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

National Report of the Commonwealth of Australia

14 October 2011

Contents

Section A – Introduction

Focus of this report

This is the fourth National Report by Australia.[1] The 2008 National Report and Australia's presentation to the Third Review Meeting in 2009 highlighted the following major issues:

- progress on national uniformity;
- progress with development of a national waste classification scheme;
- radioactive waste management policy – achievements, consultation, strategy;
- spent fuel management and management of reprocessing waste;
- decommissioning;
- uranium mining waste management; and
- recruitment and skills management.

This fourth National Report provides an update on these and all other relevant issues under the terms of the Joint Convention. It also seeks to provide sufficient background where necessary to enable it to be read as a stand-alone document.

An ongoing challenge for Australia is ensuring a coherent approach to regulations and waste management practice in view of the complex nature of national and regional legislation. The goal is for harmonisation of legislation between the nine jurisdictions within Australia's federal system as a way to enhance safety of radioactive waste management. Australia is continuing to address these challenges through the ongoing development and application of a *National Directory for Radiation Protection* (NDRP) (ARPANSA, July 2011).[2] This fourth National Report includes information on the progress Australian jurisdictions within the Commonwealth have made in these areas including in the implementation of the NDRP in relation to radioactive waste management.

The 2008 National Report included detailed information relating to the management of radioactive wastes arising from uranium mining. It also discussed the application of the recommendations of ICRP Publication 103 to remediation of closed uranium mines and the development of environmental guidance (based on ICRP Publication 91: *A Framework for Assessing the Impact of Ionising Radiation on Non-Human Species*) to be applied in areas such as uranium exploration and other NORM situations.

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[1] The Joint Convention entered into force in Australia on 3 November 2003.

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

With regard to the establishment of a national radioactive waste management facility comprising a co-located near-surface disposal facility and an above-ground store, the 2005 National Report outlined the proposal for a Commonwealth Radioactive Waste Management Facility for the management of low- and intermediate-level radioactive waste produced by Commonwealth Government agencies. Under this proposal, with the exception of the Northern Territory in which the Commonwealth facility was to be sited, the states and Australian Capital Territory would be responsible for their own waste management. The 2005 National Report also included arrangements for reprocessing of spent fuel from Australia's research reactors. Consequently, the Second Review Meeting noted the "establishment of facilities for disposal and longer term storage of radioactive waste" and the "establishment of a facility for storage of intermediate-level waste (ILW) returned from reprocessing" as significant challenges for Australia.

By the time of the 2008 National Report, Australia's national government had changed following the November 2007 federal election and it was reviewing all aspects of its long-term radioactive waste management strategy. At the time of the third Review Meeting in May 2009, site assessments had been completed at four potential sites in the Northern Territory for an above-ground store and near-surface disposal facility. The preliminary assessment was that any of the four sites could host a near-surface repository subject to appropriate engineering. A program of community consultation had been conducted in conjunction with the site assessments.

In this fourth National Report, the legislative and policy positions of Australia's current government are outlined and progress on establishing a national radioactive waste management facility is presented. New legislation, the National Radioactive Waste Management Bill 2010, which gives effect to the government's policy position, is currently before the Commonwealth Parliament. Its purpose is to establish a facility for managing, at a single site, radioactive waste currently stored at a number of locations across the country. The National Radioactive Waste Management Facility will comprise a long-term store and near-surface repository.

To assist with the regulatory process in establishing a national radioactive waste management facility, in December 2006 the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) published *Regulatory Guidance for Radioactive Waste Management Facilities: Near Surface Disposal Facilities; and Storage Facilities*. This document is currently being updated in accordance with evolving international best practice for ensuring safety in radioactive waste management.

Most Australian jurisdictions do not define radioactive waste in their legislation and most did not classify radioactive materials in long-term storage as waste as defined by the Joint Convention. Therefore, previous Australian reports could only assess compliance with the Joint Convention in relation to those facilities containing radioactive materials that had been characterised as waste for the purposes of the Joint Convention.

However, each jurisdiction has storage arrangements for radioactive materials as well as radioactive waste. In some cases, such as the State of Victoria, an interim store contains a variety of radioactive material surrendered to the regulator by the owner of the material or seized by the regulator for safe-keeping over the past 30 or so years. These materials can be considered as waste in that it is unlikely that there will be any further uses for them.

Recent advances such as:

- Australia's new national classification scheme for radioactive waste, consistent with the current International Atomic Energy Agency (IAEA) classification scheme, including a definition of radioactive waste;
- progress in national policy and legislation aimed towards establishment of a national storage and disposal facility for radioactive waste; and
- access to the IAEA database Net-Enabled Waste Management Database (NEWMDB) for maintaining waste inventories;

mean that the national radioactive waste inventory reported in this fourth National Report at Annex A is more complete than before.

Background

Australia is a federation of nine jurisdictions – the Commonwealth of Australia,[3] New South Wales, Victoria, Queensland, Western Australia, South Australia, Tasmania, and two territories - Northern Territory and the Australian Capital Territory.

Until 1998, in the area of radiation protection, there were six state and two territory regulatory authorities operating within Australia. In 1998, the Commonwealth Government created a Commonwealth regulator, the CEO of ARPANSA, to regulate the radiation and nuclear safety activities of Commonwealth entities. These entities include the Department of Defence, the Australian Nuclear Science and Technology Organisation (ANSTO) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), regardless of the jurisdiction in which the operations are undertaken. In addition, the CEO of ARPANSA was given the charter to promote national uniformity in radiation protection across all jurisdictions.

With the establishment of the Commonwealth Government regulator, ARPANSA has developed a *National Directory for Radiation Protection* (ARPANSA, July 2011). The NDRP is the principal means for addressing the inconsistencies in radiation protection regulation across the various Australian jurisdictions. The NDRP provides an overall agreed framework for radiation safety, including both ionising and non-ionising radiation, together with clear regulatory statements to be adopted by the Commonwealth Government and the States and Territories. The NDRP is developed by all regulators though the processes of the Radiation Health Committee. This Committee, established under the *Australian Radiation Protection and Nuclear Safety Act 1998* (ARPANS Act), includes radiation regulators from each

[3] Also referred to as the Commonwealth Government.

jurisdiction. Additions to the NDRP require final approval from health ministers from each of the jurisdictions before being adopted. In relation to radioactive waste management, codes of practice have been developed for inclusion under the NDRP framework, and there are associated safety guides.[4]

Australia has a few operational uranium mines and several mines that are non-operational, some of which are still under regulatory control because of the presence of potentially hazardous waste materials. All operating uranium mines are owned by non-Commonwealth entities and are therefore regulated by the jurisdictions in which they are located – the State of South Australia and the Northern Territory. The national standards developed through the NDRP process have been adopted by jurisdictions to regulate radiation safety for mining operations. In one other case, ARPANSA regulates abandoned mines located within a national park controlled by the Commonwealth Government.

Australia has operated three research reactors:

- one newly commissioned - Open Pool Australian Light water reactor (OPAL);
- one that has been permanently shut down – the High Flux Australian Reactor (HIFAR); and
- one that has been fully decommissioned in late 2010 – MOATA, an Aboriginal word meaning 'fire-stick' or 'gentle-fire'.

Each of these facilities is or was located on the ANSTO site and is or was regulated by the Commonwealth Government regulator, the CEO of ARPANSA.

Radioactive waste held in state and territory stores is largely low-level and short-lived intermediate-level waste arising from industrial, medical and research practices and includes abandoned sources. Similarly, radioactive waste held by Commonwealth Government entities is mostly low-level and short-lived intermediate-level waste, including abandoned sources. Quantities of long-lived intermediate-level waste arise from activities including decommissioning and spent fuel reprocessing, and some legacy radium from medical uses.

Assessment of Australia's compliance with the Joint Convention

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

[4] *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (2005), *Safety Guide for the Predisposal Management of Radioactive Waste* (2008), *Safety Guide for Classification of Radioactive Waste* (2010).

It should be noted that while Australian states and territories fully supported ratification of the Joint Convention, compliance of the states and territories of Australia is not subject to separate Commonwealth Government legislation.

The Commonwealth Government is committed to further development of a framework governing the long-term management of radioactive wastes arising from its activities, including, as appropriate and necessary, long-term storage and disposal.

Section B – Scope of Application

Article 3 Scope of Application

Spent fuel at reprocessing facilities

No reprocessing facilities exist in, or are proposed for, Australia. The discussion of management of spent fuel in this report does not include reprocessing activities. In addition, regulatory legislation (ARPANS Act) prohibits the Commonwealth Government regulator from licensing the construction or operation of reprocessing facilities.

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) requires that the Minister for the Environment must not approve the taking of an action involving the construction of a facility for the reprocessing of spent fuel (Part 10, Subdivision C, Section 146M).

Waste containing Naturally Occurring Radioactive Material (NORM)

The management of wastes arising from operating uranium mines is discussed under the relevant articles.

NORM wastes that are not part of the nuclear fuel cycle have not been included in this report.

Spent fuel and radioactive waste from military or defence programs

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

Section C – Policies and Practices

Article 32 Reporting (1)

Spent fuel management policy

Australia's policy on spent fuel management is unchanged since the 2008 National Report. Spent fuel is transported overseas under the Foreign Research Reactor Spent Nuclear Fuel (FRR-SNF) take-back program in the case of United States (US)-obligated fuel qualified for that program, or to another country for reprocessing. In the case of reprocessing, the fuel is transported with agreement that all resulting long-lived intermediate-level radioactive waste will be returned to Australia at a mutually agreed time for storage and in accordance with contractual obligations.

Spent fuel management practices

In Australia, the Commonwealth is the only jurisdiction in which the management of spent fuel occurs. The current and planned spent fuel management practices for the spent fuel arising from the MOATA, HIFAR and OPAL research reactors are described below.

Decommissioned Reactor (MOATA)

MOATA was an ARGONAUT type reactor operated by the ANSTO during the period April 1961 to May 1995, after which time the reactor was permanently shut down and the fuel dry-stored on site. The fuel was of US-origin and was returned to the US in December 2006 under the Foreign Research Reactor Spent Nuclear Fuel (FRR-SNF) take-back program. Under the provisions of this program no waste will be returned to Australia.

An application to commence preliminary dismantling of the MOATA reactor was made by ANSTO to ARPANSA in March 2009 with approval granted in June of the same year. An application to undertake final dismantling was made in October 2009 with approval granted in January 2010. Following dismantling of the MOATA reactor, and demonstration that the site had been returned to background levels of radiation, approval was granted by ARPANSA for release of the site from regulatory control in May 2011.

Shut-down Reactor (HIFAR)

The High Flux Australian Reactor (HIFAR), a 10 MW research reactor, was shut down in January 2007. During its operation, the reactor produced approximately 37 spent fuel elements per year. Once discharged from the reactor, the spent fuel elements were then stored for several years under water to cool, during which time much of the short-lived activity decayed. The fuel elements were then transferred to a dry storage facility, consisting of holes drilled into the bedrock and lined with stainless steel tubes.

All spent fuel from HIFAR has been shipped to the US, to the UKAEA facility at Dounreay, United Kingdom, or to the AREVA facility at La Hague, France.

For spent fuel shipments, the spent fuel elements were loaded into licensed transport casks. These casks were drained, vacuum dried and hermetically sealed, tied down in specially strengthened steel ISO containers, and transported by road to a nearby port. Sea transportation was carried out in dedicated INF-2 classified ships. No waste from spent fuel elements shipped to the US under the FRR-SNF program will be returned to Australia. Under contractual requirements with UKAEA and AREVA, waste arising from reprocessing of spent fuel elements at their facilities will be returned to Australia as long-lived intermediate-level waste. The uranium extracted during the reprocessing of spent fuel at La Hague has been sold to AREVA. The uranium from the reprocessing of spent fuel at Dounreay was used in the fabrication of fresh fuel elements for HIFAR.

ANSTO shipped a total of 2281 HIFAR spent fuel elements to Dounreay, the US and La Hague from the operation of the HIFAR and MOATA reactors. The shipments of spent fuel were carried out in accordance with the requirements of the IAEA *Regulations for the Safe Transport of Radioactive Material* (2005), TS-R-1, and the *International Maritime Dangerous Goods (IMDG) Code* (International Maritime Organisation).

Operational Reactor (OPAL)

The OPAL reactor commenced operation in 2006 and is Australia's only operating reactor. OPAL is a 20 MW thermal, open pool, light water reactor designed for low-enriched uranium (LEU) aluminium-clad fuel. The reactor currently operates on uranium silicide fuel. It is planned that a transition will be made to uranium molybdenum fuel once that fuel is qualified.

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

As a further back-up option, INVAP (the Argentinian company that constructed the reactor) has guaranteed to provide an alternative solution consistent with Australia's requirements, using proven technologies. Argentina has already developed and demonstrated a novel technology for conditioning 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. An agreement with Argentina at inter-governmental level to support these arrangements has been ratified by both governments.

Spent fuel that is discharged from the reactor core is moved a short distance under water into storage racks (capacity of 336 spent fuel elements) in the reactor service pool, adjacent to and connected with the main pool. These racks 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 (16 fuel elements) at any time, should this be required. The current usage is 30 fuel elements per year. 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. Under this process, the spent fuel is protected by the same structural features as the reactor itself, and is available at all times for visual inspection of its condition.

The reactor service pool has a purpose-built stand to take a spent fuel transport cask. For each fuel shipment, spent fuel rods will be moved the short distance from the storage racks underwater, by use of handling tools, 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.

On the basis of around 30 spent fuel elements arising per year, it is anticipated that there will be one overseas shipment of spent fuel every five or six years. The first such shipment will be approximately eight years after the commencement of reactor operation which occurred in 2006, given a minimum cooling period of three years and the above-mentioned five or six years to accumulate a sufficient quantity for shipping.

Under contractual arrangements with the reprocessing companies, all waste generated by reprocessing must be capable of classification as less than high-level waste, as defined in Australia.[5] Long-lived intermediate-level waste generated by reprocessing will be placed in long-term storage pending an appropriate disposal facility.

Radioactive waste management policy

As stated in the 2008 National Report, Australia's radioactive waste management policy requires that all radioactive waste generated within Australia be stored or disposed of in Australia at suitably sited facilities after being categorised in accordance with the national classification scheme and consistent with agreed international practice. This policy included the establishment of the previously proposed Commonwealth Radioactive Waste Management Facility. Site investigations and community consultations were undertaken at four locations in the Northern Territory during 2006-08.

The site investigations report by consultants Parsons Brinckerhoff was released by the Commonwealth Government in March 2010 following peer review by an independent

[5] From RPS No. 20 *Classification of Radioactive Waste* (2010), high-level waste (HLW) is defined as waste that contains such large concentrations of both short- and long-lived radionuclides that, compared to ILW, a greater degree of containment and isolation from the accessible environment is needed to ensure long term safety. HLW generates significant quantities of heat from radioactive decay, and normally continues to generate heat for several centuries.

consultant. The report concluded that it is feasible to construct a radioactive waste management facility on any of the sites assessed but that construction costs vary according to site characteristics.

Australia's national government changed following the November 2007 federal election. The incoming Commonwealth Government announced the outcome of a review of its long-term radioactive waste management strategy on 23 February 2010 through the introduction of the National Radioactive Waste Management Bill 2010 in Federal Parliament. Under the strategy, only land volunteered by its owners can be considered as a site for a potential facility. Two volunteer nomination processes have been proposed. The first allows an Aboriginal Land Council in the Northern Territory to volunteer Aboriginal land on behalf of Traditional Owners. The second provides for a nation-wide volunteer site selection process in the event that the government considers it unlikely that a facility will be able to be constructed and operated on a volunteered site on Aboriginal land in the Northern Territory.

Under the Bill, the Commonwealth Government committed to no longer consider the three Department of Defence sites assessed by Parsons Brinckerhoff. However, the volunteered fourth site on Aboriginal land at Muckaty Station (Northern Territory), nominated under the previous policy, is preserved.

The Bill was passed by the Federal Parliament House of Representatives on 22 February 2011 and is currently under consideration in the Senate.

The Commonwealth Government has reviewed all aspects of its long-term radioactive waste management strategy. The government's policy is that low-level radioactive waste generated by operation and eventual decommissioning of OPAL will be disposed of at a near-surface repository.

A proportion of Australia's radioactive waste currently generated can be attributed to the production of medical isotopes by ANSTO.

The majority of medical waste from hospitals is short-lived and managed via delay and decay facilities at the point of generation until it can be legally disposed of or discharged as being below regulatory concern. It is then managed with other non-radioactive medical wastes.

The majority of disused sealed sources in Australia are stored by the owner of the source. Most jurisdictions do not provide for collection or storage of sources and therefore do not charge for the cost of storage. The priority practice is to return the source to manufacturer where this is available and these costs are borne by the owner of the source.

In Queensland, certain sources may be stored in the State's dedicated radioactive waste store and while there is no direct storage cost imposed on the owner of the source, the owner is required to ensure that standards in relation to predisposal management of radioactive waste and transport of radioactive materials are met as well as the waste acceptance criteria for the waste store.

In Western Australia (WA), disposal of sources is available at the State's Mt Walton East Intractable Waste Disposal Facility (see Article 32(2)). Just prior to disposal, wastes are transferred to Radiation Health's waste store at the facility for pre-disposal packaging, but no storage costs are charged (WA does have the provision to charge for storage over a longer time period but to date have had no reason to do so). Disposal costs are based on cost recovery and are shared amongst waste owners on a pro-rata basis calculated on total packaged volume for the source.

National requirements and guidance

Since the 2008 National Report, Australia has continued to develop national guidance relating to radioactive waste management as part of the national uniformity process, in which standards are developed, referenced in the NDRP and adopted by Australian regulators. The goal is for radioactive wastes to be subject to the same legislative and regulatory requirements across the nation.

In addition, all jurisdictions apply the provisions of the ARPANSA document *Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002)* (RPS1), which is consistent with ICRP Publication 60. RPS1 is referenced in the NDRP for national adoption and is currently being revised to take into account the most recent ICRP recommendations (Publication 103) and the new International Basic Safety Standards (IAEA). Amongst other requirements, RPS1 requires organisations and employers to have and maintain a radiation management plan.

The document, *Regulatory Guideline on Review of Plans and Arrangements* (ARPANSA, 2003), sets out the regulatory expectation in the Commonwealth jurisdiction and therefore the criteria by which the adequacy of the radiation management plan is judged. This document is currently being updated. The *Australian Radiation Protection and Nuclear Safety Regulations 1999* (ARPANS Regulations) require that a Commonwealth licence holder must review its plans and arrangements for managing safety (including the radiation management plan) every 12 months and any changes to those plans must be communicated to the CEO of ARPANSA. If a proposed change to those plans has "significant implications for safety" then the proposed change requires the prior approval of the CEO of ARPANSA.

ARPANSA's *Regulatory Guidance for Radioactive Waste Management Facilities* was issued in December 2006. This document is currently being updated and will be reissued during 2012.

The contents of radiation management plans in relation to waste are stipulated in the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (National Health and Medical Research Council (NHMRC), 1992) (the Near-Surface Disposal Code), currently under review, and in the *Code of Practice and Safety Guide on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA, 2005) (the Mining Code). Guidance on the content of radioactive waste management plans for

predisposal management is also provided in the *Safety Guide for the Predisposal Management of Radioactive Waste* (ARPANSA, 2008) (the Predisposal Management Safety Guide).

