Code of practice for the near-surface disposal of radioactive waste in Australia (1992)

RADIATION HEALTH SERIES NO. 35

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NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

Code of practice for the near-surface disposal of radioactive waste in Australia (1992)

RADIATION HEALTH SERIES No. 35

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1 Preliminary

1.1 Purpose

The purpose of this code is to provide a basis for the near-surface disposal of solid radioactive waste in a way which ensures that there is no unacceptable risk or detriment to humans, other biota or the environment, at present, and that future risks or detriment will not exceed those currently accepted. Provisions of this code are intended to encourage uniform practice in Australia for the near-surface disposal of radioactive waste.

1.2 Scope

This code is intended for use by those involved in site selection, design, safety assessment, operation, regulation and rehabilitation of a disposal facility. It is also relevant for use by those who generate radioactive waste for which disposal by near-surface burial is appropriate.

The code deals with management aspects associated with radioactive waste disposal only and is not intended to cover issues related to the production and use of radionuclides, such as waste minimisation.

This code is intended to apply to the following types of solid waste:

a. waste arising from the medical, industrial, research and domestic use of radioisotopes;

b. contaminated plant and equipment resulting from handling or processing of naturally occurring materials which contain radioactive material (contaminants) in low but non-trivial amounts e.g. gypsum, phosphate, mineral sands, mineral waters, brown coal, natural gas and crude oil;

c. waste arising from processing of minerals remote from any mine site and where disposal at the mine site is inappropriate; and

d. waste arising from the rehabilitation, decontamination or decommissioning of sites or facilities where radioactive materials have been produced, stored, used or dispersed.

Radiation protection principles form the basis for developing acceptance criteria for classifying waste for disposal by near-surface burial.

The code contains provisions for the development of qualitative and quantitative waste acceptance criteria which are based upon primary dose limitation and safety assessments in the form of:

a. derived activity concentration limits for radionuclides in the waste;

b. a restriction on the total activity of radionuclides to be disposed of at any particular near-surface facility;

c. performance standards for waste forms and waste packages; and

d. restrictions on public access and land use during the operation of the facility and during a subsequent specified period of institutional control.

Variation to certain provisions of this code may be approved by the appropriate authority provided that any such modification does not diminish the standard of safety required by this Code.

The code is not intended to apply to the management of specific types of waste covered by other Commonwealth codes of practice, such as the *Code of practice on the management of radioactive wastes from the mining and milling of radioactive ores* (Australian Government Publishing Service, Canberra, 1982). Furthermore, this code is not intended to cover waste containing radioactivity at concentrations addressed by the NHMRC's *Code of practice for the disposal of radioactive waste by the user* (Australian Government Publishing Service, Canberra, 1985).

The code identifies waste that is unsuitable for near-surface disposal but does not address methods or criteria for their disposal.

1.3 Radioactive waste hazards

The health risk to humans presented by radioactive waste depends upon the radionuclides present, the type of radiation emitted by the particular radionuclides, their concentrations, and their chemical and physical form. The hazard may arise from external irradiation of the body or internally as

a result of radioactive substances entering the body by ingestion, inhalation or absorption through the skin. The radioactive waste specifically covered by this code may also present a long-term hazard to the environment and to future generations if disposal is not carried out in a responsible manner. Overall, the potential hazard is of sufficient magnitude that the practices specified in this code are considered necessary to ensure adequate protection of humans, other biota and the environment.

1.4 Specialised meanings of shall and should

The words *shall* and *should,* where used in this code, have specialised meanings. *Shall* indicates that the particular requirement is essential. *Should* indicates a procedure or precaution which is to apply, wherever practicable, in the interests of improving radiation protection.

1.5 Definitions

Activity means the average number of spontaneous nuclear transformations of a radionuclide occurring in unit time. The SI unit of activity is the becquerel (Bq) which is equal to one nuclear transformation per second.

Activity concentration means the concentration of a radioactive substance in any particular material expressed in terms of the activity of the radionuclide in becquerel per kilogram of the material.

