.

Suitable radioactive substances that may be accepted for storage are those that:

- are solid or sealed;
- are currently held in storage by a responsible person pending disposal;
- have been used in Queensland for the majority of their recommended working life;
- cannot be returned to the manufacturer or supplier, and
- are in containment approved by the regulatory authority.

Radioactive materials that will **not** be accepted into the store are:

- unsealed liquid radioactive material
- radioactive material requiring heat dissipation
- critical mass quantities of fissionable materials
- radioactive material not in containment approved by the regulatory authority
- large volumes of radioactive material (eg. contaminated soil or sand arising from mining and milling of radioactive ores)
- quantities of corrosive, oxidising or pyrophoric materials which could present a hazard to the safe operation of the store
- medical waste which may be contaminated with pathogens
- radioactive waste from other jurisdictions.

Once an item of radioactive waste is accepted, possession of, and all responsibility for the waste, is transferred to the State.

The essential features of the facility include:

- all radioactive material is contained to minimise the risk of damage or dispersal of contents
- radiation levels are kept to a minimum by keeping the material in appropriately shielded containers
- regular inspections of the store are made to ensure that the radioactive material remains safely stored, equipment is operating correctly, and to record the radiation levels in and around the store
- the design and operation of the store is to ensure that no person receives a radiation dose greater than 10μSv per week at and beyond the boundary of the site
- radiation detectors located inside the store are used to continuously monitor radiation levels
- adequate security is provided at the store.

The inventory of radioactive waste in Queensland is included in Section L, Annex E. This inventory lists the total amount of radioactive waste throughout Queensland, excluding radionuclides with a short half life (ie less than 5 years).

South Australia

There is a store for waste generated in South Australia.

Wastes from current mining operations and past practices include:

Beverley Uranium Project: Evaporation ponds, a liquid waste re-injection well and a solid waste disposal pit.

Honeymoon Uranium Project (not in operation): Evaporation pond, a liquid waste re-injection well and a solid waste storage area.

Olympic Dam Uranium Project: Tailings dams, associated evaporation ponds and a solid waste disposal pit.

Port Pirie Plant: Uranium and thorium tailings dams.

Radium Hill Mine: Tailings dam incorporating a low-level waste repository.

Tasmania

There is a small store for waste generated in Tasmania. Other storage facilities are all small scale and operated by licence holders.

Victoria

Whilst Victoria does not have any Radioactive Waste Management Facilities within the meaning of the Joint Convention, Victoria has the Victorian Interim Storage for seized and abandoned radioactive materials.

Western Australia

Western Australia has the Mt Walton East Intractable Waste Disposal Facility for the permanent disposal of intractable (chemical and radiological) waste generated within Western Australia. This facility lies about 75km north-east of Koolyanobbing and approximately 53km north of Jaurdi Station homestead. Access to the site is by a 100km dedicated unsurfaced road that extends northward from the Boorabbin siding on Great Eastern Highway. It is located on land within the Shire of Coolgardie. The main purpose of the facility is as a permanent disposal site for intractable (chemical as well as radioactive) waste generated within Western Australia. It is a site of 'last resort' and the applicants must demonstrate to the site operator (the Department of Housing and Works) that other avenues of waste disposal/management have been attempted prior to applying for disposal at the site.

The site was chosen based on criteria detailed in the report *Site Investigations for Repositories for Solid Radioactive Waste in Shallow Ground, Technical Report Series No 216, International Atomic Energy Agency (1982).*

All aspects of the design, operational requirements, duties and responsibilities must comply with the *Radiation Safety (General) Regulations* and the *Code Of Practice For The Near-Surface Disposal Of Radioactive Waste In Australia (1992).*

The Radiation Health Branch operates a radioactive waste store. The store is situated on the Queen Elizabeth II (QEII) Medical Centre Site. The store's main purpose is for interim storage of radioactive substances that have no further use prior to disposal at the Mt Walton East site. The freestanding store has been constructed with a vented central well for storage of higher activity sources as well as a vented central area for storage of sources that do not require additional shielding. The stores construction is a concrete floor with double brick walls. The store is located within a fenced locked compound and is linked to the 24 hour security of the QEII Medical Centre site.