The Near-Surface Disposal Code requires that an operator establish a radiation management plan before the commencement of disposal operations. This must meet the requirements of, and be approved by, the regulator. The purpose of this plan is to establish management practices and procedures to ensure no unacceptable risk to employees or members of the public during waste handling, packaging and disposal operations. The radiation management plan must address operational aspects of radiation safety. The plan must also address personnel training, personnel monitoring, maintenance of records, monitoring within the operational area of the facility, designation of areas of potential radiation exposure, emergency preparedness, contamination control and protective clothing and apparatus. The radiation management plan must be reviewed by the operator at approximately three-yearly intervals during the period of operation, and the operator shall submit a publicly available report detailing this review to the regulator.

Some waste at abandoned mine sites has also been regulated according to the Near-Surface Disposal Code. A technical report describing the methodology used to calculate the activity concentrations in the Code has been published (*Classification and Disposal of Radioactive Waste in Australia - Consideration of Criteria for Near Surface Burial in an Arid Area*, ARPANSA, TR152, 2010).

Radioactive waste arising from uranium mining is subject to the provisions of the Mining Code. The Mining Code requires that before the commencement of any stage of an operation to which the Code applies, a Radiation Management Plan (RMP) for that stage must be developed and presented to the regulator for approval. The Plan must be directed towards meeting the objectives of the Code and must be in accordance with best practicable technology and take into account the potential dose delivery pathways. The RMP must include a description of the operations to which it applies, and the measures that are intended to be taken to control the exposure of employees and members of the public to radiation at or from the practice including:

- demonstrated access to appropriate professional expertise in radiation protection;
- a plan for monitoring radiation exposure and for assessing the doses received by exposed employees;
- the provision of appropriate equipment, staffing, facilities and operational procedures;
- details of induction and training courses;
- record keeping and reporting;
- a plan for dealing with incidents, accidents and emergencies involving exposure to radiation; and

- a system of periodic assessment and review of the adequacy and effectiveness of procedures instituted under the Radiation Management Plan to ensure currency and to facilitate a process of continual improvement.

In some jurisdictions, requirements for radiation management plans for all uses of radioactive materials are detailed in relevant legislation. An example is *Regulation 8* of the Tasmanian *Radiation Protection Regulations 2006*.

The Mining Code also requires the operator to provide a Radioactive Waste Management Plan (RWMP) for the proper management of radioactive waste arising from the operation. Before the commencement of any stage of an operation, a RWMP for that stage must be presented to the relevant regulatory authority for approval.

This plan will include:

- an outline of the processes generating waste, and a description of the waste generated;
- a description of the environment into which the waste will be discharged or disposed, including the baseline radiological characteristics;
- a description of the proposed system for waste management including the facilities and procedures involved in the handling, treatment, storage and disposal of radioactive waste;
- prediction of environmental concentrations of radionuclides and radiation doses to people from the proposed waste management practices, including demonstration that the radiation protection requirements of this Code will be met both now and in the future as determined by the relevant regulatory authority;
- a program for monitoring the concentration of radionuclides in the environment and assessment of radiation doses to members of the public arising from the waste management practices;
- contingency plans for dealing with accidental releases, or circumstances which might lead to uncontrolled releases of radioactive waste, to the environment;
- a schedule for reporting on the operation and results of monitoring and assessments required by this plan;
- a plan for decommissioning the operation and the associated waste management facilities and rehabilitating the site; and
- a system of periodic assessment and review of the adequacy and effectiveness of procedures instituted under the Radioactive Waste Management Plan to ensure currency and to take account of potential improvements consistent with best practicable technology.

In South Australia, the criteria used by the regulator to judge the acceptability of radiation management plans relating to uranium mining are judged according to the following criteria:

- qualifications and experience of people nominated as being accessible to give advice on radiation protection matters;
- the methods of monitoring radiation exposures, the frequency of measurements, the accuracy and uncertainty of measurements, the areas to be monitored, evaluation and reporting of monitoring results;
- the specifications/capabilities and numbers of radiation monitoring equipment available as specified in the radiation monitoring plan, the number of staff engaged in carrying out the radiation management plan;
- the contents and adequacy of induction and training courses;
- the contents and adequacy of records and reports on area surveys and monitoring of personnel exposures;
- the contents and adequacy of plans for dealing with radiation accidents and incidents and accident and incident reporting mechanisms; and
- in general, the plans are assessed with consideration to the radiological risk to people and the environment from the proposed operation.

In South Australia, where waste disposal from uranium mining occurs, arrangements for ensuring that the plans are maintained throughout the required lifetimes of facilities include:

- licensees are obligated under conditions on their licence to develop radiation management plans and radioactive waste management plans as appropriate for each stage of the operation, and to implement these plans to the satisfaction of the regulator; and
- the regulator maintains surveillance of implementation of these plans and conducts site visits and inspections for this purpose.

In Western Australia, the Mt Walton East Intractable Waste Disposal Facility is operated by the Western Australian Government. An independent technical auditor is appointed in accordance with the requirements of the Near-Surface Disposal Code. A report on the maintenance of plans is presented to the independent regulatory council for determination of acceptability.

At the time of the 2009 Review Meeting it was proposed to update the NDRP by producing a consolidated second edition. The main challenges in doing this lay in the regulatory impact assessment work to be completed on any change to the NDRP. Some of this work was complex and required significant effort to resolve (mainly in areas of non-ionising radiation protection). These difficult areas delayed other amendments where the impact assessment was not so complex. Consequently, the Radiation Health Committee decided to advance the NDRP by preparing individual amendments rather than a consolidated second edition. Four

amendments have been adopted into the NDRP since the last Joint Convention review meeting. A fifth amendment (relating to justification for non-ionising radiation and introduction of codes of practice for veterinary and chiropractic radiography) is currently at the final stage of Ministerial approval. Other amendments are at various stages of preparation, including development of regulatory impact assessment prior to consultation.

A draft of new disposal and discharge limits to replace the *Code of Practice for the Disposal of Radioactive Wastes by the User (1985)* (NHMRC, 1986) has been prepared. In order to revise existing regulations in line with these new limits, a new Schedule for the NDRP to introduce these updated disposal and discharge limits is required. A cost/benefit analysis of the impacts on stakeholders of the proposed Schedule and other possible options to achieve the same objective (such as self-regulation) is also required. The assessment and the proposed Schedule will then be subject to a public consultation process. The outcomes of the consultation will then be used to review the proposal to create a final draft. Before incorporation into the NDRP, Ministers for Health from all jurisdictions must approve the proposed Schedule. Once the Schedule is part of the NDRP all jurisdictions must adopt it into their existing regulatory frameworks. It is expected that incorporation into the NDRP will be completed within the next 12 months; however, adoption into regulations across the various jurisdictions is a longer process.

In December 2009, the NDRP was amended to exclude unmodified concentrations of radionuclides in most raw materials from regulatory control.

In 2008, a *Safety Guide for the Predisposal Management of Radioactive Waste* was published by ARPANSA. As this is a guidance document, it will not be referenced in the NDRP for national adoption. As a result the use of the guidance will be up to individual regulators and licensees. This Safety Guide is an important benchmark for jurisdictional implementation of best practice. It is expected that licensees would use this Safety Guide when developing their radioactive waste management plans.

In relation to regulating producers of radioactive waste, Australian regulators apply a variety of policies aimed at minimising and controlling waste. These variously include:

- periodic inspections of licensees premises containing waste;
- the use of trusts to fund continued storage of radioactive material where licensees become bankrupt;
- *in situ* management of wastes arising from uranium mining;
- inclusion of proposed disposal arrangements with licence applications for a new source;
- approvals for relocation of sources;
- no retention of radioactive waste by licensees, or disposal as soon as possible;
- on-going use of sources that remain in sound physical condition;

- use of third parties to assist with meeting disposal requirements, preparation of management plans;
- sustainable management of radioactive waste using national exemption limits, IAEA principles, and providing guidance to assist licensees acquire the necessary knowledge and skills to manage waste;
- minimal retention periods of sealed sources after they are no longer required;
- maintaining records of radioisotope use and disposal;
- development of management plans that include waste disposal; and
- assessment of the ability of the operator to adequately manage radioactive wastes as part of the licensing process.

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*.

Strategies for the management of radioactive waste are incorporated as provisions of the *Radiation Protection Act* (NT). A radiation protection plan is required for all licensees who possess radioactive waste. Storage and disposal of all radiation sources must form part of each radiation protection plan and assistance is 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.

Radioactive waste management practices

Radioactive waste management practices are largely unchanged since the 2008 National Report. In accordance with a national protocol of 2004, Tasmania has completed an audit of its waste holdings. Victoria is nearing completion of an audit of materials secured by the Victorian Health Department at its Interim Storage Facility.

Low- and intermediate-level radioactive waste continues to be stored by Australian, state and territory government regulators and licensees at over one hundred locations around Australia in both rural areas and urban centres.

The Commonwealth Government's legislation providing for a national radioactive waste management facility is currently under consideration in the Federal Parliament. It is estimated that once legislation is enacted, it will take at least six years to site, construct and licence the facility for operation. Some of this time will be committed to nuclear and environmental regulatory processes under the EPBC Act and the ARPANS Act. Charging arrangements for use of the National Radioactive Waste Management Facility will be considered once the legislative basis for establishing the facility is available.

Although all Australian regulators have small stores of abandoned sources, legacy wastes or wastes that have arisen within their jurisdiction, many individual producers currently have

responsibility for managing their own radioactive waste. As a result, most users of radioactive materials are encouraged to return disused sources to the supplier. If this is not possible, licensees are expected to store their radioactive waste until it decays to a point at which it is no longer radioactive, or until such time as an appropriate avenue for disposal becomes available. In the case of Western Australia, a near-surface and bore-hole waste facility at Mt Walton East is available for holders of radioactive materials regulated by the Western Australian regulator. The Environmental Protection Authority's licence conditions issued for the Mt Walton East Intractable Waste Disposal Facility include the restriction that only waste generated within Western Australia may be disposed at the site.

Across Australia the re-entry or transit of sealed sources is permitted for ultimate return to the supplier and, in some instances, for recycling or disposal to a licensed waste disposal facility.

ANSTO manages wastes arising from its research reactor operation, radio-isotope production and research activities according to nationally and internationally accepted criteria. ANSTO currently conditions waste and minimises volumes by releasing decayed material that is below criteria for clearance from regulatory control, and by super-compaction of some drummed low-level waste (LLW).

Criteria used to define and categorise radioactive waste

The 2007 Integrated Regulatory Review Service (IRRS) mission to the Commonwealth of Australia recommended the development of a national classification system for radioactive waste.

Radiation Protection Series publication No.20 *Safety Guide Classification of Radioactive Waste (2010)* was published in 2010. This Safety Guide is based on the IAEA *General Safety Guide Classification of Radioactive Waste* (GSG-1) (IAEA, 2009), adapted for the Australian situation.

As the guidance is advisory, its introduction by radiation regulators could have occurred as soon as publication took place in 2010. Jurisdictions have indicated their intention to adopt the scheme but estimated implementation timeframes vary.

A categorisation of radioactive waste based on Australian holdings has also been developed as part of the Predisposal Management Safety Guide. The six categories are as follows:

- devices containing low levels of long-lived alpha emitters (dials and luminous devices containing radium and smoke alarms containing americium);
- devices containing higher levels of long-lived alpha emitters (radium needles and tubes, neutron sources);
- disused sealed sources of low radioactivity (<100 MBq) and gaseous tritium light sources;
- disused sealed sources of higher radioactivity (>100 MBq);

- laboratory waste; and
- residues from industrial processing and waste from remediation of contaminated sites.

Currently, in most cases, wastes are categorised for management purposes as long-lived or short-lived, liquid or solid, and sealed and unsealed. In some jurisdictions, waste is regulated according to whether it complies with the User Disposal Code (very low-level waste) or if not, then under a special licence.

While there is as yet no national protocol for clearance in Australia, uniform provisions for exemption, based on international guidance from the IAEA (BSS 115), have been adopted by all jurisdictions as part of the NDRP. However, the provisions in the NDRP do not explicitly deal with bulk quantities of raw material, as might be encountered in the mining industries. An amendment to ensure application of exemptions to bulk quantities of raw material has been proposed for adoption in the NDRP. Exposures that are not amenable to control are excluded**.**

Section D – Inventories and Lists

Article 32 Reporting (2)

List of spent fuel management facilities

The spent fuel management facilities for the reactor are described in Section C of this report.

The licence issued by the Commonwealth Government regulator for ANSTO's fuel operations requires monitoring and inspection of all spent fuel facilities.

Spent fuel inventory

Material description	*Number**	*Mass of Uranium (total) kg*
OPAL spent fuel elements	104	212.5

***** As at 07/06/2011

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 31/08/2011).

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

In addition, 150 spent fuel elements from HIFAR were sent to the UKAEA in 1963 and 729 spent fuel elements (715 from HIFAR and 14 from MOATA) have been sent to the USA under the Foreign Research Reactor Spent Nuclear Fuel (FRR-SNF) program for which there is no requirement for the return of waste to Australia.

Radioactive waste management facilities

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 for interim 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's radioactive waste management facilities comprise:

- a low-level solid waste store;
- a decontamination centre;
- a low-level solid waste compaction facility;
- a low-level liquid waste treatment facility;
- a delay and decay facility for decay of short-lived waste;
- an intermediate-level liquid waste storage and treatment facility;
- a 'hot cells' facility;
- an intermediate-level solid waste store facility; and
- a 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 (both radioactive and non-radioactive) up until 1968.

ARPANSA has a small waste store located at its Yallambie, Victoria premises.

CSIRO has a number of small stores for waste at its laboratories around Australia (Black Mountain, Belmont, Clayton, North Ryde, University of Queensland - Gatton, Armidale, Rockhampton, Parkville, Aspendale, Pullenvale, Lucas Heights and Woodville).

A store for Commonwealth radioactive waste is located at Evatt's Field on the Woomera Prohibited Area, South Australia. It contains large quantities of lightly contaminated soil.

There is a non-operational store for radioactive materials collected from the community, hospitals, industry and educational institutions in New South Wales. The store is a registered premise under the provisions of the *Radiation Control Act 1990* (NSW).

Victoria has an interim store that contains a variety of radioactive material surrendered to the regulator by the owner of the material or seized by the regulator for safe keeping over the past approximately 25 years. The materials in the facility can be considered as waste in that it is unlikely that there will be any further use for the materials.

Tasmania has an interim store for some legacy radioactive waste from industry and medicine.

The current storage facility for radioactive waste generated in the Northern Territory is a secure room at Royal Darwin Hospital.

In the Australian Capital Territory, the Health Protection Service has a radioactive waste store located at Holder. This store is designed for holding radioactive waste before disposal. The waste store has been at capacity for a number of years. The store is located in open space at the rear of the premises and consists of a locked steel box that is mounted on a concrete slab and enclosed within a secure compound. A list of sources and an audit report for the radioactive waste store were completed in late 2010.

Wastes from current mining operations and past practices include:

Mining operation	***Waste structures***
Ranger Mine (NT) - operational	Tailings dam, evaporation ponds, and solid waste disposal stockpiles.
Beverley Uranium Project (SA) - operational	Evaporation ponds, liquid waste re-injection wells and low-level radioactive waste disposal facilities
Honeymoon Uranium Project (SA) - operational	Evaporation ponds, liquid waste re-injection wells and low-level radioactive waste disposal facilities.
Olympic Dam Uranium Project (SA) – operational	Tailings dams, associated evaporation ponds and a solid waste disposal pit.
Port Pirie Plant (SA) – past practice	Uranium and thorium tailings dams
Radium Hill Mine (SA) – past practice	Tailings and a low-level waste repository

In relation to abandoned tailings in the South Alligator region of the Northern Territory, the licence holder (Parks Australia North) has completed a new near-surface containment facility at El Sherana for uranium mining and milling tailings (UMMT) and contaminated materials.

The purpose-built radioactive waste facility owned by the Queensland State Government is a store only. Queensland's radioactive waste store is operated by Queensland's radiation regulatory authority under the scrutiny of the Queensland Radiation Advisory Council, an independent ministerial advisory body, and the Management Advisory Committee, a public interface committee that advises the Queensland Minister. The purpose of the store is to provide safe and secure storage for radioactive substances which have outlived their useful service and which cannot be disposed of at this time. The facility is located in South East Queensland in the Somerset Region. 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 10 μSv per week at and beyond the boundary of the site;
- radiation detectors located inside the store are used to continuously monitor radiation levels; and

- adequate security is provided at the store.

The waste store holds the total amount of radioactive waste throughout Queensland, excluding radionuclides with a short half-life (i.e. less than 5 years).

The Western Australian regulator oversees a radioactive waste store, which is situated on the Queen Elizabeth II (QEII) Medical Centre Site at Sir Charles Gairdner Hospital in Perth. 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 Intractable Waste Disposal Facility. The store is located within a fenced, locked compound and is linked to the 24-hour security of the QEII Medical Centre.

Mt Walton East Intractable Waste Disposal Facility

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

The Mt Walton East Intractable Waste Disposal Facility site was chosen based on criteria detailed in the report *Site Investigations for Repositories for Solid Radioactive Waste in Shallow Ground*, (TRS No 216, IAEA, 1982). The site became operational in 1991. All aspects of the design, operational requirements, duties and responsibilities must comply with the *Radiation Safety (General) Regulations 1983* (WA) and the Near-Surface Disposal Code.

Radioactive waste management inventory

Australia has approximately 3823 m^3 of unsealed low-level radioactive waste within civilian programs awaiting disposal. This total consists of the following approximations:

- 2100 m^3 of lightly contaminated soil from ore-processing research;
- 1710 m^3 of operational waste stored at the ANSTO site; and
- 13 m^3 of miscellaneous waste including contaminated items, medical equipment and luminous signs.

It should be noted that these figures are estimates of waste volumes for disposal. Waste already disposed of at the Mt Walton East Facility in Western Australia, El Sherana in the Northern Territory, Maralinga in South Australia and the Little Forest Burial Ground near ANSTO, New South Wales, is not included in the above volume estimates.

The current estimated inventory of intermediate-level radioactive waste in the jurisdiction of the Commonwealth Government consists of a waste volume of approximately 437 m^3. Of this:

- 256 m^3 is from irradiation cans, ion exchange resins (HIFAR and OPAL), irradiated aluminium cut from HIFAR spent fuel assemblies, HIFAR coarse control arms and general waste from radiopharmaceutical production;
- 165 m^3 is uranium and thorium residues stored at ANSTO; and
- 6 m^3 is liquid waste from production at ANSTO of Mo-99 for radiopharmaceuticals.