ALARA is the acronym for as low as reasonably achievable. In terms of waste management the practices that are adopted should be such that the magnitude of doses to individuals, the number of people exposed and the likelihood of incurring exposures where these are not certain to be received should be kept as low as reasonably achievable, economic and social factors being taken into account. This will generally be achieved by the use of the best practicable technology.

Appropriate authority means one or more statutory authorities which are responsible for enforcing the provisions of legislation implementing any part or the whole of this code.

Buffer zone means a zone of restricted access which is controlled by the operator between the operational site boundary and any structure within the facility to ensure that there is a sufficient distance between the facility and any area accessible to members of the public.

Chelating agents means chemical compounds, such as amine poly-carboxylic acids, hydroxy-carboxylic acids and poly-carboxylic acids, which are capable of forming soluble complexes with metal cations.

Committed effective dose, ***equivalent dose*** **and** ***effective dose*** are terms as defined in the *1990 Recommendations of the International Commission on Radiological Protection*, ICRP publication 60, (Pergamon Press, Oxford, 1991).

Design life means the period after completion of an engineered disposal structure during which the structure and all its components are expected to perform in accordance with the design objectives.

Disposal – see waste disposal.

Disposal facility means the land, buildings and equipment which are intended to be used for the disposal of radioactive waste near the surface of the land and are enclosed within a fenced buffer zone.

Disposal site means that area of land which is used for the disposal of the waste and consists of a disposal facility and a surrounding buffer zone.

Disposal structure means a trench, bore hole or other form of excavation which is designed to contain the radioactive waste; it may be constructed from natural as well as manufactured materials.

Engineered barrier means a feature made or altered by humans which delays or prevents radionuclide migration from the waste or the disposal structure into its surroundings; it may be part of the waste package or part of the disposal structure.

Environmental management plan means a document which sets out a system of management based on social, economic and environmental aims within which the decision making process takes place.

Government means the government of the Commonwealth of Australia or of a State or Territory of the Commonwealth.

ICRP means the International Commission on Radiological Protection. It is an independent organisation which provides general guidance on radiation protection. The recommendations of the ICRP are not legally binding, but are generally followed by countries framing national regulatory requirements.

Institutional control means the control of a former waste disposal site by the appropriate authority in order to restrict access to and use of the site, and to ensure an on-going knowledge that the site has been used for the disposal of radioactive waste.

Intrusion, inadvertent or intentional, means the process by which living organisms, including humans, may come in contact with disposed or stored waste.

Manager means the person responsible for the administration and direction of a waste disposal facility.

Member of the public means a person who is exposed only incidentally to radiation as a consequence of the disposal of radioactive waste at a site or the operation of a disposal facility. Public exposure may occur through inadvertent intrusion or from dispersal of radioactive contaminants from the site.

NHMRC means the National Health and Medical Research Council. Its principal function is to advise the Australian community on matters relating to the achievement and maintenance of high standards of individual and public health through appropriate legislation, administration and practices, and to encourage health and medical research to achieve those standards.

Near-surface disposal or ***shallow ground burial*** means the disposal of radioactive waste in structures located below and/or above the natural ground surface (within approximately 30 metres of it) and covered by layer(s) of natural and/or manufactured materials.

Proponent/operator means any person, company, government or other entity which conducts or carries out operations for the disposal of radioactive waste.

Radiation means ionising radiation.

Radioactive substance means a substance which spontaneously emits radiation.

Radioactive waste means waste materials which contain radioactive substances for which no further use is envisaged.

Radiation management plan means a document which sets out a system of management of radiation protection aims within which the decision making process takes place.

Scenario means a possible series of events or conditions which describe means of human intrusion or other contact with disposed waste after the closure of the site and following the institutional control period.

Shallow ground burial - see near-surface disposal.

Stability means the capability of a waste package or disposal structure to maintain its shape and properties under disposal conditions.

Storage means the emplacement of waste in a facility with the intent and in a manner such that it can be retrieved at a later time.

Structural life means the period over which a structure is expected to continue to perform its basic functions, even at a reduced level, and is a measure of the useful life of a disposal structure.