Annex C - List of nuclear facilities in the process of being decommissioned

The 100 kW MOATA research reactor was shut down in 1995, and fuel and cooling water were removed in 1996. It is presently awaiting decommissioning. Three stages of decommissioning are envisaged: post-operational care with fuel removed (current status), partial dismantling with continuing care, and complete dismantling. Decommissioning to "green field" is under planning.

Other historical ANSTO facilities, such as small accelerators and radiation laboratories are also planned to be decommissioned at some appropriate time in the future.

Annex D - Inventory of spent fuel

Inventory of spent fuel in storage in Australia

Material description	Number*	Mass of Uranium (total) kg
HIFAR spent fuel elements	394	90
MOATA spent fuel plates	177	4

***** As at 24/08/2005

Inventory of HIFAR spent fuel elements that have been sent abroad for re-processing and for which there is a contractual requirement for the return of waste to Australia (as at 24/8/2005)

Location	Number	Mass of Uranium (total) kg
UKAEA, Dounreay, Scotland, UK	114	16
COGEMA, La Hague, France	1288	198

Annex E - Inventory of radioactive wastes

Table E1: Inventory of radioactive waste held in Australian storage facilities (excluding ANSTO, South Australian, and mining and milling wastes)

Radionuclide(s)	Total Activity [MBq]
Am-241	383113
Am-241/Be	1669010
Am-241/Be, Cs-137	1188
Ba-133	904
C-14	3111
C-14, Cs-137, Eu-152, Ni-63, Pb-210, Ra-226	100
Cf-252	2436
Cl-36	185
Cm-244	6729
Co-57	17
Co-60	114033
Co-60, Cs-137	415
Co-60, Cs-137, Gd-153, Pu-238	37000
Co-60, Ra-226	20000
Cs-137	12343000
Cs-137, Ra-226	10000
Cs-137, Ra-226, Sr-90	10000
Eu-152	5
Fe-55	3
H-3	46107855
I-129	4
Ir-192	57
Ir-192 (& Co-60)	11206
Kr-85	64773
Na-22	37
Ni-63	5277
Pb-210	983
Pm-147	37001
Po-210	13
Pu-238	34500

Table E1 cont.

Radionuclide(s)	Total Activity [MBq]
Pu-239	100
Ra-226	326440
Ra-226, Th-232	200
Ra-226, U-238	20000
Ra-226/Be	6475
Sn-119	7
Sr-90	476188
Th-230	1770
Th-232	92
Thorium Nitrate	1
Tl-204	458
U & Ra (liquids)	4
U-233	34
U-238	760

Table E2: Radioactive waste in storage at ANSTO's radioactive waste management facility is comprised of:

Type of Waste	Volume	Generation Rate
Low-level Solid Waste	1249 m^3	30 m^3 per year
Intermediate-level Solid Waste	221 m^3	2 m^3 per year
Thorium and Uranium Residues (ILW)	165 m^3	Nil
Intermediate-level Liquid Waste (to be solidified)	5.7 m^3	0.5 m^3 per year

South Australia

The quantities of waste in the tables below are estimates only. The inventory includes sealed radioactive waste sources, wastes from mining and milling of radioactive ores at the Olympic Dam, Beverley, and Honeymoon uranium projects, and wastes from past practices located at the sites of the former Radium Hill uranium mine and former Port Pirie Uranium Treatment Plant.