Refer to Annex A for tables of the inventory of radioactive waste stored in facilities in Australia and waste disposed of in the Little Forest Burial Ground, El Sherana, Maralinga and Mt Walton East facilities. These data have been supplied by the relevant regulatory authority with responsibility for maintaining the inventories of radioactive waste in their jurisdictions. It should be noted that these tables have not incorporated volumes of sealed sources, sources of unknown activity and sources of unknown radionuclides. Where the activities of waste with mixed radionuclides could be apportioned to individual nuclides, this was done. Inventories of sealed sources requiring disposal, radioactive waste in storage at ANSTO's radioactive waste management facility and of wastes from the mining and milling of radioactive ores are also supplied.

Nuclear facilities in the process of being decommissioned

The second (partial dismantling) and third (complete dismantling) stages of decommissioning MOATA were undertaken sequentially. The second stage entailed the removal of:

- control rod assemblies;
- the graphite moderator/reflector;
- aluminium core tanks and associated pipework;
- the steel core support frame; and
- the lead gamma curtain.

The removal of these active core components allowed accurate measurements of the activity of the inner surfaces of the concrete bioshield, which was dismantled in the third stage. Post-dismantling surveys showed radioactivity at background levels, and the site has now been released from regulatory control.

HIFAR, a 10 MW research reactor, was shut down in January 2007. In September 2008, ARPANSA granted ANSTO a licence to possess and control the facility for a safe enclosure period (anticipated to be around 10 years), following which a licence application to decommission the reactor is anticipated.

Section E – Legislative and Regulatory System

Article 18 Implementing Measures

Each of Australia's jurisdictions has in force an Act of Parliament establishing a framework that includes regulation of the safety of radioactive waste management and, in the case of the Commonwealth Government, the safety of spent fuel management.

Each Act establishes an authorisation system for the management of radioactive material, a regulatory authority, inspection and enforcement provisions and authorises the making of safety standards in the jurisdiction that enacted the legislation. In the case of the Commonwealth Government, the licensing system includes management of spent fuel.

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

Details of the legislative and regulatory framework and regulatory body for each jurisdiction are contained below under Article 19. Annex B contains a list of the statutory instruments currently in force.

In terms of factual compliance, Australian jurisdictions are continuing to work together to further develop and implement a uniform national set of policies and practices for the safety of radioactive waste management. In accordance with the ARPANS Act, the CEO of ARPANSA and the Radiation Health Committee are promoting nationally uniformity in radiation protection and nuclear safety, including radioactive waste management, through the development of the NDRP. Codes and standards relevant to radioactive waste management developed as part of the NDRP have been adopted by Australian jurisdictions into existing regulatory frameworks.

The ARPANS Act contains provisions for the licensing of nuclear installations that include facilities for the management of spent fuel, and for the storage or disposal of wastes arising from the reprocessing of spent fuel.

Since 2006, the Radiation Health Committee, which includes radiation regulators from each jurisdiction, decided to progress national uniformity by individual amendments to the NDRP, rather than producing a consolidated 2nd edition. Once all jurisdictional Ministers have approved an amendment, regulatory elements must be adopted by jurisdictions as soon as possible. Four amendments have been made to the NDRP since 2006 and the regulatory elements are being implemented across Australia.

In relation to radioactive waste management, the amendments include the inclusion of the *Code of Practice for Radiation Protection in Mining and Mineral Processing* (ARPANSA, 2005) and clarification of the application of exemption and exclusion provisions of the NDRP to bulk materials.

Assessment of compliance

The current legislative framework in conjunction with the implementation of the relevant elements of the NDRP by each of the jurisdictions demonstrates that Australia complies with the Joint Convention. A review recently completed on the effectiveness of the NDRP in achieving national uniformity has found that there is a high level of alignment but that the process is still incomplete. The report on the effectiveness review and the advice to the CEO of ARPANSA from the Radiation Health and Safety Advisory Council can be found on the ARPANSA web site[6].

The Radiation Health Committee, which includes radiation regulators from each jurisdiction, is continuing to develop the NDRP, with a range of amendments currently at different stages of progress. The NDRP is a dynamic document that will evolve over time as more nationally agreed positions are reached by jurisdictions.

The CEO of ARPANSA is charged with the responsibility of promoting national uniformity, and there is inter-governmental agreement to adopt the NDRP in each jurisdiction. Implementation of radiation protection legislation and compliance enforcement is however, ultimately a matter for each jurisdiction.

In order to facilitate better alignment of radiation protection legislation across Australia, ARPANSA hosts a radiation regulators forum, which is working towards creating common strategies for implementation of the regulatory elements of the NDRP.

The National Radioactive Waste Management Bill 2010 currently before the Federal Parliament ensures the ARPANS Act must be complied with in the siting, construction and operation of the National Radioactive Waste Management Facility.

The Bill has not reproduced the regulatory and administrative measures for implementing Australia's obligation under this Joint Convention. This approach is consistent with the IAEA's *Handbook on Nuclear Law Implementing Legislation*[7] which provides that "general provisions, such as basic initial provisions on scope, objectives and definitions, as well as those on the role of the regulatory body, radiation protection and regulatory functions, need not be repeated if the subject of radioactive waste and spent fuel are treated in another part of a comprehensive law".

Article 19 Legislative and Regulatory Framework

The *National Directory for Radiation Protection* (ARPANSA, 2011) provides for the development of legislation in each Australian jurisdiction consistent with the general principles for regulatory frameworks. The NDRP contains the agreed *de minimus* regulatory requirements to be implemented by all jurisdictions.

[6] http://www.arpansa.gov.au/Publications/RHSAC/rhsac_stat.cfm#ndrp

[7] http://www-pub.iaea.org/MTCD/publications/PDF/Pub1456_web.pdf.

The objective of Australian radiation protection legislation includes protection of the health and safety of people and the environment from the harmful effects of ionising and non-ionising radiation.

The legislation current in each jurisdiction:

- establishes a regulatory body accountable to a Minister of the Crown and through that Minister to the Parliament;
- includes requirements to comply with accepted national standards for occupational exposure limits, 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.

There is an additional national regulatory framework for protection of the environment established under the EPBC Act[8].

Northern Territory

The legislative and regulatory system is covered by five Acts, as follows:

I. *Radiation Protection Act*;
II. *Mining Management Act*;
III. *Dangerous Goods Act*;
IV. *Radioactive Ores and Concentrates (Packaging and Transport) Act*; and
V. *Workplace Health and Safety Act*.

The *Radiation Protection Act* is based on the National Framework for Radiation Protection, as contained in the *National Directory for Radiation Protection, Edition 1.0*. The Radiation Protection Section of the NT Department of Health administers the *Radiation Protection Act* on behalf of the Chief Health Officer. The Act relates to the control, regulation, possession, use and transport of radioactive material and radiation apparatus.

Safety requirements and regulations for radiation safety in Australia

The regulatory frameworks in each jurisdiction meet the objective identified above through the following principles and requirements:

1. Radiation protection principles including justification of practices to ensure that benefits outweigh the detriment, limitation of radiation doses to individuals from all practices, and

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

optimisation of protection and safety so that individual doses, the number of people exposed and the likelihood of exposure are all kept as low as reasonably achievable, economic and social factors being taken into account.

2. Management requirements to provide for responsible persons to establish a safety culture, establish quality assurance programs, reduce the probability of human error leading to accidents, make appropriate training and information available to staff, allocate sufficient resources to enable safety and security of radiation sources over their lifetime (including disposal), and provide the qualified expertise necessary to observe the requirements.

3. Technical requirements such as shielding design and interlocks as necessary, to ensure that radiation sources remain within control and are secure from theft or damage. Defence-in-depth measures in facility design and operating procedures, which are intended to prevent accidents, to mitigate the consequences of accidents and to restore safety should an accident occur. Also good engineering practice to be followed throughout the life (siting, design, construction, operation and decommissioning) of a facility.

4. Processes for verification of safety and security, which involve safety assessments to identify and determine the magnitudes of radiation exposures during normal operation and accidents, and to assess the provisions for protection, safety and security. Establishment of procedures and equipment required for monitoring operations and certifying compliance with safety requirements and standards.

5. Maintenance of appropriate records and reports.

6. Risk management principles, which include a broader evaluation of risk assessment and take into account not only scientific data but also social and economic considerations.

7. Intervention actions for accidental or abnormal exposure situations requiring protective action to reduce or avert radiation exposures, or their likelihood.

Nationally accepted standards are imposed in each jurisdiction by way of Regulations made under the relevant Act that established the jurisdiction's regulatory framework. Standards may also be imposed as specific conditions of licence or registration. Below is a schedule identifying the standards relevant to radioactive waste management and spent fuel management by subject and the IAEA or ICRP equivalent where applicable.

Regulatory subject	Australian code or standard	International equivalent
Occupational exposure and dose limits	*Recommendations for Limiting Exposure to Ionising Radiation*, *National Standard for Limiting Occupational Exposure to Ionising Radiation* (Printed 1995 - Republished 2002)	ICRP Publications 60 and 103, and the new BSS

Regulatory subject	Australian code or standard	International equivalent
Transport of radioactive material	*Code of Practice for the Safe Transport of Radioactive Material* (2008)	IAEA *Regulations for the Safe Transport of Radioactive Material* 1996 Edition (Revised 2000)
Mining and milling of radioactive ores	ARPANSA *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (2005).	IAEA *Management of Radioactive Waste from the Mining and Milling of Ores* (2002), IAEA *Occupational Radiation Protection in the Mining and Processing of Raw Materials* (2004) and IAEA *Application of the Concepts of Exclusion, Exemption and Clearance* (2004)
Disposal of radioactive waste	*Code of Practice for the Disposal of Radioactive Wastes by the User* (1985), *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (1992)[9]	IAEA Safety Requirements *Near Surface Disposal of Radioactive Waste*, Safety Standards Series No. WS-R-1, 1999; superseded by IAEA Specific Safety Requirements *Disposal of Radioactive Waste*, No. SSR-5, 2011.

The User Disposal Code was promulgated by the NHMRC in 1985 and is used by all Australian jurisdictions for disposal by air, water, landfill and incineration. The Code is being replaced with a new schedule for the NDRP which will update levels by introducing uniform disposal limits for radionuclides that were not in use at the time of writing the 1985 Code and brings other provisions up to date in terms of current exposure models. The proposed schedule will include discharge limits to air and water that were not part of the Code. Discharge limits currently included in legislation vary considerably across jurisdictions.

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

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

The practices to which the relevant legislation in each of the nine Australian jurisdictions applies include:

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

- the manufacturing or possession of radiation sources;
- the use of radiation or radioactive materials for any practice which involves or could involve exposure to radiation or radioactive materials including medical, dental, industrial, veterinary and agricultural purposes, in consumer products, education, training, research, or the servicing and maintenance of radiation apparatus or sealed sources;
- nuclear installations and radiation facilities identified in the NDRP, the preparation of a site, possession or control, construction, operation, decommissioning or disposal of an installation of facility;
- practices involving exposure to natural sources specified by the Regulator as requiring control;
- practices dealing with radioactive material arising from exploration, mining, mineral processing or petroleum industries;
- practices involving radioactive waste management and the disposal of radioactive material;
- sale or transfer of responsibility of ionising radiation sources identified in the *National Directory for Radiation Protection* (ARPANSA, July 2011);
- transport of radioactive material; and
- any other radiation related practice specified by the Regulator.

Under the Western Australian *Nuclear Waste Storage and Transportation (Prohibition) Act 1999*, certain types of 'nuclear installation' are prohibited in that state.

Guidance for deciding whether natural sources should be controlled is provided in the *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM)* (ARPANSA, 2008), which is consistent with the IAEA Safety Reports Series No. 49 *Assessing the Need for Radiation Protection Measures in Work Involving Minerals and Raw Materials* (2006). The ARPANSA Safety Guide discusses the issue of identifying NORM situations that may require control. This does not apply to undisturbed ore-bodies or areas of high natural background. The application of the exemption and exclusion limits in the NDRP also contributes to decisions on the control of natural sources.

The administration of radiation control legislation in each jurisdiction is the responsibility of the regulator in each jurisdiction. The legislation in each jurisdiction provides the following powers and functions to the Regulator with respect to the management of radioactive waste and spent fuel:

- advise the Minister on radiation protection and nuclear safety matters;
- set standards for radiation protection, and safety and security of radiation sources;
- assess applications for authorisations against criteria specified in the appropriate Act or Regulations;

- grant, refuse, vary, revoke or suspend authorisations and impose conditions on these authorisations;
- grant exemptions from regulatory requirements and determine conditions for exemptions;
- ensure a system of periodic inspections, documentation and reporting to verify compliance with regulatory requirements;
- enforce compliance with regulatory requirements;
- require safety assessments and environmental assessments where appropriate;
- accredit persons or classes of persons to assess compliance with the requirements of the legislation, and set the conditions to which they should be subject;
- maintain a register of radiation sources, including requirements for amendment of the register;
- plan for, and give directions in the case of, a nuclear or radiological emergency;
- require notification of radiation incidents to the Regulator;
- investigate radiation incidents and provide reports to ARPANSA for inclusion in the Australian Radiation Incidents Register;
- promote or conduct studies, investigations and research associated with radiation protection and nuclear safety, including public health and safety and environmental considerations; and
- prepare an annual report for tabling before the Parliament.

Registration and licensing are the principal means by which the use of radiation is regulated in Western Australia. The *Radiation Safety Act 1975* (WA) requires prescribed radioactive substances, X-ray equipment and electronic products, together with the associated premises, to be registered. Registrants may include individuals, companies, organisations or institutions. The Act further requires persons who manufacture, store, transport, sell, possess, install, service, maintain, repair, use, operate or otherwise deal with prescribed radioactive substances, X-ray equipment or electronic products to be licensed or, where permitted, to work under the direction and supervision of a licensee. Mining operations for the mining and milling of radioactive ores are covered by both the *Radiation Safety Act 1975* (WA) and its subsidiary legislation, and also Part 16 of the *Mines Safety and Inspection Regulations 1995*. The relevant ARPANSA codes are adopted either directly into legislation or into conditions on licences and registrations.

ANSTO waste and spent fuel

As previously reported, regulation of spent fuel is only undertaken within the Commonwealth jurisdiction by the Commonwealth Government regulator, the CEO of ARPANSA. Commonwealth Government legislation prohibits dealing with controlled material or conduct

relating to a controlled facility without a licence. Spent fuel management is regulated under a facility licence authorising the operation of the relevant facilities.

For Commonwealth use of radiation, including spent fuel management, the CEO of ARPANSA must take into account the following significant matters in deciding whether to issue a licence:

- international best practice in relation to radiation protection and nuclear safety as it relates to the licence application;
- 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;
- whether the applicant has shown that there is a net benefit from carrying out the conduct relating to the controlled facility;
- 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;
- whether the applicant has shown a capacity for complying with these regulations and the licence conditions; and
- the content of any submissions made by members of the public about the application.

Radioactive ores

Radiation protection regulation of the mining and milling of uranium ores is undertaken by radiation regulators in the States and Territories where such ores are mined – South Australia and the Northern Territory and, prospectively, Western Australia.

Ores are defined in the legislation of South Australia as being radioactive if they contain more than 0.02% uranium or 0.05% thorium by mass. In South Australia, waste from ore processing is not considered radioactive waste unless these limits are exceeded.

In the case of solid wastes originating within the supervised area of uranium mining or milling operations in South Australia, all waste is designated as radioactive waste unless clearly demonstrated otherwise. For example, for recycling, it must be shown to have a specific activity no greater than 35 kBq/kg. Alpha surface contamination levels must also be below an approved value. Any waste not meeting these criteria is disposed of on-site according to the approved Radioactive Waste Management Program.

Any disposal of radioactive waste in South Australia requires approval of the South Australian Minister for Environment and Conservation, or the Minister's delegate within the South Australian Environment Protection Authority.

In the Northern Territory, it is an offence to dispose of radioactive waste without a licence to do so. Exemption levels for radioactive material are taken from the NDRP. Only disposal according to Australian Codes of Practice is licensable.

Institutional control and regulatory inspection

Through the NDRP, users of radioactive materials, including radioactive waste, are subject to the responsibilities detailed in RPS1. The requirements to meet these responsibilities can be summarised as follows:

1. A plan for the management of radiation safety in planned situations for occupational and public exposures that must address the following:
    - Approvals and Authorisations
    - Radiation Management Plan
    - Control of Exposure
    - Monitoring Radiation Exposure
    - Incidents Accidents and Emergencies
    - Induction and Training
    - Record Keeping and Reporting
    - Assessment and Compliance
2. The management of radiation safety for medical exposures
3. Radiation safety in emergency situations
4. Radiation safety in existing situations

In accordance with Regulation 63 of the ARPANS Regulations, ARPANSA has published guidelines[10] on how Commonwealth licence holders will report their compliance with the Act, the Regulations and licence conditions.

Part 7 of the ARPANS Act prescribes powers available to the agency to conduct inspections[11] to monitor and enforce compliance with the Act, its Regulations[12] and licence conditions.

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

[10] These guidelines can be found at http://www.arpansa.gov.au/pubs/regulatory/licenceholders/Compliance.pdf

[11] A copy of ARPANSA's inspection policy is also available for viewing at http://www.arpansa.gov.au/pubs/regulatory/licenceholders/inspection_policy.pdf

[12] A copy of the ARPANS Act and Regulations is available at http://www.arpansa.gov.au/Regulation/Legislation/index.cfm

ANSTO waste and spent fuel

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

- The licence holder must investigate suspected breaches of licence conditions. If a breach is identified, the licence holder must rectify the breach and any of its consequences as soon as reasonably practicable. The licence holder must also inform the CEO about the breach as soon as reasonably practicable.
- The licence holder must take all 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.

Radioactive Ores

The mining or milling of radioactive ores in South Australia is subject to regulatory control via a licence issued under section 24 of the *Radiation Protection and Control Act 1982* (SA). Conditions attached to the licence require uranium mining operators to comply with the requirements of the Mining Code and RPS1.

Companies in South Australia 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 South Australian radiation regulator is responsible for granting approvals under the Mining Code. In its assessment of applications for approval of waste management plans and waste disposal facilities, the South Australian radiation regulator consults with the South Australian mining regulator that issues a mining lease under the *Mining Act 1971* (SA).

In the case of radioactive wastes remaining from mining or processing of radioactive ores that ceased prior to the introduction of the South Australian *Radiation Protection and Control Act 1982*, legislative control is achieved via registration of the sites as premises under the *Radiation Protection Control Act 1982*.

Mt Walton East Intractable Waste Disposal Facility

The safety of the Mt Walton East Intractable Waste Disposal Facility in Western Australia is assessed regularly, as required by the conditions of registration, in particular the requirement for a technical auditor and the ongoing requirement for monitoring. The monitoring is undertaken by an approved licensed 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 any other factors of radiological concern after any site changes, including the receipt of material for disposal and sealing of the trenches.

Enforcement of legislation and licence conditions

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

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

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

Legislation in each Australian jurisdiction enables the regulator to suspend, vary or cancel an authorisation if there is evidence to suggest that:

- the authorisation was obtained improperly;
- the holder of an authorisation has contravened a condition of the authorisation;
- the holder of an authorisation has been convicted of an offence against the legislation under which the authorisation was granted, or other relevant legislation;
- unless the authorisation is suspended, varied or cancelled there would be a risk to the health and safety of people and the environment;
- the holder of an authorisation ceased to hold a qualification or meet other criteria which formed the basis on which the authorisation was granted;
- the holder of an authorisation has consistently made decisions that compromised radiation safety; or
- the holder of an accreditation has ceased working in a capacity for which accreditation is required.