Technical auditor means an appropriately qualified scientist or organisation who, or which, is competent to assess the degree of compliance of the proponent/operator of a waste repository with this code, or with the requirements of the appropriate authority as specified in this code.

Waste - see radioactive waste.

Waste conditioning means the process which converts the waste into an acceptable concentration and stable form for packaging, shipment and disposal. The process may involve solidification of the waste and/or encapsulation in a stable matrix such as concrete.

Waste disposal means the placement of radioactive waste in a structure and in a manner such that there is no intention of retrieval.

Waste minimisation means the establishment of practices in all stages of the production, processing and use of radioactive materials to minimise the quantity of waste generated, including its radioactivity.

Waste package means the waste form and its container as prepared for handling, transport, storage or disposal.

Waste treatment means the processes that are carried out to change the characteristics of the waste to produce a safe and convenient form for storage or disposal. This may involve operations such as solidification, incineration or compaction to minimise the waste volume.

2 Criteria for waste management

2.1 Waste disposal objective

The objective in establishing a waste disposal facility is to isolate radioactive waste in a way which ensures that 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. Associated with this is the principle that the burden placed upon future generations for the surveillance and control of waste produced by the present generation should be minimised.

2.2 Radiation protection considerations

Radiation protection considerations shall be the basis for the establishment of waste acceptance criteria to achieve the objective in Section 2.1.

The characteristics of the site chosen for the disposal facility and the design of facilities for waste treatment, packaging or conditioning for disposal shall ensure that the following system of radiation protection is adhered to. The system is recommended by the International Commission on Radiological Protection and has been adopted by the National Health and Medical Research Council.

a. No practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiological detriment it causes (justification).

b. The magnitude of individual radiation exposures, the number of people exposed and the likelihood of incurring the exposures where these are not certain to be received shall be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account (optimisation).

c. The exposure of individuals resulting from the combination of all the relevant practices should be subject to dose limits or to some

control of risk in the case of potential exposures (individual dose and risk limits).

The concept of a dose constraint on the exposure of an individual has been introduced by the ICRP to be applied to a single source in order to ensure that dose limits are not exceeded. The dose constraint is therefore set at a fraction of a dose limit as a boundary to optimisation for that source.

The objective outlined in Section 2.1 shall be achieved by the use of the annual radiation dose limits recommended by the NHMRC for the following individuals:

a. personnel employed at the disposal facility or personnel involved with operations for the treatment, packaging or conditioning of waste or in the transport of waste to the facility; and

b. any member of the public who might be exposed as a result of inadvertent intrusion or environmental dispersal of radioactivity from the site during operations, or during or after the institutional control period.

Dose constraints shall be applied to the waste disposal system to ensure that individual dose limits are not exceeded. Such constraints shall apply where individuals may be exposed to other potential, or actual, sources of radiation, excluding natural background or medical sources.

2.3 Performance requirement and safety assessment

The performance requirement of the overall waste disposal system is contained within the objective of Section 2.1.

To show that this performance requirement will be achieved by the proposed waste disposal facility, the proponent shall submit to the appropriate authority a detailed analysis of the design and operation of the facility, and an assessment of the projected long-term integrity of the site after closure. The structural requirements of Section 2.6.5 should be addressed in this assessment.

A safety assessment shall also be undertaken by the proponent, and be subject to independent technical audit. This assessment shall identify those pathways through which radionuclides could be released to the general environment during the operation of the facility or after its closure. The assessment shall also include a quantitative treatment of realistic scenarios which could lead to exposure through inadvertent intrusion at the site after institutional control has ceased. It should be clearly demonstrated that the degree of protection of humans is optimised, and that potential radiation exposure of an individual member of the public in the event of off-site releases of radioactivity or inadvertent intrusion will not lead to a radiation dose in excess of the limits prescribed in Section 2.6.1 of this code.