Table E3: Inventory of sealed radioactive sources of Category B[42] held in the South Australian jurisdiction

Radionuclide(s)	No. of Sources	Approx. Total Volume [m^3]
Am-241/Be	9	0.3
Ba-133	1	0.02
Co-60	54	1.1
Cs-137	101	1.6
Fe-55	1	0.02
I-125	1	0.02
Ir-192	1	0.02
Pm-147	1	0.02
Pu-238	3	0.1
Sr-90	13	0.15

(Data from survey conducted in October 2000)

Table E4: Inventory of sealed radioactive sources of Category S[43] held in the South Australian jurisdiction

Radionuclide(s)	No. of Sources	Approx. Total Volume [m^3]
Am-241	5	0.1
Am-241/Be	8	0.26
Co-60	3	2.6
Pu-238	2	0.04
Ra-225	5	0.06
Ra-226/Be	6	0.1

(Data from survey conducted in October 2000)

[42] *NHMRC Code of practice for the near-surface disposal of radioactive waste in Australia 1992*

Table E5: Inventory of wastes from the mining and milling of radioactive ores in SA

Site	Estimated Mass (Tonnes)	Type of Waste
Olympic Dam U Project	74,000,000	U Tailings
In-situ leach U projects (Beverley and Honeymoon)	< 1000	Contaminated soil and solids from U processing
Port Pirie (Former U Treatment Plant)	~200,000	U Tailings & waste rock
Radium Hill (Former U mine)	300,000	U Tailings
Repository on Site	400	Contaminated soil and solids from U processing

(Current estimates as of 2005)

Table E6: Inventory of wastes from mining and milling of ores

Tailings produced since 30 June 2003 to 31 August 2005, 4.7Mt overall total 32.2Mt
Solid waste produced (mineralised and non-mineralised) since commencement of operations to 31 August 2005, 80.8Mt
Solid waste produced (mineralised and non-mineralised) since 30 June 2003 to 31 August 2005, 20.3Mt
Average grade of ore as reported in the ERA Annual Report, 0.24% U3O8

Inventory of radioactive waste that has been disposed of

Prior to 1968, the then Australian Atomic Energy Commission used the Little Forest Burial Ground (an area near ANSTO's facilities) for disposal of low levels of radioactive waste and beryllium oxide. Approximately 1675 m^3 of mixed radioactive waste, with an estimated activity of 150 GBq as at the time of its disposal, was disposed of at that site. This site is under ongoing ANSTO management and control.

Table E7: **Total activities per radionuclide in waste disposed of in Western Australia's Mt Walton East facility.**

Radionuclide(s)	Total Activity [MBq]
Am-241	10586
Cd-109	286
Co-60	490
Cs-137	29153
H-3	131252698
Ra-226	1900

There have been no disposal operations at the Mt Walton East facility since the information was provided for the 2003 Report.

Annex F - References to national laws, regulations, requirements, guides, etc.

Australian Government

- *Australian Nuclear Science and Technology Organisation Act 1987*
- ***Australian Radiation Protection and Nuclear Safety Act 1998***
- **Australian Radiation Protection and Nuclear Safety Agency, *Recommendations for Limiting Exposure to Ionizing Radiation* and the *National Standard for Limiting Occupational Exposure to Ionizing Radiation,* Radiation Protection Series No. 1, (1995 - republished 2002).**
- **Australian Radiation Protection and Nuclear Safety Agency, *Code of Practice for the Safe Transport of Radioactive Material,* Radiation Protection Series No. 2, 2001.**
- Australian Radiation Protection and Nuclear Safety Agency, *National Directory for Radiation Protection,* Radiation Protection Series No. 6, 2004.
- Australian Radiation Protection and Nuclear Safety Agency, *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing,* Radiation Protection Series No. 9, 2005.
- **Australian Radiation Protection and Nuclear Safety Regulations 1999**
- **Commonwealth of Australia, *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores,* 1982.**
- *Environment Protection and Biodiversity Conservation Act 1999*
- Environment Protection and Biodiversity Conservation Regulations 2000
- **National Health and Medical Research Council, *Code of Practice for the Disposal of Radioactive Waste by the User,* Radiation Health Series No. 13, 1985.**
- **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.**
- National Road Transport Commission and Federal Office of Road Safety, *Australian Dangerous Goods Code*, 6th ed., 1998.