Where an Australian regulator makes a decision to suspend, vary or cancel an authorisation, it advises all other relevant regulators within and outside of its jurisdiction of the decision.

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

ANSTO waste and spent fuel

The Commonwealth Government regulator ARPANSA considers the following in relation to enforcement action:

- risk-informed approach and the hazard category of the facility;
- breaches or history of non-compliance;
- failure to comply with regulatory and safety requirements; and
- incidents, accidents and abnormal occurrences and the corresponding trend analysis.

Radioactive ores

Uranium mining operations are periodically inspected by the South Australian radiation regulator, and quarterly meetings are held to review safety of operations, including radioactive waste management. Qualified staff and financial resources are provided by the Northern Territory Government for a program of inspections.

Mt Walton East

For the Mt Walton East Facility in Western Australia, the site operator must hold a registration under the *Radiation Safety Act 1975* (WA). The conditions imposed on the registration cover aspects of packaging, transport, radiation monitoring, operational requirements and reporting. Direct reference is made to such documents as the *Radiation Safety (General) Regulations 1983*, *Code of Practice for the Safe Transport of Radioactive Material* (ARPANSA, 2008), the Near-Surface Disposal Code and IAEA Technical Reports Series 376 *Quality Assurance for Radioactive Waste Packages* (1995). Additionally reference is made to documentation specifically developed for Mt Walton East.

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

Assignment of responsibilities

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

In jurisdictions where mining of radioactive ores takes place, radiation regulation can be undertaken in conjunction with regulators of mining and transport. For example, in South Australia 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 South Australian radiation regulator is responsible for granting approvals under the Mining Code. In its assessment of applications for approval of waste management plans and waste disposal facilities, the radiation regulator consults with the mining regulator that issues a mining lease under *Mining Act 1971* (SA). Mining operations are periodically inspected by the radiation regulator, and quarterly meetings are held to review safety of operations, including radioactive waste management.

In the Northern Territory, regulation of the mining of uranium ores is undertaken by the mining regulator in accordance with the *Mining Management Act* (NT) which targets protection of the environment. The Act requires operators to follow best practice, and companies by default use the ARPANSA *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (2005).

The Northern Territory *Workplace Health and Safety Act*, administered by NT WorkSafe, deals with the occupational health and safety of workers. Transport of radioactive material from a mine site is administered under the *Radioactive Ores and Concentrates (Packaging and Transport) Act* (NT*),* again administered by NT WorkSafe.

Assessment of compliance

Australia has a well-developed legislative and regulatory framework and a process to encourage national uniformity between Commonwealth and state and territory regulators. The legislative and regulatory frameworks are consistent with the objectives of the Joint Convention.

Article 20 Regulatory Body

Regulatory authorities responsible for implementing the legislative framework

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

The majority of licensees in State and Territory jurisdictions are medical users of radiation sources. The Commonwealth regulates medical use of radiation sources by the Australian Defence Force. The staffing of radiation protection regulators in each jurisdiction varies from 2 up to about 20 staff depending on the population and scale of operations within that jurisdiction. Staff members possess the experience, skills and knowledge needed to undertake their regulatory activities.

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

- Commonwealth: the Australian Radiation Protection and Nuclear Safety Agency;
- New South Wales: the Office of Environment and Heritage;

- Queensland: Queensland Health;
- South Australia: Environment Protection Authority;
- Tasmania: Department of Health and Human Services;
- Victoria: Department of Health;
- Western Australia: Radiological Council;
- Australian Capital Territory: Health Protection Service; and
- Northern Territory: Department of Health.

Jurisdiction	***Approximate number and type of licensees/licences***	***Regulator and radiation protection regulatory body***	***Number of staff in the regulatory body***	***Expertise of regulatory staff***
Commonwealth	90 licences (~60 source and ~30 facility) including for defence forces, a radiopharmaceutical production facility, 2 research reactors (1 operating, 1 shutdown)	CEO of ARPANSA, Operations Services	37	20 regulatory scientists and engineers, 11 policy, 6 administrative
South Australia	3 uranium mines licensed to mine or mill radioactive ores. 1 uranium mine licensed to conduct developmental testing of a process. 157 registered premises where unsealed radioactive substances are handled or kept. 636 registered sealed radioactive sources. 969 individuals licensed to use or handle radioactive substances.	Minister for the Environment and Conservation, Environment Protection Authority, Radiation Protection Division	14	12 scientific and technical, 2 administrative and clerical staff
New South Wales	20 000 licensees (which includes 8 000 registered sources or premises)	Minister for Environment and Heritage, Office of Environment and Heritage, Hazardous Materials, Chemicals and Radiation Section.	12	7 scientific and technical, including policy, and 5 administration staff
Queensland	13400 licensees, 4750 sealed radioactive sources	Minister for Health, Queensland Health,	18	11 scientific, 7 administrative

Jurisdiction	***Approximate number and type of licensees/licences***	***Regulator and radiation protection regulatory body***	***Number of staff in the regulatory body***	***Expertise of regulatory staff***
	registered, 7300 radiation apparatus registered	Radiation Health Unit		
Tasmania	354 licences (consisting of 780 apparatus, 530 radioactive materials, 2000 authorised persons)	Director of Public Health, Department of Health and Human Services, Radiation Protection Unit	4	3 scientific and 1 administrative
Victoria	10476 operator licences, 2480 management licences	Minister for Health, Department of Health, Radiation Safety section	14	7 technical and policy staff, 7 administrative staff
Western Australia[13]	5759 licences, 1839 registered premises including 1 operating disposal facility 5125 sealed sources registered 4430 radiation apparatus registered	Western Australian Radiological Council, Radiation Health Branch	17	1 technical, 13 scientific and policy, 3 administrative
Australian Capital Territory	520 registrations, 900 licensees	Australian Capital Territory Radiation Council, Radiation Safety Section of the Health Protection Service	2	2 scientific
Northern Territory	565 licensees 619 registered apparatus 228 registered sealed sources	Chief Health Officer, Department of Health, Radiation Protection Section of Environmental Health	2.5	2 scientific, 0.5 administrative

ARPANSA regulatory staff use the IAEA Safety Culture Assessment Review Team (SCART) methodology for making judgements about the licensees' safety culture. This methodology relies upon '*safety characteristics*' which are then broken down into '*attributes*'. The *safety characteristics* are:

- safety of a clearly recognised value;
- leadership for safety is clear;

[13] As of December 31 2010

- accountability for safety is clear;
- safety is integrated into all activities; and
- safety is learning driven.

Effective independence of the regulatory function

Within all jurisdictions in Australia, there is 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 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.

In Queensland, the regulatory authority 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 Somerset Regional 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.

In Western Australia, the registration of the radioactive waste store at the Queen Elizabeth II Medical Centre Site at Sir Charles Gairdner Hospital in Perth is held by the Radiation Health Branch of the WA Department of Health. The WA Radiological Council does not own/operate the store. The Radiological Council requires a registration of premises and sources and imposes conditions on the registration.

In all other jurisdictions, the regulatory body is effectively independent of its licence holders and owners of radioactive waste, with the exception that the regulatory bodies all have some sources and store a small quantity of radioactive waste. Some jurisdictions have a form of executive management, independent of the regulatory body that can make decisions upon the safe management of facilities belonging to the regulatory body.

Assessment of compliance

Australia has an effective independence of its regulatory functions within each of the nine Australian jurisdictions responsible for the regulation of radioactive waste management and spent fuel to ensure its safe management. Australia has appropriate and adequately resourced regulatory bodies to implement the established legislative and regulatory framework.

Section F – Other General Safety Provisions

Article 21 Responsibility of the Licence Holder

Responsibility of the licence holder

In accordance with the NDRP, Australian legislation requires that a 'responsible person' be primarily responsible for radiation protection and safety.

The responsible person is defined as the person who has overall management responsibility for the security and maintenance of the sources, apparatus, installation or facility and in whose name the source, apparatus, installation and facility would be registered if required.

"Responsible person" is defined in the NDRP in such a way as to allow for the fact that there are differences in terminology in the regulations of jurisdictions regarding responsibility for particular actions. Each jurisdiction can interpret this definition in a manner consistent with the terminology adopted in its legislation. In each jurisdiction the "responsible person" is the person/entity that would be prosecuted for non-compliance within that jurisdiction.

Australia's research reactors are operated by ANSTO. ANSTO is a Commonwealth Government funded research agency and the Commonwealth Government is ultimately responsible for the organisation.

The safe-keeping and management of radioactive waste held in the Northern Territory rests with the holder of the relevant licence issued under the *Radiation Protection Act.* This Act requires a radiation protection plan, in which storage and disposal arrangements form part of the plan. Development of the plan and compliance with the plan are responsibilities defined under provisions of the Act, Regulations and approved Codes of Practice.

Responsibility when there is no licence holder

The uranium mines and milling facilities in South Australia and future facilities in the Northern Territory are/will be privately owned and any liability carried by the owner. To protect against the contingency of a private company ceasing to exist, the South Australian and Northern Territory regulatory bodies require a bank guarantee or cash deposit before operations can commence. However, the bond for the existing Ranger uranium mine in the Northern Territory is held by the Commonwealth because of its authorisation arrangements.

Dedicated facilities for storage of radioactive material in each of the jurisdictions are owned by the relevant State or Territory. The regulatory authority operates the facility on behalf of the State or Territory. Adequate resources and qualified staff are provided by the States and Territories to support the facilities.

Enforcement actions

For Commonwealth regulated entities, penalties incurred for non-compliance with the ARPANS Act are based on the provisions of the Commonwealth Criminal Code. The

imposition of penalties is the most severe enforcement action that could be taken against a licence holder and would only be resorted to if lower order enforcement action was either inappropriate, given the seriousness of the circumstances of the breach, or had not had a desired effect on the behaviour of a licence holder.

Queensland reports that a range of regulatory actions are available ranging from imposition of improvement notices, prohibition notices, seizure of radiation sources as well as revocation of licences and court action. The last prosecution in Queensland occurred in the early 1990s. The potential for seizure of radiation sources is seen as the most effective means of achieving compliance.

Assessment of compliance

Australia's legal framework provides adequate assignment of responsibilities for the safety of spent fuel management and the safety of radioactive waste management to the operators or licensees. Regulators have adequate provisions for control of orphan sources in the absence of a licence holder or other responsible party.

Article 22 Human and Financial Resources

Staffing

All jurisdictions have reported that regulatory authority staff possess the essential skills, knowledge and expertise to assess the safe management of radioactive materials and waste within their jurisdiction and to conduct the necessary inspections for regulatory compliance monitoring.

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

Recruiting qualified staff is an issue as there is a relatively small pool of qualified radiation protection and nuclear safety experts within Australia. Measures have been put in place to maintain training and professional development opportunities for younger or less experienced staff, recruit staff internationally and attract new staff through a targeted graduate recruitment program.

ARPANSA's graduate recruitment program allows recent graduates in physics, chemistry, environmental science and engineering to undergo two years training in the theory and practice of radiation protection and nuclear safety. These graduates gain experience in several aspects of environmental monitoring, ionising and non-ionising radiation, standards of medical, public and occupational radiation exposures, and the Commonwealth's regulatory framework, as well as financial and policy matters. Subject to satisfactory completion of the first year's training program, the graduates undertake 12 months of experiential learning working closely with senior staff on project-based activities aligned to ARPANSA's goals and objectives.

Within ANSTO Waste Operations and Fuel Management, staff are appropriately trained and are qualified to carry out their tasks using defined procedures and instructions. The adequacy of human resources is reviewed on an ongoing basis to ensure that operations are safe. 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.

ANSTO has an established process for succession management. During this process, successors are identified for each role (i.e. those who are 'Ready Now; Ready within 2 years; Ready 2-5 years'). If areas of deficit are identified in the 'pipeline' for core roles, ANSTO directs resources and develops a strategy to minimise this risk. The strategy may be one of intensive development for successors, a recruitment drive for this role or a combination of these methods. In 2008 ANSTO employed 12 graduates who commenced a 4 year development program. A second intake of 24 graduates was conducted in 2010. ANSTO also has development pathways available for Year in Industry students (1 year program) and Vacation students (3 month program). Each year these students are recruited for project roles and evaluated for potential future positions.

In addition, ANSTO has a 'development needs analysis' process, which is part of the Annual Performance Appraisal system. ANSTO's dedicated Safety and Radiation Protection staff deliver a range of training courses to other staff. ANSTO has 'preferred supplier' relationships with providers who consistently deliver value-add programs for those areas where they do not have internal expertise. In 2008, ANSTO began the process of capturing, retaining and transferring knowledge, in conjunction with an external organisation with specialist expertise in knowledge retention strategies. Through a combination of facilitated workshops, simple technology, and coaching sessions, a 'knowledge capsule' which collates and categorises the information is produced. This information is then used as part of ANSTO's employee development program.

Qualified staff and financial resources are provided by the Northern Territory Government for a program of inspections. This extends to decommissioning and monitoring post-closure of operations where it is appropriate.

In the case of uranium mining in the Northern Territory, there is no requirement to advise of a reduction in the number of safety related advisers under the *Radiation Protection Act* but this will be known when the principal licence is renewed.

There are extra requirements for uranium mines. Under the *Mining Management Act* (NT) the operator of a mine must ensure all workers are trained and competent to perform the work they are employed for. In the case of Ranger Mine and the Ranger Authorisation, the operator must implement a system to control radiological exposure of people. There is radiation reporting and monitoring requirements and the need for a Radiation Safety Officer as defined in the Mining Code. There is no stipulation on the number of Radiation Safety Officers or any requirement to notify of any changes. In 2007, the responsibility for health and safety on NT

mine sites was transferred from Department of Regional Development, Primary Industry, Fisheries and Resources (now Department of Resources) to NT WorkSafe. Since then radiation safety in relation to personal safety is under the jurisdiction of NT WorkSafe. There is no specific requirement for Radiation Safety Officers in the *Workplace Health and Safety Act* (NT). The Code of Practice states that 'the operator and employer must …. ensure that appropriate expertise in the fields of radiation protection and radioactive waste management is available, and appoint a Radiation Safety Officer who has qualifications and experience acceptable to the relevant regulatory authority.'

A Radiation Management Plan (RMP) which meets the objectives of the Code must be approved by the regulator. Any significant changes to the RMP must be authorised by the regulator.

In the case of other jurisdictions, a number of different approaches are used commensurate with the types of sources and expertise of the licence holder. Tasmania requires that all licence holders have radiation management plans that specify a radiation safety officer, their duties and the roles and responsibilities of all persons expected to be dealing with radiation sources. Changes to the plan or personnel specified must be approved in advance. Other jurisdictions specify in conditions of licence that adequate staffing is required or that a list of all holders of authority be provided. In remaining jurisdictions, inspection of premises to ensure necessary safety requirements are being met and an emphasis on the responsibility of licensee to comply with requirements are used.

With respect to operator capabilities, in Victoria, and in Western Australia if the support required is of a significant level, authorised practices that generate radioactive wastes are advised to access commercially available health physics support to assist with waste management.

In South Australia, radioactive waste 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 *Radiation Protection and Control Act 1982* (SA) and its Regulations.

Financial resources

The adequacy of ANSTO's financial resources is reviewed on an ongoing basis. ANSTO is a statutory body of the Commonwealth Government, so the ultimate liability lies with the Commonwealth Government. Funding of the proposed national radioactive waste management facility is a matter for the Commonwealth Government.

Financing of institutional controls and monitoring after closure

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

Assessment of compliance

Regulators have ensured that there are currently adequate resources provided to comply with this article. However, in the future there is potential for shortages of adequately trained and experienced staff due to the ageing workforce for regulators and operators. This is being addressed through the introduction of targeted graduate recruitment programs and employee development programs.

Article 23 Quality Assurance

Establishment and implementation of quality assurance programs

Australian radiation regulators monitor compliance of licensees with a variety of quality assurance programs through regular site visits. These programs include certification to ISO 9001 and ISO 14001 for spent fuel operations and radioactive waste management facilities at ANSTO and *Quality Assurance for Radioactive Waste Packages*, IAEA Technical Report Series No.376 (1995).

Large-scale operations regulated by the States and Territories operate under quality assurance systems as part of the management plan required by the regulator.

For example, periodical audits and inspections by the Northern Territory Government are conducted by Radiation Protection (NT Department of Health). Under NT legislation, this extends to inspections based on a sound knowledge of radiation risk and quality assurance of procedures that are controlled by the licence holder. Periodical inspections and audits form part of the regime for mining operations.

Assessment of compliance

Australian regulators have complied with this article by appropriately applying quality assurance programmes.

Article 24 Operational Radiation Protection

Application of the ALARA principle, adherence to dose limits and prevention of uncontrolled releases at spent fuel and radioactive waste management facilities

Public dose constraints of 0.1 mSv per annum for liquid discharges and 0.3 mSv per annum for airborne discharges are imposed on the ANSTO (Lucas Heights) site, where all nuclear

installations are operating, including the operation of spent fuel and radioactive waste management facilities. Further, an objective of 0.02 mSv to a member of the public from all authorised airborne discharges is applied. In addition, ARPANSA has issued ANSTO with a discharge authorisation specifying the annual notification levels for airborne discharges of radioactive material to the environment.

States and Territories that operate radioactive waste management or disposal facilities are subject to national dose limits that are consistent across Australia's nine jurisdictions. RPS1 stipulates an effective dose limit of 20 mSv per year for workers, averaged over a period of five consecutive calendar years with no more than 50 mSv in one year. For women who declare a pregnancy, the dose limit is 1 mSv to the foetus for the remainder of the pregnancy. In addition, licence conditions can include a requirement for disposal of radioactive waste and the use of personal radiation monitors. Dose constraints are set by the relevant jurisdiction where applicable.

Application of the ALARA principle and adherence to dose limits for discharges

In addition to the dose limits discussed previously, some jurisdictions use management plans such as those required in the Mining Code. Independent audits are generally used by Australian jurisdictions to verify compliance with management plans. Jurisdictions also apply the requirements of the User Disposal Code which is in the process of being replaced by a schedule in the NDRP to update the list of radionuclides and exposure scenarios. Records of discharges must be kept and in some jurisdictions approval must be given before discharges or disposal of very low-level waste can be undertaken.

In relation to the spent fuel and radioactive waste management facilities at ANSTO, the ANSTO Occupational 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. The monitoring results show that, by use of conservative assumptions, members of the public resident in areas surrounding the site receive less than 1% of the public dose limit of 1 mSv per year as a result of discharges from the ANSTO facilities. Public health studies have confirmed that the operation of ANSTO's facilities has had no negative impact upon the health of nearby residents.

ANSTO has an internal ALARA trigger that requires investigations for annual worker doses greater than 2 mSv as part of the optimisation process. An investigation level of 1 mSv/month is also set for occupationally exposed workers. Exposures above this level require a documented investigation and follow up action to reduce radiological exposure, if applicable. 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. Workers who are potentially exposed to radiation are routinely monitored for external exposure (and internal exposure if required). Comprehensive records are maintained.