The probability of occurrence of the various exposure scenarios should also be estimated within the safety assessment. A common practice in the development of quantitative waste acceptance criteria is to assume that any given exposure scenario is likely to happen at least once and, therefore, assign to it a probability of one. The assumption of any probability of less than unity, which may subsequently be used to establish quantitative criteria for a specific disposal facility, shall be justified in the safety assessment.

2.4 Site requirements and selection criteria

2.4.1 General site characteristics

A near-surface repository site ideally should be located in an area with favourable meteorological, geological and geographical characteristics so that the radioactive waste, once in place, will be adequately isolated from the biosphere for the time that the radionuclides originally present, or their progeny, constitute a radiation hazard. Ideally the natural characteristics of the site should provide the initial effective barrier to the dispersal of radionuclides from the waste or to human intrusion. The location of the disposal site and its characteristics will influence the design of the facility. These should also be considered when determining

the limits to be placed on the total site activity for the facility, on the radionuclide concentrations in the waste and appropriate conditioning for waste packages.

Water and wind are environmental agents most likely to influence the off-site migration of radionuclides; therefore, the meteorological and hydrogeological characteristics of a disposal site are especially important. The best practicable technology consistent with ALARA shall be incorporated into the design of structures to enhance the confinement of waste, especially where these characteristics are less favourable than desired. A surrounding area of restricted development with characteristics that further augment the safety of the site shall be provided.

2.4.2 Site selection criteria

To be suitable for near-surface disposal of radioactive waste, the site chosen for the facility shall have characteristics that will facilitate its long-term stability and provide adequate isolation of the waste so that the objective in Section 2.1 is achieved. Site selection criteria should include not only natural physical characteristics but also socioeconomic, ecological and land use factors. The criteria listed below have been subdivided into those which are regarded as being important from a radiation health perspective and non-radiological factors which are also significant. A potential site may not necessarily comply with all of these criteria. However, there should be compensating factors in the design of the facility to overcome any deficiency in the physical characteristics of the site.

The criteria are:

a. the facility site should be located in an area of low rainfall, should be free from flooding and have good surface drainage features, and generally be stable with respect to its geomorphology;

b. the water table in the area should be at a sufficient depth below the planned disposal structures to ensure that groundwater is

unlikely to rise to within five metres of the waste, and the hydrogeological setting should be such that large fluctuations in the water table are unlikely;

c. the geological structure and hydrogeological conditions should permit modelling of groundwater gradients and movement, and enable prediction of radionuclide migration times and patterns;

d. the disposal site should be located away from any known or anticipated seismic, tectonic or volcanic activity which could compromise the stability of the disposal structures and the integrity of the waste;

e. the site should be in an area of low population density and in which the projected population growth or the prospects for future development are also very low;

f. the groundwater in the region of the site which may be affected by the presence of a facility should ideally not be suitable for human consumption, pastoral or agricultural use; and

g. the site should have suitable geochemical and geotechnical properties to inhibit migration of radionuclides and to facilitate repository operations.

Other factors which shall also be considered are:

h. the site for the facility should be located in a region which has no known significant natural resources, including potentially valuable mineral deposits, and which has little or no potential for agriculture or outdoor recreational use;

i. the site should have reasonable access for the transport of materials and equipment during construction and operation, and for the transport of waste into the site;

j. the site should not be in an area which has special environmental attraction or appeal, which is of notable ecological significance, or which is the known habitat of rare fauna or flora;

k. the site should not be located in an area which is of special cultural or historical significance;

l. the site should not be located in reserves containing regional services such as electricity, gas, oil or water mains; and

m. the site should not be located in an area where land ownership rights or control could compromise retention of long-term control over the facility.

2.4.3 Public consultation

Site selection shall include a suitable consultative process to establish public consent to the location of a disposal facility at the particular site.

2.5 Waste classification

This code provides for four categories of waste in which the activity concentrations of radionuclides exceed the limits permitted under the 1985 NHMRC *Code of practice for disposal of radioactive waste by the user*.

Radioactive waste, suitable for near-surface land disposal, shall be separated into three categories: Category A, Category B and Category C. The general characteristics of these categories are given below.

