3. Radioactive Waste Management (RWM) Status in FNCA Countries

3.1 Radioactive Waste Management (RWM) Status in Australia

Radioactive waste in Australia is generated by research, industry, medical applications, research reactor operation and radiopharmaceutical production. Naturally occurring radionuclides (NORM) and technologically enhanced naturally occurring radioactive materials (TENORM) are produced in Australia by the mining, mineral sands processing and other resources sectors. Australia has no nuclear power plants.

Australia has embarked on developing and implementing an integrated waste management strategy to safely manage radioactive wastes and to minimise the burden on future generations. In line with this strategy, Australia is in the process of selecting a site for a Commonwealth Radioactive Waste Management Facility (CRWF), which would include (depending on the geological characteristics of the site) either a near surface repository for disposal, or a store for the storage, of low-level radioactive waste and a store for the storage of intermediate level radioactive waste produced by Commonwealth agencies.

3.1.1 Australian Regulatory Framework

Australia has a federal system of government, and the regulation of radioactive waste management and disposal comes under both Commonwealth (federal) and State/Territory regulation. The States and Territories are responsible for monitoring the use, transport and disposal of radioactive materials under their control or the control of private companies or individuals in accordance with State and Territory acts and regulations, which are administered by State or Territory radiation safety authorities. Similarly, the Commonwealth Government is responsible for managing radioactive material in organisations under its control. Commonwealth organisations, including contractors handling radioactive materials, are regulated by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), which is part of the Health and Ageing Portfolio.

ARPANSA regulates all Commonwealth entities (including Departments, Agencies and Bodies Corporate) involved in radiation or nuclear activities or dealings. This includes regulating the management and storage of radioactive waste at Commonwealth agencies such as the Australian Nuclear Science and Technology Organisation (ANSTO), the Commonwealth Science Industry and Research Organisation (CSIRO) and the Department of Defence. ARPANSA is also tasked with promoting uniformity of radiation protection and nuclear safety policy and practices across all jurisdictions (Commonwealth, the States and the Territories). In the States and Territories, the uses of radiation and radioactivity are regulated by Environmental Protection Authorities and Health Departments in each state (unless it arises from the activities of a Commonwealth agency, in which case it is regulated by ARPANSA). In addition to the Acts and Regulations listed above, a series of codes and standards on radiation protection, which were previously published under different umbrellas, are in the process of review and reissue by ARPANSA as the Radiation Protection Series. These codes and standards provide guidelines for handling, processing and disposal of radioactive waste.

3.1.2 Criteria Used to Define and Characterise Radioactive Waste

The classification of radioactive waste and requirements for site selection, design criteria and operational requirements for a near surface facility in Australia are specified in the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia*, issued by the National Health and Medical Research Council (NHMRC 1992). Three categories of radioactive waste (A, B and C) are defined in the Code as suitable for near-surface disposal and one category (S) as unsuitable. The generic concentration limits for these categories are listed in Table 3.1-1. These activity limits are provided for a remote and arid site where groundwater pathways for release of radionuclides are insignificant and could be ignored, and were derived from an evaluation of potential intruders such as road construction, house building, residential use, livestock grazing and archaeological excavation scenarios which might arise after the institutional control period.

Table 3.1-1
Generic Concentration Limits for Disposal of Radioactive Wastes at an Arid Remote Site

Radionuclide	Category	100 y control Bq/kg	200 y control Bq/kg
Tritium	Category A	5×10^{8}	10^{11}
	Category B & C	10^{10}	5×10^{12}
Carbon-14	Category A	10^{7}	10^{7}
	Category B & C	5×10^{7}	5×10^{7}
α-emitters	Category A	10^{5}	10^{5}
(inc. ^{238}U, ^{239}Pu, ^{241}Am)	Category B & C	10^{7}	10^{7}
Ra-226, U*	Category A	5×10^{3}	5×10^{3}
Ra-226	Category B	5×10^{5}	5×10^{5}
Ra-226, Th-232, U*	Category C	5×10^{5}	5×10^{5}
β/γ emitters with	Category A	5×10^{5}	5×10^{6}
half-life > 5 y	Category B & C	10^{8}	10^{9}
β/γ emitters with	Category A	10^{9} **	10^{9} **
half-life = 5 y	Category B & C	no limit**	no limit**

Notes:
* Is uranium in secular equilibrium with progeny
** In practice consideration of surface dose rates from waste packages during transport and handling will lead to more restrictive values.

ARPANSA regulations define exemption values for all radionuclides which are based on the IAEA Basic Safety Standards. At this time, the States and Territories have inconsistent definitions as to what constitutes a radioactive substance, but are working towards a uniform standard through the recently implemented National Directory for Radiation Protection.

3.1.3 Radioactive Waste Management Facilities

Australia has a number of radioactive waste management facilities where radioactive wastes is held in storage and/or processed. The Australian Nuclear Science and Technology Organisation (ANSTO) is a key facility in radioactive waste management in Australia and has a 10 MW heavy water research reactor (HIFAR), a medical cyclotron and associated radiopharmaceutical production facilities. This existing research reactor will soon be replaced by a multipurpose 20 MW research reactor, which is currently being commissioned.

Radioactive waste management facilities in Australia range from custom built decontamination facilities and radioactive waste stores, such as those at ANSTO, to temporary storage facilities where radioactive material is held in transit. Current operational radioactive waste management facilities in Australia are listed in Table 3.1-2.