Some of the State and Territory stores only contain sources of very low activity, or are no longer active. An example is the Northern Territory Government's Interim Storage Room (no new waste has been received there since 1996). Due to its inactive status, operational radiation protection is limited to periodical audits and to maintaining security of the store. Wall thickness and location prevent any emission of radiation in the environment while the contents provide a negligible exposure to people outside the store. Discharge of radioactive material into the environment is impossible.

Assessment of compliance

Australia's compliance with this article is demonstrated through the mandatory use of radiation management plans and independent audits that ensure optimisation, adherence to national dose limits, and minimisation of releases to the environment. This is achieved through monitoring, imposing dose constraints, radiation management plans, mandatory reporting of incidents and near misses, and independent audits and inspections.

Article 25 Emergency Preparedness

Emergency plans

The ARPANSA Radiation Protection Series No. 7 (RPS7); *Intervention in Emergency Situations Involving Radiation Exposure* (2004) provides guidance to Australian regulators for the implementation of protective measures in radiological and nuclear emergencies. RPS7 is included as part of the NDRP.

There is no overarching national nuclear emergency plan in Australia. The responsibility for the immediate radiation emergency response resides with the States and Territories and there are Plans covering both nuclear and radiological emergencies. The State Plans for emergencies relating to Nuclear Powered Warship visits are reviewed every two years by a Commonwealth Government inter-Agency Committee that includes ARPANSA and ANSTO. It is a Commonwealth Government requirement that State Port Plans are exercised at least every two years.

Commonwealth Government response plans are written in terms of a generic national response, with provision to support the States and Territories when requested. The Commonwealth Disaster Plan has specific arrangements for dealing with national emergencies and contains specific details regarding a radiological incident. Each State and Territory has local Hazardous Materials Plans in place for responding to an incident involving hazardous materials. Plans at the national level are reviewed regularly and exercised as required. Commonwealth Disaster Plan arrangements in the event of a Radiological or Nuclear Incident are due for review.

It is unlikely, considering the geographical separation, that Australia could be affected by a radiological emergency at a spent fuel or radioactive waste management facility in the region.

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

Measures employed by ANSTO to prevent nuclear emergencies include:

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

For storage facilities operated by State and Territory radiation regulators, a variety of measures are employed to ensure preparedness for an emergency including:

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

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

In the Northern Territory, preparedness for radiological emergencies forms part of the overall emergency plan for the Royal Darwin Hospital site, where the waste storage facility is located. Royal Darwin Hospital is staffed by experienced and dedicated people. The current radiation protection plan for secure storage includes emergency response.

Responsibilities in emergency situations

For an incident in a single jurisdiction, it is the responsibility of the relevant state/territory government to coordinate the response to a radiation emergency or a lost or stolen source.

Emergency Management Australia, which is part of the Commonwealth Attorney General's Department, is the Commonwealth agency responsible for coordination of Commonwealth

Government consequence management activities in support of state and territory governments, in accordance with existing emergency management arrangements.

The on-site arrangements for emergencies at the OPAL Research Reactor and associated spent fuel management facilities at Lucas Heights are the responsibility of the reactor operator ANSTO. It is a requirement of its ARPANSA Licence that ANSTO complies with the content of these arrangements, including the annual review and exercising of the emergency arrangements. The off-site arrangements for emergencies at the Lucas Heights facility are covered in a NSW State Sub-Plan and these are reviewed and exercised regularly, in line with other State Plans.

In the case of spent fuel and waste facilities at ANSTO, a *Response Plan for Accidents and Incidents at ANSTO/LHSTC,* developed in close consultation with the emergency services agencies, covers response to accidents and incidents at the ANSTO facility, including spent fuel and radioactive waste management facilities.

Radiation emergencies related to the malevolent use of radioactive material fall within the National Counter Terrorism arrangements. The Commonwealth Government Attorney-General's Department coordinates a national programme of exercises for crisis and consequence management arrangements for Chemical, Biological, Radiological and Nuclear (CBRN) incidents. The location and type of exercise rotates between States over a multi-year cycle.

These arrangements are aimed at only the more serious emergencies that might arise and do not presently cover cross-jurisdictional arrangements for minor issues such as locating and retrieving uncontrolled sources. For an incident involving the malevolent use of radioactive material, the coordination of response capability and high-level decision-making is guided by the National Counter-Terrorism Plan, and underpinned by State and Territory plans and arrangements. The National Counter-Terrorism Plan lists CBRN incidents as a possible trigger for declaration of a National Terrorist Situation. Specific CBRN operational and procedural arrangements are covered by Guidance on the National Coordination Arrangements for Responding to the Deliberate Use of Chemical, Biological and Radiological Materials.

Training of ARPANSA emergency response personnel

ARPANSA maintains specialised teams to support State and Territory arrangements to respond to radiation emergencies. The ARPANSA radiation emergency response teams undertake on-going training to ensure that the personnel in the teams have the required skills and resources to carry out the task expected of them in an emergency situation. The requirements and capabilities of these teams are intended to be consistent with the IAEA Radiation Assistance Network teams. ARPANSA provides its own in-house radiation emergency training for the staff forming the ARPANSA teams. This on-going training takes the form of lectures, field deployment and exercises at local, national and international level.

Testing of emergency plans

At the national level, there is a rotating exercise schedule covering security, consequence management and other disasters relating to emergency response. The schedule rotates on a two year cycle through the states and territories and is all hazard in its approach. During the cycle, both field and table top exercises are conducted in order to test management and field responses at all levels.

Assessment of compliance

Australia is compliant in that appropriate on- and off-site emergency plans are in place in all jurisdictions and are tested regularly.

Article 26 Decommissioning

Section 32 of the ARPANS Act includes the requirement that the CEO of ARPANSA, when making a licensing decision about decommissioning of a facility, must take into account international best practice in radiation protection and nuclear safety. Other information regarding the decommissioning plan and schedule required by the Regulations must also be taken into account.

The ANSTO MOATA reactor was successfully decommissioned in 2009-2010. MOATA was a 10 kW Argonaut type reactor which was later up-rated during its lifetime to 100 kW. ANSTO is currently decommissioning a radioisotope production facility, and the wastes generated from both these decommissioning processes are being stored in existing ANSTO Waste Management facilities.

In the States and Territories, most simple storage facilities operated by the regulators would not require complex procedures to be undertaken in order to decommission the facility. Hence some do not have decommissioning plans in place but would require development of plans prior to undertaking specific decommissioning activities. More complex facilities require a preliminary or conceptual decommissioning plan as part of the overall radiation management plan for the facility. For example, in the Northern Territory decommissioning of the store will form part of the applicable radiation protection plan as required under the *Radiation Protection Act*.

Staffing and financial resources

ANSTO is cognisant of the challenges posed by diminishing numbers of staff qualified in the nuclear industry and seeks to ensure that it has the appropriate resources in future years.

Each year, ANSTO allocates funds from its annual budget to decommissioning projects. ANSTO is also in the process of updating a decommissioning process plan for long-term planning and management of decommissioning projects. Measures have been put in to place to keep up the training and professional development opportunities of younger, less experienced staff; staff are recruited internationally, and new staff are being attracted through

a targeted graduate recruitment program. Refer to the discussion on this issue in relation to Article 22 for more details.

Refer also to the discussion in relation to Article 22 for details on the Succession Management and Graduate Programs, which ensure the future availability of adequately trained and experienced staff.

For Commonwealth regulated entities, ARPANSA has the power to ensure that the licence holder has appropriate numbers of qualified staff to perform the required safety related duties as ARPANS Regulations require an applicant for a licence to demonstrate through its plans and arrangements that it can manage safety and has capacity to comply with the regulations and licence conditions. The regulatory expectations document *Regulatory Guideline on Review of Plans and Arrangements* (August 2003) sets out the nature of the information that needs to be provided to demonstrate that safety is being managed appropriately, including the stated expectation that "the licence holder is responsible for ensuring that it has arrangements in place to effectively control the technical, administrative and human factors associated with its conduct and dealings. The arrangements must provide a clear description of the lines of communication, responsibilities and authorities, duties and competencies required for each activity."

In South Australia, the mining or milling company is expected to provide appropriate technical expertise and resources for the decommissioning of uranium mining facilities. 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* (SA) a bond may be set by the relevant Minister 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* (SA) 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.

There is no difference between financial guarantees and Bonds. Bonds are used primarily to provide financial assurance that the mine operator does not default on their obligation to appropriately decommission and rehabilitate the mine, regardless of the reason for the closure (planned or unplanned). Bonds are estimated on the maximum liability that may arise during the life of the mine.

The current financial security bond, in the form of a Bank Guarantee, for decommissioning the Beverly uranium mine in South Australia is $10,325,000. The bond for the Beverley North extension of the Beverley project is currently $4,125,000.

The value of these bonds is revised every year. The operator of the Beverly uranium project is required to submit an estimate of the costs involved to rehabilitate the mine sites as part of its Mining and Rehabilitation Program (MARP), which is then assessed and revised if necessary

by the South Australian Government. Information on the determination of this bond can be found in the MARP 2008 document for the project which has been posted on the Primary Industries and Resources South Australia (PIRSA) website[14]. The assessment has been accepted by State and Commonwealth Government agencies and the bond has been paid and is being held by PIRSA.

In the Northern Territory securities for all exploration sites and mines are calculated by the Northern Territory Government, based on the disturbance and estimated rehabilitation cost. Mines must submit a Mine Management Plan annually. The appropriate security is reviewed and upgraded where necessary, based on this plan and planned future operations. The security is lodged with the relevant government department and is held against the operator to ensure satisfactory closure and rehabilitation of the site. On successful completion and rehabilitation of the site, the security held by the department is refunded to the operator. Securities are held against all authorised exploration and mining sites and are in the form of cash or bank guarantee. The exception is the Ranger uranium mine, the only operating uranium mine in the Northern Territory. Regulation of this mine is carried out under a joint working agreement between the Commonwealth and Northern Territory Governments, and the security is held in trust by the Commonwealth Government. The bond, as at 31 May 2011, is $169,289,854. On successful close out and rehabilitation of the mine the security is returned to the operator.

In the case of the Ranger uranium mine the operator is required to submit an annual rehabilitation plan based on a scenario that the mine will cease operations on 31 March of that year and is unable to recommence operations. The operator must outline plans and costings to close and rehabilitate the mine site. Both the Commonwealth and Northern Territory Governments and the Northern Land Council review the plan. Following agreement with the operator on the appropriateness of the plan, the Commonwealth engages an independent assessor to review the costs before they are approved. The security is updated to the new agreed amount for that year and is held by the Commonwealth Government.

Operational radiation protection

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

Operational radiation protection was a very important consideration during the decommissioning of MOATA and the preparation for safe enclosure of HIFAR. During the decommissioning of the HIFAR reactor, operational protection by means of radioactive waste management will be in place to ensure that wastes are appropriately controlled.

14 http://outernode.pir.sa.gov.au/minerals/mines__and__developing_projects/approved_mines/beverley

The application for a licence to possess or control HIFAR contained a radiation protection plan (http://www.arpansa.gov.au/pubs/hifar/partb3.pdf), which outlined the measures that will be taken to minimise exposures during the safe enclosure period. The application for approval to dismantle MOATA also contained similar detail.

Emergency preparedness

The *Response Plan for Accidents and Incidents at ANSTO/LHSTC* encompasses all facilities at the site, including the shutdown HIFAR reactor.

Emergency plans in all jurisdictions can be applied to the operation of facilities as well as decommissioning.

Record keeping

ANSTO keeps comprehensive records of all radioactive waste generated from ongoing production and specific decommissioning activities. The records are maintained through databases and tracking systems. Record keeping for spent radioactive sources is also managed through comprehensive database management.

Jurisdictions in which uranium mining operations have occurred also require maintenance of relevant records.

Assessment of compliance

Currently regulatory requirements adequately address the provision of resources, operational limits, emergency plans and record keeping in regard to decommissioning and closure of disposal facilities as required by Article 26. For older facilities that did not have decommissioning plans that would be regarded as adequate by current standards, regulators are ensuring that conceptual plans are developed prior to decommissioning activities.

Section G – Safety of Spent Fuel Management

Article 4 General Safety Requirements

Within Australia, only Commonwealth Government agencies have responsibility for the management of spent fuel. Thus this Section only refers to ANSTO, which manages spent nuclear fuel, and ARPANSA, which as the regulator, licences the spent fuel management facilities.

ARPANSA has issued a facility licence to ANSTO that authorises operation of its spent fuel management facilities. The facility licence is subject to licence conditions that specify how individuals, society and the environment are to be protected against radiological hazards.

At ANSTO, spent fuel from the HIFAR reactor was stored in several wet-store facilities for various periods after discharge from the reactor. A large dry store was also used in the past 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 Annex A for further detail.

The spent fuel management facilities for the OPAL reactor form part of the OPAL reactor facility. As such, ANSTO's compliance with the requirements of Chapter 2 of the Joint Convention was examined in detail as part of the consideration of its applications to the regulatory body ARPANSA for authorisations to prepare a site, construct and operate the facility.

Measures to prevent criticality and ensure removal of residual heat

This is relevant to wet storage of aged spent fuel before final shipment. ARPANSA requires that facilities for the storage of spent fuel at ANSTO adequately address criticality and heat generation issues as part of the licence authorisation and licence conditions. The wet storage facilities currently in use, or formerly used for spent fuel, adequately address criticality as well as the removal of any decay heat generated during the storage period. All operations involving fissile material are covered by criticality certification. The subcritical mass of each fissile nuclide is also stipulated by operational limits and conditions for spent fuel storage.

Measures to ensure minimum practical generation of radioactive waste

Under its Radioactive Waste Management Policy, ANSTO minimises its generation of radioactive waste by a number of different mechanisms, including selection of appropriate materials and strict segregation of active and non-active wastes. The generation of radioactive waste from spent fuel storage is kept to a minimum and consists largely of water filters and ion-exchange resins.

Measures to take into account interdependencies

The spent fuel handling processes address the interdependencies among the different steps in spent fuel management.

Protection of individuals, the public and the environment

ARPANSA's Commonwealth nuclear safety legislation, the ARPANS Act, accompanying Regulations and subsidiary regulatory guidance, 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.

Assessment of biological, chemical and other hazards

Whilst Australia does not reprocess spent fuel, ANSTO has safely managed its spent fuel since commencement of reactor operations, and has stored that spent fuel in both dry and wet facilities. Currently, only wet storage of spent fuel is in practice at ANSTO. Management of the wet facilities entails monitoring and controlling pond chemistry, and radiation safety is maintained by standard practices as applied to all radioactive materials whether in dry or wet storage.

As a Commonwealth entity, ANSTO is also subject to the *Occupational Health and Safety Act 1991*. This Act outlines legal requirements for control of non-radiological hazards. These requirements are incorporated into ANSTO's internal safety approvals process.

Avoiding greater and undue burdens on future generations

'Burden on future generations' is considered when assessing an application to operate or use a nuclear facility, equipment or material. For example, the CEO of ARPANSA must consider international best practice in radiation protection and nuclear safety when assessing each licence application, and in addition must consider:

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

These factors are considered taking into account both current and future impacts of the facilities.

Assessment of compliance

Australia has effective regulatory and operations controls in place to ensure that it complies with the general safety measures for the management of spent fuel and to ensure the protection of individuals, society and the environment from radiological hazards.

Article 5 Existing Facilities

Review of safety assessment of spent fuel management facility

There are no spent fuel management facilities currently in use which were existing at the time the Convention entered into force for Australia.

For currently operating spent fuel management facilities, Commonwealth Government legislation and ARPANSA's licensing system require that appropriate steps be taken to review safety and ensure 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. The safety of the spent fuel facilities is assessed at a regular interval and the safety analysis reports for these facilities are updated accordingly.

Assessment of compliance

There are no spent fuel management facilities currently in use which were existing at the time the Convention entered into force.

Article 6 Siting of Proposed Facilities

The Commonwealth Government is the only jurisdiction in Australia with facilities related to the management of spent fuel.

Evaluation of site related factors

Commonwealth Government environment legislation (EPBC Act) requires that an application for a proposed facility that is characterised as a nuclear action[15] must be referred to the Minister for Sustainability, Environment, Water, People and Communities (SEWPAC), who determines whether an approval is needed and, if so, the required level of assessment. The ARPANS Act requires that the assessment of the environmental impact be taken into account by the CEO of ARPANSA in deciding whether to issue a facility licence authorising the preparation of a site. This assessment must include an evaluation of site related factors likely to affect the safety of the facility during its operating lifetime.

Evaluation of safety on the public and environment

Under Commonwealth Government legislation, establishment of a new spent fuel management facility for the storage of spent fuel must be referred to SEWPAC for consideration under the EPBC Act.

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

Provision of information to the public

In accordance with Regulation 40 of the ARPANS Regulations 1999, ARPANSA must invite public submissions on any application involving a nuclear installation. The CEO of ARPANSA is required to take into account the content of any public submissions in deciding whether or not to issue a facility licence that authorises conduct in relation to a nuclear installation.

In the past, public submissions have been invited as part of assessing the application for licences to prepare a site for, to construct and to operate ANSTO's OPAL research reactor16, including its spent fuel management facilities.

The EPBC Act also has statutory public engagement requirements. The Environment Minister is required to invite comments on any referral prior to a decision whether it is a controlled action and if it is a controlled action, comments are to be invited as part of the assessment.

Consultation with other Contracting Parties

It is highly unlikely that Australian spent fuel management facilities would have impacts on other Contracting Parties.

Assessment of compliance

Australia has appropriate legislative and regulatory measures in place to ensure proper evaluation of sites for spent fuel management facilities and the meaningful engagement of the public in the decision making in relation to siting.

Article 7 Design and Construction of Facilities

Arrangements for limiting radiological impacts

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

Plans and provisions for decommissioning

At the design stage, plans and other provisions for decommissioning of a facility are only required in conceptual form. They must be revised and updated as the facility moves through the different licensing stages.

[16] Information about the submission process and a copy of the public consultation reports for the construction and operating stages of the licensing process can be found at www.arpansa.gov.au/Regulation/opal/index.cfm

Validation of technologies used

Spent fuel from the OPAL reactor is managed in a service pool adjacent to the reactor pool. Like all safety systems in the OPAL reactor, the design of the service pool was subjected to a rigorous safety assessment process by ANSTO and INVAP prior to approval by the CEO of ARPANSA. Additionally, approval by the CEO of ARPANSA was required before construction of structures, systems and components which were identified as being important for safety.

Assessment of compliance

Australia has appropriate legislative and regulatory measures in place to ensure proper assessment of the construction of spent fuel management facilities.

Article 8 Assessment of Safety of Facilities

Safety and environmental assessment requirements prior to construction

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

Safety and environmental assessment requirements prior to operation

Updated and detailed versions of the safety and environmental assessments must be prepared as part of the application for a licence to operate a spent fuel management facility. This application must be approved before operation can commence.

Assessment of compliance

Australia has legislative and regulatory measures in place to ensure proper assessment of the construction of spent fuel management facilities.

Article 9 Operation of Facilities

Basis of licensing decision

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

Definition and revision of operational limits and conditions

Operational limits and conditions derived from tests, operating experience and assessments, must be defined and revised as necessary. The operational limits and conditions will be derived from periodical safety analysis and health and environmental impact assessments conducted for the facilities.