Category A covers solid waste with radioactive constituents, mainly beta or gamma emitting radionuclides, whose half-lives are considerably shorter than the institutional control period. The radioactivity will decay substantially during this period. Long-lived alpha-emitting radionuclides should only be present at very low concentrations. This category of waste will comprise, predominantly, lightly contaminated or activated items such as paper, cardboard, plastics, rags, protective clothing, glassware, laboratory trash or equipment, certain consumer products and industrial tools or equipment. It may also comprise lightly contaminated bulk waste from mineral processing or lightly contaminated soils.

Category B covers solid waste and shielded sources with considerably higher activities of beta- or gamma-emitting radionuclides than Category A waste. Long-lived alpha-emitting radionuclides should be at relatively low levels. This category of waste will comprise, typically, gauges and sealed sources used in industry, medical diagnostic and therapeutic sources or devices, and small items of contaminated equipment.

Category C covers solid waste containing alpha-, beta- or gamma-emitting radionuclides with activity concentrations similar to those for Category B. However, this waste typically will comprise bulk materials, such as those arising from downstream processing of radioactive minerals, significantly contaminated soils, or large individual items of contaminated plant or equipment for which conditioning would prove to be impractical.

Radioactive waste which does not meet quantitative and qualitative criteria in this code shall not be approved by the appropriate authority as suitable for near-surface disposal. Therefore a fourth category, Category S, shall be designated as follows:

Category S covers waste that does not meet the specifications of Categories A, B or C. Typically this category will comprise sealed sources, gauges or bulk waste which contains radionuclides at higher concentrations than are allowable under Categories A, B or C.

Waste within Category S shall be unacceptable for near-surface disposal and shall be retained in storage until an alternative disposal method is available.

Quantitative criteria in terms of activity concentration limits for specific radionuclides shall be derived for each category of radioactive waste for each facility in accordance with the principles outlined in Section 2.6.3 of this code.

2.6 Specific criteria and requirements for waste acceptance and disposal

Exposure of individuals resulting from waste acceptance and disposal shall be subject to dose limits recommended by the NHMRC. If other potential sources of exposure exist, dose constraints shall be established to ensure that the dose to a member of the public from all sources, excluding natural background radiation and medical exposure, does not exceed the specified limit.

2.6.1 Radiation protection criteria

The annual effective dose for exposure of members of the public shall not exceed the value recommended by the NHMRC. This is currently 1 mSv. This limit shall be the basis for the development of quantitative criteria for the acceptance of waste for disposal. If a dose constraint is established to take into account other potential exposures, the lower value shall be used to calculate activity concentration limits for each category of waste.

Radiation protection standards for those personnel who work at the disposal facility shall be in accord with the recommendations of the NHMRC on occupational exposure. The 1991 interim recommendations specify a limit on the annual effective dose of 20 mSv, averaged over five years, with no more than 50 mSv in a single year.

2.6.2 Institutional control period

Following closure of the disposal facility, public access to, or alternative use of, the site shall be restricted for a predetermined period of time. This will be termed the institutional control period.

The institutional control period shall be established before commencement of disposal operations and should not be less than 100 years. The appropriate authority may vary the institutional control period according to the usage of the facility. However, the period shall not be reduced without a full safety assessment of the site. This assessment shall take into account the nature of the radionuclides, their total activity and

activity concentrations in waste already disposed of, and the intended future use of the facility.

2.6.3 Activity concentration limits

Activity concentration limits for a specific disposal facility shall be calculated to cover radionuclides in each category of waste. These shall be derived from detailed assessment of the radiological impact of the facility and the possible pathways for the radiation exposure of members of the public during the operation of the facility and following its closure. Exposure scenarios appropriate to possible future uses of the site and its environs shall be included in the safety assessment. It should be assumed that inadvertent or intentional intrusion by humans does not occur during the institutional control period specified in Section 2.6.2 and that, after this period, the probability of any exposure within each scenario is unity, unless it can be shown to be otherwise.