Australian Capital Territory

- ***Radiation Act 1983***
- ***Radiation Regulation 2002***

New legislation is in the process of drafting, and is expected to be enacted around the fourth quarter of 2006

New South Wales

- *Contaminated Land Management Act 1997*
- *Dangerous Goods Act 1975*
- Environmental Planning and Assessment Regulation 2000
- National Parks and Wildlife (Land Management) Regulation 1995
- *Occupational Health and Safety Act 2000*
- Occupational Health and Safety Regulation 2001
- *Protection of the Environment Operations Act 1997*
- Protection of the Environment Operations (Waste) Regulation 1997
- ***Radiation Control Act 1990***
- *Road and Rail Transport (Dangerous Goods) Act 1997*
- Road and Rail Transport (Dangerous Goods) (Rail) Regulation 1999
- *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986*
- *Waste Avoidance and Resource Recovery Act 2001*
- ***Radiation Control Regulation 2003***

Northern Territory

- *Dangerous Goods Act 1996*
- ***Mining Management Act 2002***
- *Radiation Protection Act 2004* (this Act is yet to come into effect and is intended to replace the *Radiation (Safety Control) Act 1978*)
- ***Radiation (Safety Control) Act 1978***
- **Radiation (Safety Control) Regulations 1997**
- ***Radioactive Ores and Concentrates (Packaging and Transport) Act 2002***
- **Radioactive Ores and Concentrates (Packaging and Transport) Regulations 1980**

Queensland

- Queensland Department of Health, *Queensland's Radioactive Waste Store - Operational Management Plan*.

- Queensland Department of Health, *Queensland's Radioactive Waste Store - Operational Procedures Manual*.

- 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*.

- ***Radiation Safety Act 1999***

- Radiation Safety (Radiation Safety Standards) Notice 1999

- **Radiation Safety Regulation 1999**

South Australia

- ***Radiation Protection and Control Act 1982***

- **Ionizing Radiation Regulations 2000**

- ***Nuclear Waste Storage Facility (Prohibition) Act 2000***

- **Radiation Protection and Control (Transport of Radioactive Substances) Regulations 2003**

Tasmania

- ***Radiation Control Act 1977***

- Radiation Control Amendment Regulations 2002

- **Radiation Control Regulations 1994**

- *Environmental Management and Pollution Control Amendment Act 2001* (No. 88 of 2001)

Tasmania is in the process of preparing a new Radiation Protection Act and Radiation Protection Regulations.

Victoria

- ***Health Act 1958 (until 31 August 2007)***

- **Health (Radiation Safety) Regulations 1994*(until 31 August 2007)***

- ***Nuclear Activities (Prohibitions) Act 1983***

- *Radiation Act 2005 (comes into force 1 September 2007)*

Western Australia

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

Annex G - References to reports on international review missions performed at the request of a Contracting Party

To date, there have been no international reviews of spent fuel or radioactive waste management activities in Australia.

Acronyms and abbreviations

ANSTO:	Australian Nuclear Science and Technology Organization
ANU:	Australian National University
ARPANSA:	Australian Radiation Protection and Nuclear Safety Agency
BNFL:	British Nuclear Fuels Limited
COGEMA:	Compagnie Générale des Matières Nucléaires
CSIRO:	Commonwealth Scientific and Industrial Research Organization
EPA:	Environment Protection Authority
ERA:	Energy Resources of Australia Ltd
HLW:	High level waste
IAEA:	International Atomic Energy Agency
INVAP:	Argentinian company which is contracted to design, build and commission the OPAL research reactor.
LEU:	Low enriched uranium
LHSTC:	Lucas Heights Science and Technology Centre
NHMRC:	National Health and Medical Research Council
NOHSC:	National Occupational Health and Safety Commission
VLLRW:	Very low level radioactive waste