Procedures for operation, maintenance, monitoring, inspection and testing

Licence conditions require that operation, maintenance, monitoring, inspection and testing must be conducted in accordance with established procedures. Compliance is ensured through regular inspections by the regulatory authority.

Availability of engineering and technical support

Licence conditions require that engineering and technical support in all safety-related fields must be available throughout the operating life of the spent fuel management facility. Compliance is ensured through regular inspections by the regulatory authority.

Reporting of incidents significant to safety

In accordance with ARPANS Regulations, incidents significant to safety must be reported to the regulatory authority in a timely manner by the licence holder.

Collection and analysis of operating experience

Under the ANSTO Business Management System and the Occupational Health, Safety and Environment system, ANSTO collects and analyses data on operating experience, and acts upon that data where appropriate.

Preparation and update of decommissioning plans

Decommissioning plans for spent fuel management facilities are in place and will be reviewed by ANSTO, in conjunction with ARPANSA, prior to seeking approval for implementation. The Draft ARPANSA Decommissioning Guideline (due to be completed by June 2012) states that it is expected that the operating organisation will progressively update the decommissioning plan throughout the life of the facility and that each separate application for authorisation under the ARPANS Act (siting, construction, operation and eventually decommissioning itself) will include a decommissioning plan. Each updated plan must take into account recent experience derived from international developments in decommissioning practice.

Assessment of compliance

Australia has in place the appropriate regulatory and operational framework to ensure the safe operation of its spent fuel management facilities.

Article 10 Disposal of Spent Fuel

All spent fuel managed in Australia by ANSTO will be transported overseas for reprocessing (UK and France) or for long-term storage and eventual disposal (US).

All spent fuel elements from the MOATA and HIFAR reactors have been transported overseas for reprocessing and/or for long-term storage and/or disposal.

The spent fuel from the OPAL reactor will be stored in Australia until it is ready for shipment. After a suitable period in storage, the spent fuel will be transported overseas for disposal or reprocessing. The timing of spent fuel shipments 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 radiological safety benefit of minimising the number of shipment operations.

Spent fuel will be shipped for reprocessing in France or another country and returned to Australia in the form of intermediate-level waste.

Assessment of compliance

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

Section H – Safety of Radioactive Waste Management

Article 11 General Safety Requirements

Measures to prevent criticality and ensure removal of residual heat

Criticality is considered in guidance provided by the *Safety Guide for the Predisposal Management of Radioactive Waste* published by ARPANSA in September 2008. The guidance advises that if fissile material is present in laboratory or medical waste, the potential for criticality should be evaluated and eliminated by means of design features and administrative controls.

ANSTO holds small amounts of radioactive wastes with fissile material associated with its production of molybdenum-99 for nuclear medicine. Specifically, residual uranium from LEU target plates is captured on filter cups, which are stored at ANSTO's waste management facilities. Criticality of the uranium in these filters is prevented though operating limits and conditions and verified by criticality certificates.

Heat removal and criticality are addressed in the design and operation of relevant facilities. For example, all steps in waste management at ANSTO are subject to ANSTO's internal safety management processes. Those safety management processes consider all factors relevant to safety, including criticality and heat generation. In addition to the safety management processes, residual heat and criticality are addressed in facility design.

ARPANSA licences and routinely inspects the Waste Management operations at ANSTO. In addition, the safety of these facilities is optimised through ANSTO's internal review processes including inspections, evaluation of performance and criticality certification systems.

Measures to ensure minimum practical generation of radioactive waste

The Predisposal Management Safety Guide provides detailed guidance on methods of minimising waste generation both at the facility design stage and during operations.

Waste contaminated with short-lived radionuclides can be collected and stored until the radioactivity decays sufficiently to meet exemption levels adopted by all jurisdictions in their legislation as detailed in the NDRP.

In most jurisdictions, licensees are required to prepare plans for the management of waste. These plans also address the processes by which the generation of radioactive waste is minimised.

At ANSTO, waste minimisation practices include segregation of wastes at the source (radioactive from non-radioactive) to reduce the potential for cross-contamination; 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.

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

Measures to take into account interdependencies

Interdependencies have been carefully considered in the development of the Predisposal Management Safety Guide. The guidance includes consultation with responsible personnel and organisations.

ANSTO has in place procedures for clearances and certification between each step in radioactive waste management.

National legislation to protect individuals, society and the environment

The legislative systems in place in Australia, described in *Section E: Legislative and Regulatory System* of this report, underpin the process of minimising the risk of harm to individuals, society and the environment from exposures to ionising radiation that result from the management of radioactive waste. These systems are based on the document RPS1, which in turn is consistent with the Basic Safety Standards (IAEA, 1996) and ICRP Publication 60 (1990).

Other subordinate legislative measures used to control exposures include conditions of licence based on national guidance. An example is reference to codes of practice in relation to the near-surface disposal of radioactive waste (the Near-Surface Disposal Code) and the disposal of very low-level radioactive waste by the user (the User Disposal Code).

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 disposal at depth or disposal following a suitable period of decay.

Discharge of very low-level radioactive waste to the air or sewer usually takes place as part of an on-line operation such as the preparation and dispensing of radionuclides.

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. In most cases, little radioactive residue is left in the ash, which is monitored and disposed of according to licence conditions. In those cases where incineration does take place,

environment protection limits and standards control incineration and release to the atmosphere to protect air quality. Most jurisdictions require waste to fall below exemption levels or the threshold where waste is legally defined as radioactive before being incinerated, while other jurisdictions permit incineration provided the release to the atmosphere is within the levels outlined for radiation disposal to air. Waste, usually biological, is required to be incinerated in accordance with the User Disposal Code.

Currently, the regulatory requirements for discharge of very low-level radioactive materials vary between jurisdictions. In some jurisdictions, discharge limits for airborne and waterborne radionuclides are given in schedules to 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.

The recommendations of ICRP Publication 60 were incorporated into a national standard in 1995 and republished as Radiation Protection Series publication No. 1; *Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002).* The national standard has since been adopted into legislation by each jurisdiction. However, some of the state and/or territory regulations, however, predate the ICRP Publication 60 recommendations, and the ICRP Lung Model described in ICRP Publication 66, and as such are not up to date with respect to current dose conversion factors and public dose limits.

ARPANSA has commenced a review of RPS1 to bring it up to date so that it is consistent with ICRP Publication 103. This review is expected to be completed within the next 2 years.

To date there are no plans to specifically adopt ICRP Publication 66 into legislation in Australia, although it may be considered as part of the review of RPS1.

Australian regulators are in the process of replacing the User Disposal Code with a new schedule in the NDRP which will update levels by introducing disposal and discharge limits for radionuclides where necessary, and will bring other provisions up to date in terms of current exposure models. Once the schedule has been agreed to by all the governments of Australia, it will be adopted into existing regulatory frameworks in each jurisdiction.

Assessment of biological, chemical and other hazards

As mentioned above, regulatory guidance on management of radioactive waste is used by waste producers to assist in achieving compliance with mandatory Australian requirements.

The Predisposal Management Safety Guide advises that the radioactive waste management plan, safety assessment and management system should include consideration of the physical, chemical and/or biological characterisation of waste.

The Safety Guide also advises that the design and operation of facilities for the predisposal management of radioactive waste should take into account any potential hazards due to non-

radioactive physical, chemical or biological characteristics of the waste. Protection from non-radiological hazards should be provided in accordance with the relevant standards on health and safety and environmental protection.

In the case of a near-surface disposal facility, the Near-Surface Disposal Code requires that an assessment of the likely behaviour of the waste in the geochemical environment of a disposal facility be undertaken. The Near-Surface Code requires the following:

- treatment of waste containing inorganic acids, alkalis and corrosive salts to neutralise the chemical effect; radioactive waste must not contain corrosive materials;
- separation and packaging of flammable or combustible materials from non-flammable solids;
- avoidance of waste containing or capable of generating gaseous materials in quantities which might lead to the release of harmful vapours or fumes or compromise the integrity of the facility;
- exclusion of waste containing material that readily detonates upon impact, decomposes explosively, reacts violently with water or undergoes vigorous exothermic reaction;
- treatment, conditioning or packaging of waste containing pyrophoric material;
- solidification of liquid waste to ensure compliance with the stability requirements for the category of waste;
- removal of biological materials from the waste;
- treatment or conditioning of waste contaminated with toxic, pathogenic or infectious material to minimise both occupational exposures and the potential for long-term public exposures; and
- treatment or conditioning of wastes containing chelating agents to reduce effects of leaching by water.

The facility located at Mt Walton East in Western Australia is the only operating near-surface disposal facility for radioactive waste in Australia that accepts packaged wastes. Material accepted by the facility has to comply with the waste acceptance criteria specified by the operator of the facility.

Avoiding greater and undue burdens on future generations

As part of the application of the optimisation principle, RPS1 states that the risks to individuals in the case of potential exposures should be optimised, taking social and economic factors into account. This requirement extends not just to the current generation but also to future generations.

‘Burden on future generations’ is taken into account in the decision on whether or not to give the applicant a licence to operate or use the facility, equipment or material. Some jurisdictions

require that responsible persons must have adequate measures in place before they can acquire a radioactive source. These measures include an appropriate facility to store the source, measures in place to relocate or dispose of the radioactive source, return of sealed sources to supplier as a condition of licence, or demonstration of the optimisation principle for the proposed application. Other jurisdictions have a strategy for the sustainable management of radioactive waste within their jurisdiction.

In the case of Western Australia, the Mt. Walton East disposal facility accepts waste generated within the jurisdiction. This minimises the potential risk for future generations arising from orphan sources.

Assessment of compliance

Australia's compliance in terms of requiring producers to minimise waste production is largely dependent on national regulatory guidance and any specific licence conditions. Inconsistencies between jurisdictions in the provision of disposal facilities, requirements on waste minimisation and the need to reduce the undue burden on future generations are being addressed by the development of a uniform national approach to waste management.

RPS1 is currently being revised, to make it consistent with ICRP Publication 103. This review is expected to be completed within the next 2 years.

Further, ARPANSA is also currently reviewing the Near-Surface Disposal Code and requirements/recommendations for waste minimisation may be included in that revision. The revised code and associated safety guide are expected to be published within two years. However, adoption of the code into legislation across all jurisdictions will take longer.

Article 12 Existing Facilities and Past Practices

Review of safety

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.

The disposal of radioactive wastes at the Mt Walton East facility in Western Australia has been regulated by the radiation regulator since 1992. The site was chosen based on criteria in the IAEA publication, *Site Investigation for Repositories for Solid Radioactive Waste in Shallow Ground, Technical Report Series No. 216* (1982). All aspects of the design, operational requirements, duties and responsibilities must comply with the Western Australian legislation and the Near-Surface Disposal Code. Radiation monitoring at the disposal facility is carried out in accordance with documented requirements given by the regulator. Measurements include absorbed dose rates in air, radon concentration in air,

radionuclide concentrations in water, and pre- and post- disposal measurements. Personnel monitoring is carried out during a disposal campaign.

The Radium Hill Low-Level Radioactive Waste Repository in South Australia was operated by the South Australian Government from 1981 to 1998. The material disposed at this repository was naturally occurring radioactive materials from mining and mineral processing operations conducted in South Australia. The site was registered as a premises under Section 29 of the South Australian *Radiation Protection and Control Act 1982* in 2003, and conditions were attached to the registration to provide for development of an appropriate long-term management plan for the site. A preliminary risk assessment on the site was performed in 2004. The assessment showed dose levels well below the public dose limit of 1 mSv/year[17]. The repository is now closed.

The site of the former Port Pirie Treatment Plant, also in South Australia, is a legacy site where radioactive tailings remain from the processing of uranium ore concentrate from the Radium Hill uranium mine during a period from 1954 to 1962. The site is also regulated via registration as premises under Section 29 of the *Radiation Protection and Control Act 1982*, with conditions on the registration to provide for the development of an appropriate long-term management plan for the site.

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

In the Northern Territory, the tailings dams for the storage of waste at the Ranger uranium mine form part of the authorisation to operate. The mine has been in operation and regulated since the 1980s. The *Mining Management Act* (NT) requires operators to use best practice; as a consequence companies have used the ARPANSA Mining Code to demonstrate to the mining regulator best practice in protecting the environment. For ensuring safety of the occupational exposed persons at the site, the Code is used as a regulatory tool by the occupational health and safety regulator. Potential offsite impacts of the operation, including public exposures, are monitored by the statutory officer of the Commonwealth Supervising Scientist. Storage of waste forms part of the authorisation to operate this mine.

[17] www.pir.sa.gov.au/__data/assets/pdf_file/0016/10825/rb2004_009_radium_hill.pdf

Review of past practices

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

From 1960 to 1968, ANSTO operated a near-surface disposal site for radioactive waste (Little Forest Burial Ground) near the boundary of the Lucas Heights 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 in the ANSTO Environmental Report. Some additional characterisation of the wastes contained in the facility has been performed since the previous national report. The site is not currently licensed.

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

Operations at the Rum Jungle Mine site in the NT between 1954 and 1971 produced uranium, copper, nickel and lead, and resulted in significant environmental impacts primarily due to acid mine drainage and heavy metal mobilisation.

From 1983 to 1986, Rum Jungle was rehabilitated under an $18.6m cooperative agreement between the Commonwealth and NT. The objectives included reduction of surface water pollution and public health hazards, including radiological hazards.

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

The rehabilitation program at Rum Jungle met its original objectives, but gradual deterioration of the site's historic reclamation works has been documented over a number of years. The current environmental issues are primarily due to acid mine drainage and heavy metal mobilisation.

Funding has recently been provided to address environmental issues at the former Rum Jungle Mine site, and closure of the nearby former Rum Jungle Creek South Mine site. On 7 October 2009, the Commonwealth concluded a National Partnership Agreement (NPA) with the NT under which $7.05m will be provided over four years from FY2009/10 to support ongoing Rum Jungle rehabilitation activities. The NT Department of Resources is supported by the Rum Jungle Working Group (Australian and NT governments, Northern Land Council).

The NPA was expanded in May 2011 to include sites related to the former Rum Jungle operation; Rum Jungle Creek South Mine site (about five kilometres south-east of Rum Jungle), Mt Burton and Mt Fitch (both downstream of Rum Jungle).

A subordinate Implementation Plan details payments and reporting requirements. Broadly, reporting of actual activities undertaken to meet the NPA's objective is required against:

- site maintenance;
- environmental monitoring;
- stakeholder engagement; and
- development of site management and rehabilitation strategies.

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

Assessment of compliance

Following Australia's ratification of the Joint Convention, a number of the sites subject to this Article have undergone remediation works and been brought within the regulatory licensing system.

Article 13 Siting of Proposed Facilities

Since Australia's last national report, there have not been any new legislative requirements or mandatory standards for the siting of radioactive waste management facilities.

The CEO of ARPANSA is required to consider international best practice when assessing any licence application for the siting of Commonwealth-owned waste management facilities. ANSTO is preparing an application to site an interim store for long-lived intermediate-level waste arising from overseas reprocessing of research reactor spent fuel. This facility is required to manage reprocessing waste, which will be returned to Australia before a national radioactive waste management facility is available.

Evaluation of relevant site-related factors

There is a separate national regulatory framework[18] for protection of the environment established under the EPBC Act, which is binding on all jurisdictions. If a proposed action is referred to the Commonwealth Government Minister for Sustainability, Environment, Water, Population and Communities and the Minister decides that the proposed action requires approval, an assessment process (including an environmental impact assessment) must be carried out.

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

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

Legislative requirements for the selection of a site for a proposed facility are based on the national the Near-Surface Disposal Code. This Code 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. The Code sets out selection criteria for site characteristics that will facilitate the long-term stability and provide adequate isolation of the waste. The criteria include socio-economic, ecological and land use factors as well as natural physical characteristics of the proposed site.

As mentioned under Article 12, the site of the Mt Walton East disposal facility in Western Australia was established in 1992 based on criteria in the IAEA publication, *Site Investigations for Repositories for Solid Radioactive Wastes in Shallow Ground, Technical Report Series No. 216* (1982). These criteria include safety.

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 EPBC Act and to safety assessment processes under the ARPANS Act.

Most State and Territory stores are also sited subject to national codes. For example, an interim storage room is located in the Northern Territory at Royal Darwin Hospital and is in a secure location. The site is actively supervised by employees of the Northern Territory Government. The interim storage room is well separated from all other hospital facilities and a permanent security presence is stationed at the Hospital.

Impact on safety of people and the environment

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 that the Environment Minister makes an informed decision on whether or not to approve the action. The definition of environment in the EPBC Act makes reference to people and communities as part of ecosystems and requires social and economic impacts, in addition to environmental impacts, to be considered.

Under the ARPANS Act the application for a licence for the proposed interim store at the ANSTO site must include an assessment of the impact of the facility on the safety of people and the environment.

Under the ARPANS legislation, separate authorisation is required for closure of a waste management facility.

In the case of a near-surface disposal facility, the Near-Surface Disposal Code includes radiation protection considerations in accordance with the objective to establish a waste facility that isolates the radioactive waste to ensure there is no unacceptable health risk to humans, and no long-term unacceptable detriment to other biota and the environment from the operation of the facility or following its closure. The radiation protection considerations are based on the justification, optimisation and limitation radiation protection principles. Dose limits are applicable to personnel employed at the disposal facility and any member of the public inadvertently exposed during operations or during the institutional control period.

Availability of information to the public

Public consultation in the EPBC Act is required as part of the environmental approval process and the regulatory licensing process. Consultations with the relevant jurisdictions is mandatory and would normally take place as part of public consultation.

Referrals under the EPBC Act and any subsequent environmental impact assessments/statements are released for public comment as part of public consultation by the Environment Minister.

Licence applications to ARPANSA for the siting of a radioactive waste management facility may also be subject to public consultation. This entails release of the application for public comment and the requirement for the CEO of ARPANSA to take into account the content of public submissions in deciding whether to issue a licence.

Consultation with the public has been undertaken at a number of stages of previous proposals to establish waste facilities. For previous proposals, policy has required that community consultation has been undertaken by the proponent as part of the project; the proponent has also undertaken community consultation as part of the legislated process for obtaining environmental approval for the proposal; and the radiation regulator has undertaken public consultation again as part of the legislated process for the assessment of the licence application.

For future proposals, it is expected that consultations that are part of the environmental approval and nuclear licensing application processes will be integrated to some degree. During the previous project to establish the Commonwealth Radioactive Waste Management Facility in the Northern Territory, views expressed during community consultations ranged from strongly opposed through neutral to supportive. No detailed surveys were undertaken to precisely measure levels of support and opposition.

One of the potential sites was volunteered by its traditional Aboriginal owners and enjoyed strong local community support. Those same traditional Aboriginal owners have continued to express their desire to have the facility located on their land. However, some Aboriginal owners of other land in the region have opposed the nomination of this land.