Generic activity concentration limits for Categories A, B and C have been derived in conformity with this code for a remote arid site in Australia and are presented in Tables 1, 2 and 3. Limits have been derived for institutional control periods of 100 and 200 years based on human intrusion scenarios. In practice, values should be derived for a specific disposal site using data for environmental parameters and exposure scenarios appropriate to that site.

For radioactive waste in Category A or B which has been packaged, treated or conditioned the activity concentration shall be calculated by averaging the activity of the waste over the whole conditioned package or container.

For Category C bulk waste, radionuclide activities may be averaged over the volume of the disposal structure into which the Category C waste has been placed. In exceptional circumstances the appropriate authority may permit the operator to accept some individual waste packages as Category C, provided that the activity concentrations of radionuclides do not exceed the limit by more than a factor of 10. If

this provision is used the operator shall ensure that the concentration of each radionuclide when averaged over the volume of the disposal structure does not exceed the limit applicable to that radionuclide. This may be achieved by the inclusion of inactive material with similar properties to that of the waste.

For waste containing a mixture of radionuclides, the activity concentration of radionuclides in the waste package should satisfy the following summation rule:

$$\sum_i \frac{C_i}{L_i} \leq 1$$

where C_i is the activity concentration of radionuclide i in the waste package; and
L_i is the activity concentration limit for radionuclide i.

The appropriate limits shall be taken from the relevant table (Tables 1, 2 or 3).

2.6.4 Derivation of total site activity

There are possible scenarios in which the potential exposure of members of the public is more dependent on the total radionuclide activity contained within the disposal facility than on radionuclide concentrations in a particular part of the facility. In this respect exposure scenarios related to groundwater migration of radionuclides are of prime importance; these in turn depend very much on site specific conditions.

A quantitative evaluation of exposures that might result from the leaching and dispersal of radioactive contaminants by groundwater shall be carried out by the proponent/operator using established hydrogeological models which incorporate site specific data. Based on this evaluation, and prior to commencement of disposal operations, the appropriate authority shall establish a limit on the total radionuclide activity for the proposed disposal facility.

2.6.5 Structural stability and waste conditioning

The waste shall be required to meet certain criteria with respect to structural stability, firstly, to ensure the overall long-term integrity of the disposal site and, secondly, in the case of waste in Categories B and C, to ensure that it remains in a recognisable and non-dispersable form for a longer period, thereby limiting exposures in the event of inadvertent intrusion when there is unrestricted access to the site.

Generally the requirements for stability will be achieved through appropriate waste treatment, packaging and/or conditioning prior to disposal. The extent and nature of the treatment or conditioning required depends upon the physical properties and concentrations of radionuclides in the waste, and therefore varies for each of the three categories of waste as outlined below.

a. Treatment of Category A waste shall be carried out to reduce the waste volume and to minimise voids. The minimum requirement shall be consolidation and compaction of the waste. Bulk waste in which the levels of radioactive contamination are low may meet the criteria for Category A, in which case the waste shall be required to meet the stability requirements of Category C bulk waste.

b. For disposal of Category B or Category C waste, the waste shall be in a form which will maintain its physical dimensions and properties under the anticipated conditions of disposal. Factors requiring consideration may include the compressive load of overburden or compaction equipment, and possible structural changes caused by chemical reaction or biodegradation. Waste in either of these two categories shall be structurally stable for a design period of at least 300 years.

Stability may be provided by the waste form itself, by processing the waste to a stable form, by placing the waste into a disposal container, or by placing it into a structure such as a lined trench or a bore hole. The method of conditioning the waste to give the required stability after disposal will generally depend upon the volume of the waste and its ease of handling.

Category B waste will comprise relatively small items (i.e. less than about 0.1 m^3 prior to conditioning), and the individual waste package, after conditioning, should meet the long-term stability requirements and provide additional protection against inadvertent intrusion. This stability and protection should be achieved by embedding the radioactive waste in a solid matrix such as concrete, bitumen or polymeric material.

Category C waste will comprise bulk waste and the required stability may be provided by the properties of the bulk waste itself. Otherwise, Category C waste shall be disposed of in a container or structure which is designed to provide stability.