Table 3.1-2
Radioactive Waste Management Facilities

Location	Main Purpose	Essential Features and estimated waste inventory
ANSTO, Lucas Heights, NSW	Treatment and Packaging	Management of waste from research reactor operation, radiopharmaceutical production, research and development
ANSTO Lucas Heights, NSW	Storage	1500 m^3 low level waste 370 m^3 intermediate level waste
Mt Walton East Intractable Waste Facility, WA	Disposal	Near surface disposal of low level radioactive waste generated in the State of Western Australia
Woomera Protected Area, SA	Storage	Storage of low level and intermediate level waste owned by Department of Defence
Woomera Protected Area, SA	Storage	Storage of 2010 m^3 contaminated soil owned by CSIRO
Esk Storage Facility, Qld	Storage	Storage of radioactive waste (sources and low volume material) generated in the State of Queensland.
Others	Storage	Over 100 locations around the country where low level, short-lived and/or long-lived intermediate level radioactive waste is stored

Most of the radioactive waste that has been generated at Lucas Heights over more than 40 years is held in storage at Lucas Heights. Recent developments in radioactive waste management at ANSTO include:

- Improved facilities for storage and characterisation of solid low-level radioactive waste;
- Implementation of a formalised waste exemption and clearance system;

- Segregation, assessment and subsequent clearance of decayed waste from the low-level waste store; and
- Commissioning of a Drum Drying system to treat waste from the site liquid waste treatment process.

3.1.4 Nuclear Facilities being Decommissioned

The 0.1 MW research reactor MOATA was shutdown in May 1995, with the fuel, the cooling system and electric systems removed. A decommissioning plan has been prepared and agreed to by the regulator (ARPANSA). Timing of dismantling has not yet been decided. The 10 MW research reactor HIFAR will be shut down in 2007. The decommissioning proposal is based on removal of the fuel and heavy water followed by 10 years care and maintenance before decommissioning.

3.1.5 Australian Uranium Industry and the Management of NORM Waste

Uranium ore processing in Australia was reviewed recently [Ring 2006]. As a result of the universal concern over the effect of increased carbon emissions on the global climate, increased oil prices and the significantly improved price for uranium, there has been a rapid increase in interest in uranium deposits in Australia over the last 12 months. This has been accompanied by a corresponding demand for support for services relating to uranium ore processing, including health physics and process metallurgy. The three existing uranium mines are examining strategies for increased production by expansion, improved efficiency and/or the treatment of lower grade ores. BHP Billiton is considering a major expansion for Olympic Dam from 5,500 to approximately 14,000 tonnes U_3O_8 per year. Licences have been granted for a forth mine, which will be the second uranium in situ leaching operation in Australia.

The Australian Code of Practice for the management of radiation protection in the mining industry has also recently been updated [ARPANSA 2005] and now includes NORM affected industries. This Code replaces the Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores (1982) and the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores (1987).

3.1.6 Inventory of Radioactive Waste

Australia has about 3,700 m^3 of low-level and short-lived intermediate level radioactive waste considered suitable for disposal in a near-surface repository or a suitable engineered store This includes soil lightly contaminated with uranium mill tailings, contaminated or activated items such as paper, cardboard, plastic, rags, protective clothing, laboratory waste from research, production of radiopharmaceuticals and research reactor operation, solid residues for the treatment of low level liquid waste and some gauges and sealed sources. The low level and short-lived intermediate level waste is currently stored at over 100 locations around the country. The annual generation rate of low and short-lived intermediate level radioactive waste suitable for the repository is about 50 m^3 per year on an annual basis. In addition there will be between 500 and 2500 m^3 of low level and short

lived intermediate level waste from decommissioning the HIFAR research reactor. A summary of Australian radioactive waste inventory is given in Tables 3.1-3 and 3.1-4.

Table 3.1-3
Current inventory of low level radioactive waste in storage

Source	Typical Waste	Volume (m^3)
CSIRO	Slightly contaminated soil from research into ore processing	2010
ANSTO	Operational waste including clothing, paper and glassware	1320
Department of Defence	Contaminated soils from land remediation, sealed sources, gauges, electron tubes and equipment	210
Other	Spent sealed sources, and miscellaneous laboratory waste (numerous locations around Australia)	160

Table 3.1-4
Estimates of current inventory of intermediate level radioactive waste in Australia

Source	Typical Waste	Volume (m^3)
ANSTO – radioisotope production, reactor operation and research	Target cans, ion exchange columns, used control arms, aluminium end pieces, some solidified liquid waste	205
Historical waste	Thorium and uranium concentrates from mineral sands processing	165
Other Commonwealth agencies	Disused sources from medical, Defence and research equipment	35
States/Territories	Disused sources from medical, industrial and research equipment	100

3.1.7 Future of Radioactive Waste Disposal in Australia

In July 2004, the Australian Government announced its intention to develop a Commonwealth Radioactive Waste Facility (CRWF) on Commonwealth land for the management of both low and intermediate level waste generated by Australian Commonwealth departments and agencies. Later that year, three commonwealth sites in the Northern Territory were identified for further assessment for suitability for a waste facility. These were Defence Department properties at Mount Everard, Harts Range and Fishers Ridge. In late 2005, the Commonwealth Radioactive Waste Management

Act 2005 was passed to strengthen the Commonwealth's statutory position to develop and operate the CRWF. Preliminary evaluations are currently under way to assess the suitability of these sites for a radioactive waste management complex, which would include (depending on the geological characteristics of the site) either a near surface repository for disposal, or a store for the storage, of low-level radioactive waste and a store for the storage of intermediate level radioactive waste produced by Commonwealth agencies.