The Commonwealth Government has decided not to proceed with the three Defence department sites identified by the then Government in 2005. At the time of writing, legislation

is before the Australian Senate which gives effect to a policy of considering only volunteered sites. Under this legislation, the existing nomination of a volunteered site on Aboriginal land at Muckaty Station in the Northern Territory is preserved. The Bill provides that a national volunteer site selection process would be initiated in the event that it was not possible to site a national radioactive waste management facility at a volunteered site on Aboriginal land in the Northern Territory.

Consultation with other Contracting Parties

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

Avoiding unacceptable effects on other Contracting Parties

As stated, it is not foreseen that Australian waste management facilities would have impacts on other Contracting Parties outside Australia.

Assessment of compliance

There are procedures in place for evaluating all factors relating to the safety and impact of proposed facilities. As these procedures have been followed when required, Australia remains compliant with Article 13.

Article 14 Design and Construction of Facilities

Since Australia's last national report, there have not been any new legislative requirements or mandatory standards for the design and construction of radioactive waste management facilities. A near-surface radiological containment facility was constructed in the dry season in 2009 by Parks Australia North at El Sherana in the Northern Territory, for waste arisings from remediation of former mining operations. The process of siting, design and construction followed all legal and regulatory requirements.

Limiting possible radiological impacts

In each Australian jurisdiction, the radiological impact of the design and construction of a radioactive waste management facility is assessed 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 must 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.

Facility proposals that are designated 'nuclear actions' would also be subject to environmental assessment under the EPBC Act, and require the approval of the Commonwealth Environment Minister.

In the case of a near-surface disposal facility, the Near-Surface Disposal Code sets out mandatory requirements for the facility design that include packaging of waste, structural parameters, engineered barriers, cover specifications, backfill, surveying, water management, drainage, waste parameters, buffer zone and restricted occupancy zone.

Each jurisdiction has discharge limits set out in legislation, as conditions of licence or as part of mandatory management plans. As mentioned previously, Australian regulators are in the process of harmonising discharge limits, as part of the process of replacing the User Disposal Code by a Schedule in the NDRP.

Provision for decommissioning allowed in design

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

Technical provisions for closure of disposal facility

In the case of a near-surface disposal facility, the Near-Surface Disposal Code requires that prior to commencement of operations, the operator prepare draft or conceptual plans for closure and decommissioning of the facility and rehabilitation of the site and that these plans be submitted for approval. These plans must be reviewed every five years and resubmitted for approval.

The Code also stipulates that approval for ceasing operations must be applied for at least three years prior to the proposed closure date. Detailed plans for the decommissioning of the facility and for rehabilitation must also be submitted at this time.

Validation of technologies for design and construction

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

In the case of a near-surface disposal facility, the Near-Surface Disposal Code requires that the structure be constructed in accordance with best engineering practice.

In the case of uranium mining operations, the Mining Code 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.

Assessment of compliance

Australia remains compliant with this Article.

Article 15 Assessment of Safety of Facilities

Safety and environmental assessment requirements prior to construction

As part of legislative and regulatory requirements, an assessment of safety and environmental impact of a proposed radioactive waste management facility during the operational period is required for approval before construction of the facility can commence. The assessment of safety and environmental impact must be reviewed and updated if required prior to the operation of the facility. Regulators would also consider security in addition to safety.

In the case of a near-surface disposal facility, the national standard, the Near-Surface Disposal Code, requires the proponent to submit to the regulatory authority a detailed analysis of the design and operation of the facility. A safety analysis, subject to independent technical audit, is also required of the proponent. The safety assessment must:

- identify pathways through which radionuclides could be released during the operation of the facility;
- demonstrate that protection of humans is optimised;
- demonstrate that potential radiation exposure is below prescribed limits in the Code;
- estimate the probability of the occurrence of the exposure scenarios; and
- provide justification of any probability less than one for the identified scenarios.

Post closure safety and environmental assessment requirements prior to construction

In the case of a near-surface disposal facility, the Near-Surface Disposal Code requires an assessment, prior to construction, of the projected long-term integrity of the site after closure. Site rehabilitation plans must include the proper provision of site markers and exclusion barriers, which are to remain for the duration of the institutional control period. Following the institutional control period, the Code also requires removal of all superfluous surface structures that may encourage occupation of the site. The operator must remain responsible for the site and all necessary site rehabilitation work until the completion of the work has been approved by the regulator.

The Code requires the regulator to ensure that a surveillance program involving site inspections and environmental monitoring is carried out during the institutional control period, and that the historical records of the waste disposed are maintained. This includes the location and purpose of the disposal site being marked on land titles as caveats or mentions

for the institutional control period. The perimeter fence and site markers must also be maintained during the institutional control period.

In addition to the requirements of the Code for safety and environmental assessments of the operational phase, the safety assessment must:

- identify pathways through which radionuclides could be released after closure of the facility; and
- include a quantitative treatment of scenarios for inadvertent intrusion after institutional control.

Review of safety and environmental assessments prior to operation

In the case of a near-surface disposal facility, the national standard, the Near-Surface Disposal Code, requires the establishment an environmental management plan prior to commencement of construction and operation of a near-surface disposal facility and a radiation management plan prior to commencement of disposal operations. Both plans must be reviewed approximately every three years during the period of operation and the review must be reported publicly.

The radiation management plan includes personnel training, personnel monitoring, maintaining records, monitoring within the operational area of the facility, designation of areas of potential radiation exposure, emergency preparedness, contamination control and protective clothing and apparatus.

Assessment of compliance

Ongoing regulatory reviews and independent audits against national legislative, regulatory and licence requirements verify Australia's ongoing compliance with Article 15.

Article 16 Operation of Facilities

Basis of licensing decision

A licence to operate a radioactive waste management facility is required prior to operation of such a facility. The regulatory authority cannot grant the licence until, amongst other requirements, the proposed facility meets the requirements for design and construction, and an assessment of safety and environmental impact has been undertaken and approved. 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 ARPANS Act and to internal safety review in accordance with the requirements of the ANSTO safety system.

Definition and revision of operational limits and conditions

In the case of a near-surface disposal facility, the national standard, the Near-Surface Disposal Code, provides generic activity concentration limits for a range of radionuclides at concentrations categorised as low-level waste and short-lived intermediate-level waste. These limits are applicable to a remote arid site and based on institutional control periods of 100 and 200 years. In practice, values will be derived for a specific disposal site using site-specific data for environmental parameters and exposure scenarios particular to that site.

The Near-Surface Disposal Code provides requirements for and restrictions upon the management of the site during the institutional control period. At the end of the established institutional control period the status of the site is to be reviewed to determine whether any further management or control should be instituted. Records and inventory of the waste disposed at the site are required to be preserved in two locations, including the appropriate state or federal government archives, at least until the end of the institutional control period. During the institutional control period the site is to be maintained and secure. Post-institutional control requirements are for the removal of infrastructure, and for the assessment of the site for any proposed new use.

The Near-Surface Disposal Code also specifies requirements for treatment, packaging and conditioning of waste, transport, disposal operations, environmental and radiation management and emergency response plans, and records and inventory keeping.

There are no limits on the surface dose rate of packaging that is accepted for near-surface disposal at the Mt Walton East disposal facility in Western Australia. However, the limits on the surface dose rate of packaging set by the provisions of the *Code of Practice for the Safe Transport of Radioactive Material* (ARPANSA, 2008), applies to material that is transported to the facility, and therefore, by implication, to material that can be accepted by the facility. The Near-Surface Disposal Code places no limits on surface dose rates, but provides limits on radionuclide concentrations for near-surface disposal for the waste categories defined in the Code.

The Predisposal Management Safety Guide includes generic waste acceptance criteria for the disposal of radioactive waste in near-surface and deep borehole facilities. The Safety Guide advises that if a disposal facility is not established and the waste acceptance criteria are not known, an assessment should be undertaken to determine the type of disposal appropriate to the particular waste stream and an estimate made of the range of likely waste acceptance criteria for that type of disposal.

Procedures for operation, maintenance, monitoring, inspection and testing

The regulatory authority in each jurisdiction conducts a risk-based routine program of radiation safety monitoring to assess a responsible person's compliance with the legislation and the required level of radiation safety. These monitoring activities may lead directly to

investigations and inspections, followed by enforcement activities when breaches of the relevant legislation have been identified.

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

The legislation in each jurisdiction contains reporting requirements on matters such as abnormal or unplanned exposure to radiation, out of control radiation sources, damage or malfunction of a 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.

In Western Australia, appropriate safety measures must be outlined in the radiation management plan. The safety of the Mt Walton East Intractable Waste Disposal Facility is assessed regularly, particularly the requirements for a technical auditor and the ongoing requirement for monitoring, as required by the conditions of registration.

The El Sherana near-surface radiological containment facility in the Northern Territory was inspected by ARPANSA in August 2010 following the first wet season. It was observed that covering vegetation was establishing itself, but some significant erosion gullies had developed in the cover during the first wet season. Recommendations were made by ARPANSA for the repair of the erosion gullies, and additional diverting drainage was to be constructed. The reparatory work to the containment cover, and additional drainage installation occurred during the 2011 dry season. In addition, baseline radiological characterisation and baseline environmental monitoring data have been collected, and reports provided to ARPANSA which are currently being reviewed.

The El Sherana radiological containment was inspected in late September 2011 to follow up on repair works made to the cover due to erosion in the 2010-11 wet season. There has been noticeable improvement in the containment cover integrity, which is attributable to an engineered drainage solution to divert rainfall around the containment during the wet season. In addition, the native vegetation planted in the cover has subsequently flourished, which should afford more protection from erosion in the future. ARPANSA has recommended minor repairs to one area of the containment cover which appeared to have been missed in the 2011 repairs.

The regulator is currently assessing regulatory requirements based on Commonwealth law and best international practice prior to relicensing the operator for the institutional control phase of the now-closed facility.

Availability of engineering and technical support

The issuing of a licence to operate a radioactive waste management facility must take into account the availability of engineering and technical support during the operating lifetime of the facility.

ARPANSA has prepared regulatory guidance[19] for use by applicants for licences for near-surface disposal facilities and storage facilities. The guidance advises that applicants should describe in detail the knowledge, skills and experience of the operator of the proposed facility for the initial campaign and the requirements that will be placed in operators for subsequent campaigns.

Waste characterisation and segregation procedures

The Predisposal Management Safety Guide advises on approaches to the characterisation and segregation of waste and suggests segregation on the basis of radionuclide half-life into three categories consistent with the Near-Surface Disposal Code:

- short-lived waste with half-life less than six years;
- intermediate-lived waste with half-life more than six years but less than 40 years; and
- long-lived waste with half-life more than 40 years.

The Safety Guide also advises that waste can be segregated on the basis of the level of radioactivity and the radiotoxicity of the radionuclides present, based on the exemption levels used in the National. Alpha emitting waste can also be segregated from low-level or non-alpha emitting waste. Non-radiological considerations for segregation are also discussed.

The Safety Guide also provides specific advice on the management of wastes typical of Australia's current waste inventory.

In Queensland, certain requirements must be met before radioactive material may be accepted for storage as waste at the state's radioactive waste store.

Suitable radioactive substances that may be accepted for storage as waste in Queensland's radioactive waste store 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 working life;
- cannot be returned to the manufacturer or supplier; and
- are in containment approved by the regulatory authority.

[19] ARPANSA Regulatory Guidance for Radioactive Waste Management Facilities: Near-surface Disposal Facilities; and Storage Facilities 2006.

Additionally, any radioactive material, including orphan sources taken into custody by regulatory inspectors pursuant to the provisions of the *Radiation Safety Act 1999* (Qld) is accepted into the store.

Radioactive materials that will not be accepted into the store as waste 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 (e.g. 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; and
- 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 of Queensland.

Radioactive waste is not acceptable for storage is either:

- conditioned so that it is suitable for storage in accordance with the national Predisposal Management Safety Guide; or
- conditioned so that it is acceptable for immediate disposal (release into the environment as per the requirements of the Queensland *Radiation Safety Act 1999*, the NDRP and the User Disposal Code).

Reporting of incidents significant to safety

The NDRP specifies the types of incidents that must be reported to ARPANSA for compilation in the Australian Radiation Incident Register. Radiation Incidents are defined as:

‘Any unintended or ill-advised event when using ionising radiation apparatus, specified types of non-ionising radiation apparatus or radioactive substances, which results in, or has the potential to result in, an exposure to radiation to any person or the environment, outside the range of that normally expected for a particular practice, including events resulting from operator error, equipment failure, or the failure of management systems that warranted investigation.’

There are 11 types of Radiation Incidents that must be reported to the Australian Radiation Incident Register which apply to all incidents, not only for waste management facilities. The types of radiation incidents relevant to waste management that must be reported include:

- incidents that cause or may lead to radiation injuries or radiation doses exceeding the annual dose limits to workers or members of the public;
- unintentional or unauthorised discharges of radioactive materials into the environment;
- contamination with, or dispersal of, radioactive material;
- out of control (lost or stolen) radioactive sources;
- nuclear incidents such as criticality incidents;
- transport of radioactive material, including where a package is damaged during freight handling or transport; and
- other incidents that the Authority considers warrant reporting, including near-miss situations that can serve as a warning to other users.

The last provision was included to allow regulators to identify additional types of incident that are not specified in Schedule 13 of the NDRP, but which are reported to the regulator and may warrant inclusion on the national register. Should additional types of incident be identified, this may lead to revision of Schedule 13 to ensure that all regulators report similar incidents to the national register. At the present time there is no additional guidance on "other incidents". Australian regulators all require licensees to report incidents significant to safety. For example, a licence holder subject to the ARPANS Act must comply with the following statutory conditions set out in the Regulations to the Act:

- 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; and
- 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 the Act and Regulations, incidents are reported[20] to the Parliament of Australia in ARPANSA's quarterly reports.

[20] These reports are available on the web at http://www.arpansa.gov.au/AboutUs/Corporate/quarterlyreports.cfm

Collection and analysis of operating experience

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

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

Preparation and update of decommissioning plans

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

Uranium mines and production facilities are required under the ARPANSA Mining Code to submit a mine management plan (or equivalent) addressing all facets of mine management including decommissioning and site rehabilitation.

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

Preparation and update of closure plans for disposal facility

The national standard, the Near-Surface Disposal Code, requires that prior to the commencement of operations, the operator must prepare draft or conceptual plans for decommissioning the facility and rehabilitating the site, and submit the plans to the regulator for approval. The plans must be reviewed every five years and resubmitted for approval.

The Code also requires that at the end of the institutional control period, the status of the site must be reviewed to determine whether any further management or control should be instituted.

Assessment of compliance

Australia meets this Article in terms of compliance with the relevant legislative and subordinate regulatory measures such as guidance.

Article 17 Institutional Measures after Closure

Maintaining records

The Near-Surface Disposal Code requires that detailed records of all waste consigned to and received at the facility be kept by the operator and the regulator. For each shipment, the waste generator, the type of waste, its volume and weight, and the nature and concentration of the radionuclides in the waste must be recorded. All data from environmental and area monitoring at and around the facility must also be retained.

The Code also stipulates that site records must be kept at least until the end of the institutional control period in two widely separated locations, one of which must be the government archives of the relevant jurisdiction, and must include:

- the locations of any disposal structures;
- the locations of the waste packages or containers within the structures and the date of their emplacement;
- details of the contents of waste packages or containers; and
- details of the backfilling and cover materials.

Records of the location, design and inventory of radioactive wastes at the former Radium Hill uranium mine ('Radium Hill Uranium Mine and Low-Level Radioactive Waste Repository') and Port Pirie Treatment Plant sites will be preserved by the South Australian radiation regulator and the owner of the sites, the South Australian Government Department of Primary Industries and Resources. Records relating to waste disposed at Maralinga are held by the Commonwealth and can be accessed by the South Australian regulator.

Conduct of institutional controls

As mentioned under Article 15, the national standard, the Near-Surface Disposal Code, requires the regulator to ensure that a program of surveillance involving site inspections and environmental monitoring be carried out during the institutional control period and that the historical records of the waste disposed are maintained. This includes the location and purpose of the disposal site being marked on land titles as caveats or mentions for the institutional control period. The perimeter fence and site markers must also be maintained during the institutional control period.

The institutional control period must be at least 100 years and can only end with the approval of the relevant regulatory authority. In addition, licence conditions may be imposed in certain instances. For example, conditions requiring post-closure environmental monitoring were imposed in the licence to possess the Maralinga atomic weapons test site subsequent to its rehabilitation.

As mentioned under Article 12, 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 water and airborne and surface contamination. The results are publicly available in the annual ANSTO Environmental and Effluent Monitoring report.

Under the Northern Territory *Radiation Protection Act*, registration is an Authority 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 Authority under the *Radiation Protection Act*.

Intervention measures

Any unplanned releases of radioactive materials into the environment that are detected during the institutional control period would trigger regulatory assessment of any impacts followed by intervention measures and changes to the control procedures as required.

Regulatory controls over the Radium Hill, Port Pirie and Maralinga sites, and any other facilities in South Australia, 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.

Assessment of compliance

A program of on-going monitoring, assessments and audits of closed disposal sites has verified Australia's continuing compliance with Article 17.

Section I – Transboundary Movement

Article 27 Transboundary Movement

Requirements on import

Legislation restricting the import of radioactive substances, including waste, appears in Regulation 4R(2) of the *Customs (Prohibited Imports) Regulations 1956* (Cth).[21]

4R Importation of radioactive substances

(2) The importation into Australia of a radioactive substance is prohibited unless:

(a) a permission in writing to import the substance has been granted by the Minister for Health and Ageing or an authorised officer; and

(b) the permission is produced to a Collector.

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.

Current Commonwealth Government policy prohibits the import of radioactive waste.

Permissions are normally granted by officers in ARPANSA who have been appointed by the Minister for Health and Ageing. The Customs Regulations establishing the import control (Regulation 4R of the *Customs (Prohibited Imports) Regulations 1956*) give the Minister powers to vary or revoke applications that have been granted by authorised officers. If the authorised officer has formed an opinion that the permission should not be granted, the application must be referred to the Minister for Health and Ageing for the final decision, which may be to grant, or refuse to grant, the permission. There is no overlap or conflict of decision-making authority.

Requirements on export

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

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

[21] http://www.comlaw.gov.au/Details/F2010C00785

Australia's *Customs (Prohibited Exports) Regulations 1958* (Cth)[22] prohibit the export of most uranium and thorium source material, most special fissionable material and other fissionable materials (as set out in Schedule 7 to Regulation 9) without the prior written permission of the Minister for Resources and Energy.

The export of radioactive waste to the Pacific Island Developing Countries is prohibited in Regulation 13G of the *Customs (Prohibited Exports) Regulations 1958* unless permission in writing to export the radioactive waste has been granted by the Minister for Resources and Energy, taking into account the international obligations of Australia. The Regulation defines 'radioactive waste' as waste consisting of material that emits ionising radiation as a result of the spontaneous transformation of the nucleus of the atom but does not include material that has an activity concentration below 1 becquerel per gram or an activity below 1000 becquerel.

Return to manufacturer

The Commonwealth Government and state and territory jurisdictions allow the transboundary movement of disused sealed sources for return to the manufacturer. These movements must comply with all relevant legislative and regulatory requirements, and are covered by the ARPANSA *Code of Practice for the Safe Transport of Radioactive Material* (ARPANSA, 2008), which follows the IAEA Transport Requirements.