For all categories, void spaces within the waste packages or containers shall be minimised to avoid subsidence.

2.6.6 Qualitative physical, biological and chemical requirements

For waste to be acceptable for disposal, the following physical and chemical characteristics shall apply to all categories of waste. These requirements are specified to minimise the potential hazard to personnel at the disposal site, and to facilitate handling during disposal operations. The intention is to ensure the long-term stability of the waste and reduce the potential for dispersal of radionuclides from the site. In addition to the requirements stated below, an assessment of the likely behaviour of the waste in the geochemical environment of the facility shall be made.

a. For disposal, radioactive waste shall not contain corrosive materials; waste containing inorganic acids, alkalis and corrosive salts shall be treated to neutralise them and thereby to nullify the chemical effect of these materials.

b. Where practicable, flammable or combustible materials, such as paper, plastics, cloth or resins, shall be separated from non-flammable solids and packaged, contained and labelled in a proper manner.

c. Waste shall not contain or be 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.

d. Waste shall not contain material which will readily detonate upon impact, decompose explosively, react violently with water or undergo vigorous exothermic reaction at normal temperatures and pressures.

e. Waste containing pyrophoric material shall be treated, conditioned or packaged to render it non-flammable.

f. Liquid waste shall be solidified to be acceptable for disposal. The final package for disposal shall comply with the stability requirements for the particular category of waste.

g. As far as practicable, waste materials being disposed of should be free of biological materials.

h. Radioactive waste contaminated with toxic, pathogenic or infectious material shall be treated or conditioned to minimise both the potential hazard to disposal site personnel and the long-term health risks to members of the public. Any treatment should be carried out in accordance with relevant NHMRC guidelines such as *National guidelines for the management of clinical and related wastes* (Australian Government Publishing Service, Canberra, 1988) and *Guidelines for laboratory personnel working with carcinogenic or highly toxic chemicals* (Australian Government Publishing Service, Canberra, 1990).

i. Waste which contains chelating agents shall be treated or conditioned to reduce the possible long-term effects of leaching by water.

3 Facility design and operational requirements

3.1 Facility design

The facility design shall comply with the requirements listed below to ensure that the objective stated in Section 2.1 is met.

a. Waste shall be disposed of in a manner which ensures the integrity of the package. Void spaces between packages should be minimised and such spaces filled to prevent subsidence or settlement.

b. The base of a disposal structure shall be constructed in accordance with best engineering practice, and shall be capable of bearing the weight of the whole system.

c. Suitable engineered barriers of natural or manufactured materials shall be incorporated in the design of the facility. Their purpose is to guarantee the integrity of the waste under all foreseeable circumstances, to minimise the possibility of water infiltrating the disposal structure, and to delay or prevent radionuclide migration, both during operations and after closure of the facility. In addition, the engineered barriers should be designed to provide protection in the event of inadvertent intrusion into the disposal structure. For Category B and C waste the design life of the barriers shall be not less than 300 years with a structural life of 1000 years. For Category B waste the conditioned waste package may provide one such barrier.

d. The design shall include a suitably engineered cover for the disposal structure following a consideration of site specific parameters. The cover may require several layers of material to be incorporated into the design, each layer having a specific function to stabilise the structure, prevent ingress of water, discourage entry of animals and people, and inhibit erosion.

The minimum cover requirements for each category of waste shall be:

- for Category A, two metres between the top of the waste and the top surface of cover;
- for Category B, five metres between the top of the waste and the top surface of cover;
- for Category C, five metres between the top of the waste and the top surface of cover.

e. Backfill material shall be used to prevent subsidence and to minimise settlement within the disposal structure.

f. Each disposal structure shall be accurately located and surveyed. Appropriate permanent surface and below-ground markers shall be put in place to define the boundaries and locations of disposal structures.

g. A surface water management system shall be incorporated to control water erosion of the cover and to divert water away from any partially Filled disposal structure, but shall not allow water to drain off-site.

h. Drainage shall be provided so that any water, which might enter the disposal structure during operations or following the closure of the site, does not accumulate within the structure.