Assessment of compliance

Australia has adequate controls for import of radioactive materials including radioactive waste, but only controls the export of radioactive waste under the conditions described.

[22] http://www.comlaw.gov.au/Details/F2011C00191

Section J – Disused Sealed Sources

Article 28 Disused Sealed Sources

Australia chaired and was represented at an IAEA technical meeting in 2009 on the implementation of the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* (2004) with regard to long-term strategies for the management of sealed sources. The objective of the meeting was to consider legal and technical issues and possible strategies related to the management of sealed sources, in particular when these sources are reaching the end of their life cycle, or when orphan sources are detected at borders or during transit. The meeting agreed that holders of disused sources should not be permitted to retain them indefinitely. An emphasis was placed on harmonising strategies based on more effective communication and cooperation among states, regulators, suppliers, shippers, users and waste management organisations.

In order to improve the long-term management of disused sealed sources, Australia is supportive of initiatives to explore possible synergies between the Code of Conduct and the Joint Convention.

Legislative requirements for dealing with disused sealed sources

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

Australia operates a radioactive material import control scheme under the *Customs (Prohibited Imports) Regulations 1956.* The scheme is administered by ARPANSA in conjunction with the Australian Customs Service, and State and Territory radiation protection regulators. The Regulations allow ARPANSA to attach conditions to a permission given to import a radioactive material. In addition to other conditions that might be placed on the permission, the person importing the material must inform the radiation protection regulator (in the State or Territory that the imported material will be located in) 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.[23]

ARPANSA has delegated powers from the Minister for Health and Ageing to issue export permissions for the export of high-activity radioactive sources from Australia, including sources which are designated as radioactive waste. These permissions are issued under

[23] Further information on the import control schemes can be found at

http://www.arpansa.gov.au/Regulation/permits/medical.cfm, and

http://www.arpansa.gov.au/Regulation/permits/index.cfm

Regulation 9AD of the *Customs (Prohibited Exports) Regulations 1958*. In order to export a high-activity radioactive source, the exporting party is required to present to the Australian Customs Service a valid ARPANSA Export Permit signed by an authorised ARPANSA officer. The export control has been introduced to satisfy Australia's obligations under the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* (2004).

Criteria for the approval of an application to export high-activity radioactive sources are the same as those set out in the IAEA *Guidance on the Import and Export of Radioactive Sources* (2005). Namely, that the intended recipient is authorised to receive and possess the radioactive source, the importing State has the necessary governmental infrastructure to safely and securely manage the radioactive source, and after consideration of the risk of the radioactive source being diverted for malicious use. The export control regime has been designed to meet Australia's obligations under the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* (2004). ARPANSA requires the following information to be provided before it will give permission for the export of a high-activity radioactive source: the name of the exporter and the details of the regulatory regime under which the source is managed, the details of the recipient who will receive the source, and details of the source proposed to be exported.

The Australian Customs and Border Protection Service operates radiation portal 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 holders of sources in Australia), and at scrap metal merchants.

In the Northern Territory, storage and disposal arrangements for all radiation sources will form part of each radiation protection plan that is approved.

Re-entry of disused sources

Sealed radioactive sources are re-furbished in a number of jurisdictions 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 management of sealed sources that are returned to them.

Assessment of compliance

Australia has adequate controls for re-entry of disused sealed sources, but only controls the export of high-activity disused sealed sources in accordance with the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* (2004), along with controls on the export of disused sealed sources as radioactive waste to some Pacific Island states.

Section K – Planned Activities to Improve Safety

A national audit of radium legacy wastes was performed in 2007. Most of the radium was from medical applications and from the luminising industry. Ultimately the intention is to condition and centrally store all this waste until a suitable disposal facility becomes available.

The Commonwealth Government intends to establish a facility at which low-level waste will be disposed of by near-surface burial and the smaller inventory of intermediate-level waste will be stored. The Government's legislation providing for a national radioactive waste management facility is currently under consideration in the Federal Parliament. It is estimated that once legislation is in place, it will take at least six years to site, construct and licence the facility. Much of this time will be committed to nuclear and environmental regulatory processes under the EPBC Act and the ARPANS Act.

Nationally, an amendment to the NDRP that will update limits for disposal and discharge of radionuclides by the user is being prepared. The amended limits and requirements for disposal of low-level radioactive waste which is not otherwise exempt will ultimately be adopted by all Australian jurisdictions.

A revision of RPS1, to take account of the publication of more recent recommendations by ICRP Publication 103 and the revised IAEA Basic Safety Standards, has commenced.

The national Near-Surface Disposal Code is currently being reviewed and will be updated and reissued, together with an accompanying safety guide.

Guidance based on ICRP Publication 91: *A Framework for Assessing the Impact of Ionising Radiation on Non-Human Species* is being developed. The guidance will be particularly relevant with the expansion of uranium mining in Australia. It is estimated that development of the guidance will require approximately three years. As the guidance will be advisory, its introduction by radiation regulators can occur as soon as publication takes place; however, implementation timeframes vary across jurisdictions.

The document *Regulatory Guideline on Review of Plans and Arrangements* (ARPANSA, 2003) sets out the regulatory expectation and therefore the criteria by which the adequacy of a radiation management plan is judged. This document is currently being updated.

ARPANSA is also updating its 2006 *Regulatory Guidance for Radioactive Waste Management Facilities: Near Surface Disposal Facilities; and Storage Facilities* for proposed Commonwealth facilities. The new draft Regulatory Guidance is based on international best practice and current international safety standards. It encompasses the essentials ('requirements') and help on how to achieve what is required ('guidance') for potential applicants seeking regulatory approval to site, construct, operate and decommission/close a radioactive waste storage or disposal facility. The Regulatory Guidance addresses both safety and security issues.

The Regulatory Guidance refers to storage as the placement of radioactive waste in a specific facility where appropriate isolation and monitoring are provided and designed to last for a period of at least tens of years. The Guidance is directed towards stores with an anticipated duration of storage of ca. 50-100 years. Specific disposal options that are addressed are near-surface and borehole disposal facilities, which cover all forms of radioactive waste currently held in Australia.

The updated Regulatory Guidance is now ready for stakeholder consultation before being finalised and published on the ARPANSA web site as a replacement for the 2006 Regulatory Guidance document.

The ARPANSA Radiation Health and Safety Advisory Council (RHSAC) has provided advice and recommendations to the CEO of ARPANSA on improved strategies for safe management of intermediate-level waste.[24]

CSIRO are investigating appropriate segregation and characterisation techniques for the 10,000 drums of low-level uranium-processing waste currently stored at Woomera, South Australia, to aid in identifying those below exemption levels and for consolidation to reduce the volume for storage.

An interim store for ILW is proposed at the ANSTO site. This will be used to temporarily store the vitrified and cemented waste packages to be returned to Australia from reprocessing of spent fuel in France and the UK.

Western Australia is proposing to relocate its interim state waste storage facility.

[24] Scoping Review of Issues Related to the Management of Intermediate Level Radioactive Waste in Australia http://www.arpansa.gov.au/pubs/rhsac/waste_report_RHSAC.pdf

Section L – Annexes

Annex A – Inventory of radioactive wastes

The following current inventory of radioactive waste held in Australian storage and disposal facilities is produced from data stored in the IAEA database NEWMDB (as yet unpublished). In all cases, if the date of activity measurement was unknown it was conservatively assumed that the activity provided was the activity on 1/7/2011. This inventory does not include sources of unknown activity and sources of unknown radionuclide. If the total activity of all sealed sources of a particular radionuclide at a given site was below the exemption levels quoted in the NDRP, the radionuclide has not been included in the inventory.

Inventory of disused sealed sources held in Australian storage facilities:

Site: Commonwealth (ANSTO, CSIRO, ARPANSA)

Activity Reference Date: 1/07/2011

Radionuclide	Number of Sources	Total Activity (GBq)
Ac-227	13	8.1E+00
Am-241	63	1.9E+02
Am-241/Be	45	1.3E+03
Ba-133	16	4.2E-02
Cf-252	7	3.7E-01
Cm-244	6	1.7E+00
Co-57	5	1.0E-02
Co-60	2101	3.4E+06
Cs-137	119	4.1E+04
H-3	9	9.3E+02
Hg-203	5	1.9E+01
Ir-192	6	2.1E+01
Kr-85	6	3.1E+00
Ni-63	6	2.1E+00
Pb-210	2	3.7E-02
Pu-238	4	4.3E+00
Pu-238/Be	1	2.3E+01
Pu-238, Pu-239, Pu-241	37	1.8E+02
Ra-226	85	3.9E+01
Ra-226/Be	9	3.2E+00
Sr-90	30	5.2E-01
Sr-90, Y-90	6	9.5E-04
Mixed radionuclides	28	1.7E+00

Site: Victoria

Activity Reference Date: 1/07/2011

Radionuclide	Number of Sources*	Total Activity (GBq)
Am-241	506	1.8E+02
Am-241/Be	5	6.1E+00
Co-60	76	4.9E-01
Cs-137	22	2.9E+00
Kr-85	3	3.4E-01
Ni-63	2	8.5E-01
Pb-210	1	7.4E-04
Ra-226	157	6.9E-01
Ra-226/Be	1	2.7E-01
Ru-106	1	8.0E-03
Sr-90	108	1.0E+01
Th-232	1	4.2E-04
Tl-204	15	6.1E-02
U-238	2	5.9E-03

Site: Queensland

Activity Reference Date: 1/05/2011

Radionuclide	Number of Sources	Total Activity (GBq)
Am-241	3307	2.1E+01
Am-241/Be	29	4.1E+02
Ba-133	19	1.0E-01
C-14	12	1.8E-02
Cd-109	9	3.0E-03
Cm-244	1	4.0E-01
Co-57	59	2.0E-03
Co-60	117	7.0E-01
Cs-137	117	5.1E+03
Fe-55	6	4.6E-02
H-3	35	2.3E+01
Kr-85	2	2.2E-02
Ni-63	6	8.0E-01
Pb-210	23	1.0E-02
Pu-238	8	5.0E+00
Ra-226	604	1.2E+02
Ra-226/Be	7	2.0E+00
Sr-90	64	4.9E+01
Tl-204	24	3.9E-05
Th-232	6	6.0E-04
U-233	1	3.4E-02

Site: Australian Capital Territory

Activity Reference Date:	**1/07/2011**	
Radionuclide	**Number of Sources***	**Total Activity (GBq)**
Am-241	4	1.9E-01
Cd-109	5	4.4E-02
Co-60	2	1.0E-08
Cs-137	6	4.0E-04
Fe-55	8	3.7E-01
Ra-226	1	7.3E-05
Sr-90	5	9.1E-01

Site: Tasmania

Activity Reference Date:	**1/07/2011**	
Radionuclide	**Number of Sources**	**Total Activity (GBq)**
Am-241	13	1.7E+00
Co-60	6	1.2E-03
Cs-137	11	1.9E+01
H-3	45	2.5E+01
Pu-238	2	2.0E+00
Ra-226	12	5.0E+00
Sr-90	4	2.3E+00

Site: New South Wales

Activity Reference Date:	**1/07/2011**	
Radionuclide	**Number of Sources***	**Total Activity (GBq)**
Am-241	5	3.0E+00
Am-241/Be	40	1.5E+02
Co-60	13	1.1E+00
Cs-137	21	5.6E+01
Kr-85	7	2.3E+01
Ra-226	735	7.5E+01
Ra-226/Be	15	5.0E+00
Sr-90	158	2.4E+02
Tl-204	2	5.4E+00
U-238	1	4.4E-03

Site: Northern Territory

Activity Reference Date:	**1/07/2011**	
Radionuclide	**Number of Sources**	**Total Activity (GBq)**
Am-241	4	2.2E+02
Co-60	3	3.0E-02
Cs-137	3	1.5E+00
Sr-90	3	2.9E+00

Site: South Australia

Activity Reference Date:	**1/07/2011**	
Radionuclide	**Number of Sources**	**Total Activity (GBq)**
Am-241	150	4.6E-01
Cs-137	2	2.7E-02
Ra-226	4	1.1E+00
Tl-204	1	3.7E-03
Po-210	3	3.0E-03

*In some instances the number of sources was not available – these values are estimated from other information provided by state and territory regulators.

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

Activity Reference Date:	**1/07/2011**	
Radionuclide	**Number of Sources***	**Total Activity (GBq)**
Am-241	2732	7.4E+01
Am-241/Be	5	8.2E+00
Ba-133	10	3.5E-02
C-14	1	8.3E-03
Cf-252	1	6.4E-04
Co-60	55	2.3E+00
Cs-137	142	2.6E+02
H-3	2810	4.4E+05
Ni-63	5	1.5E+00
Ra-226	21	5.8E+00
Ra-226/Be	3	5.7E-01
Sr-90	12	3.5E+00
Th-232	12	1.2E-02
Tl-204	3	1.1E-02

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

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

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

Inventory of unsealed radioactive waste:

Uranium Mining and Milling Sites

Jurisdiction	**Site Name**	**Waste Class**	**Volume (m^3)**	**Mass (Mt)**
Northern Territory	Ranger	UMMT		43.1
South Australia	Beverly	LLW	6420	
South Australia	Honeymoon	LLW	205	
South Australia	Pt Pirie	UMMT	120000	
South Australia	Radium Hill	LLW	200	
South Australia	Radium Hill	UMMT	250000	
South Australia	Olympic Dam	UMMT		178

Disposal Sites

Jurisdiction	**Site Name**	**Waste Class**	**Volume (m^3)**
Commonwealth	ANSTO - Little Forest	LLW	1540
Commonwealth	ANSTO - Little Forest	ILW	178
Commonwealth	Parks Australia North	LLW	22000
South Australia	Maralinga	LLW	432000
Western Australia	Mt Walton East	LLW	124

Storage Sites

Jurisdiction	**Site Name**	**Waste Class**	**Volume (m^3)**
Commonwealth	CSIRO - Woomera	LLW	2100
Commonwealth	ARPANSA	LLW	0.28
Commonwealth	ARPANSA	ILW	6.50
Commonwealth	ANSTO - Lucas Heights	LLW	1710
Commonwealth	ANSTO - Lucas Heights	ILW	427
Australia Capital Territory	Store	LLW	0.22
New South Wales	Store	VLLW	0.70
New South Wales	Store	LLW	7.02
Queensland	Store	LLW	0.15
South Australia	Store	LLW	1.04
Victoria	Store	VLLW	1.09
Victoria	Store	LLW	2.40

Annex B – References to national laws, regulations, requirements, guides, etc.[25]

Commonwealth Government

- ***Australian Nuclear Science and Technology Organisation Act 1987***
- ***Australian Radiation Protection and Nuclear Safety Act 1998***
- ***Australian Radiation Protection and Nuclear Safety Regulations 1999***
- Australian Radiation Protection and Nuclear Safety Agency. *Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002).* Radiation Protection Series No. 1.
- Australian Radiation Protection and Nuclear Safety Agency. *Regulatory Guideline on Review of Plans and Arrangements.* ARPANSA Regulatory Guidance Document RB-STD-15-03, August 2003.
- Australian Radiation Protection and Nuclear Safety Agency. *Code of Practice for the Safe Transport of Radioactive Material.* Radiation Protection Series No. 2, 2008.
- Australian Radiation Protection and Nuclear Safety Agency. *National Directory for Radiation Protection.* Radiation Protection Series No. 6, July 2011.
- Australian Radiation Protection and Nuclear Safety Agency. *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*. Radiation Protection Series No. 9, 2005.
- Australian Radiation Protection and Nuclear Safety Agency. *Safety Guide for the Predisposal Management of Radioactive Waste*. Radiation Protection Series No.16, 2008.
- Australian Radiation Protection and Nuclear Safety Agency. *Safety Guide for Classification of Radioactive Waste*. Radiation Protection Series No.20, 2010.
- Australian Radiation Protection and Nuclear Safety Agency. *Regulatory Guidance for Radioactive Waste Management Facilities: Near-Surface Disposal Facilities; and Storage Facilities*, 2006.
- ***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 Wastes by the User (1985).* Radiation Health Series No. 13, 1986.
- 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.

[25] Principal instruments appear in bold type.

Australian Capital Territory

- ***Radiation Protection Act 2006***
- ***Radiation Protection Regulation 2007***
- ***Work Safety Act 2008***
- ***Work Safety Regulation 2009***

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***
- ***Mining Management Act***
- ***Radiation Protection Act***
- ***Radiation Protection Regulations (No 20 of 2007)***
- ***Radioactive Ores and Concentrates (Packaging and Transport) Act***
- ***Radioactive Ores and Concentrates (Packaging and Transport) Regulations 1980***
- ***Workplace Health and Safety Act***

Queensland

- ***Radiation Safety Act 1999***
- Radiation Safety (Radiation Safety Standards) Notice 1999
- ***Radiation Safety Regulation 1999***

- Queensland Government, *Agreement for the establishment and operation of a Secure Radioactive Waste Storage Facility at Esk between State of Queensland and Council of the Shire of Esk.*
- ***Nuclear Facilities Prohibition Act 2007***
- ***Environmental Protection Act 1994***
- ***Environmental Protection (Waste Management) Regulation 2008***

South Australia

- ***Radiation Protection and Control Act 1982***
- ***Radiation protection & Control (Ionizing Radiation) Regulations 2000***
- ***Nuclear Waste Storage Facility (Prohibition) Act 2000***
- ***Radiation Protection and Control (Transport of Radioactive Substances) Regulations 2003***

Tasmania

- ***Radiation Protection Act 2005***
- ***Radiation Protection Regulations 2006***
- ***Environmental Management and Pollution Control Act 1994***

Victoria

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

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 C – References to reports on international review missions performed at the request of a Contracting Party

At the request of the Commonwealth of Australia, an international team of eleven experts in radiation and nuclear safety visited the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) from 25 June to 6 July 2007 to conduct a full scope IAEA Integrated Regulatory Review Service (IRRS) mission to review ARPANSA's regulatory framework and its effectiveness.

The scope of the mission included sources, facilities and activities regulated by ARPANSA: research reactors, industrial and research activities, safety and security of radioactive sources, radioactive waste management, decommissioning, and remediation. Both regulatory technical and policy issues were addressed. Among the policy issues discussed was that of achieving progress in national uniformity of radiation protection in the Commonwealth and the six States and Territories within Australia.

Particular strengths of ARPANSA, its policy, its regulatory framework and its regulatory activities that were identified by the IRRS team included the development and implementation of a NDRP as a means to progress the goal of national uniformity in radiation protection.

The IRRS team also reported recommendations or suggestions where improvements were necessary or desirable to further enhance the legal and governmental infrastructure for radiation and nuclear safety. Consideration of promotion of a national system for the classification of radioactive waste was one of the areas the team identified that would contribute significantly to the enhancement of the overall performance of the regulatory system.

The full report of the mission is available online:
http://www.arpansa.gov.au/pubs/regulatory/irrs.pdf

The 2007 IRRS mission was a full-scope review to assess ARPANSA's regulatory framework and practices against the IAEA Safety Standards. There is to be an IRRS follow-up mission to ARPANSA in November 2011, to assess implementation of the 2007 IRRS recommendations.