i. Category A waste shall not be placed in the same structure as Category B or C waste, except if Category A waste is conditioned or packaged to meet the same criteria as Category B or C. Suitable Category A waste may be considered to form part of the cover requirements for Category B or C as in 3.1d above.

j. A buffer zone shall be maintained between buried waste and the boundary of the disposal site. This zone shall be of sufficient area surrounding the facility operations to allow environmental monitoring to be carried out, to allow contingency measures to be carried out in an emergency, and to ensure that during site operations there is an adequate distance between the facility and any area used by, or accessible to, members of the public.

k. Consideration should be given to the inclusion of a zone of restricted occupancy outside the site perimeter as a region in which there is public access, but in which permanent occupancy is prohibited for the institutional control period.

3.2 Operational practices/procedures

3.2.1 Treatment, packaging and conditioning of waste

Before disposal, the radioactive waste shall be treated, packaged and/or conditioned (where necessary) to ensure that it meets the criteria in Section 2 of this code for the appropriate category. The waste shall also comply with any additional specifications of the appropriate authority. The proponent/operator shall submit a detailed specification of the proposed treatment, packaging and conditioning for approval by the appropriate authority. Facilities may be provided at the disposal site by the proponent/operator for conditioning of waste to ensure that it conforms to the disposal criteria for the particular category of waste.

Waste producers, or their agents, shall be provided with the necessary specifications for conditioning particular shipments of their waste to ensure that they will be acceptable for disposal at the facility.

The packaging of waste for shipment to the disposal site, whether in a conditioned form or not, shall be done in compliance with the relevant transport regulations.

The proponent/operator shall institute a quality assurance program to verify that all packaging, labelling and accompanying documentation accurately reflects the contents of conditioned waste packages received for disposal. This program shall meet the requirements of the appropriate authority.

3.2.2 Transport

Transportation of waste to the facility shall comply with the legislative requirements for the transport of radioactive materials.

3.2.3 Disposal operations

Waste shall be disposed of in accordance with the criteria and requirements of this code and following procedures which have the prior approval of the appropriate authority. Only waste containing or contaminated with radioactive materials should be accepted for disposal at the facility.

3.2.4 Environmental management plan

An environmental management plan, approved by the appropriate authority, shall be established for the disposal site prior to the commencement of its construction and operations. The purpose of the plan is to set out management objectives and practices which will provide for the safe and environmentally sound management of the facility during its construction, operational and post-operational stages.

The objectives of this plan will be:

a. to outline management strategies and practices which will prevent unacceptable dispersal of radioactive contaminants through the various environmental pathways, from the commencement of operations at the facility until institutional control ceases, and which will minimise such releases thereafter;

b. to establish performance indicators and outline monitoring procedures necessary to acquire the data needed:

- to assess any impact of site operations on members of the public and on the environment;

- to enable early detection of any inadvertent releases of radioactivity, and thus allow corrective action to be taken to limit the impact upon site personnel, the public or the environment;

- to predict the long-term behaviour of the waste in the site following closure of the facility; and

c. to ensure that disposal operations comply with regulatory requirements.

The environmental management plan shall include an assessment of possible exposure pathways. A program of routine on-site and off-site monitoring shall also be required within the plan and shall include appropriate measurements of radionuclides at various locations and in various environmental media such as surface run-off and groundwater, surface soil, local plants and animals, airborne dust, together with external radiation measurements on the site perimeter and off-site. The location and frequency of sampling, sampling procedures and analytical methods shall be examined and approved by the appropriate authority.

In the absence of adequate existing data, pre-operational measurements shall be carried out for at least 12 months prior to the commencement of operations to establish baseline data for each aspect of the proposed monitoring program. The adequacy of the baseline data for the assessment of the potential environmental and radiological impact of the facility shall be confirmed by the technical auditor.

A review of the environmental management plan shall be carried out by the proponent/operator at intervals of approximately three years during the period of operation. A publicly available report detailing this review shall be provided to the appropriate authority.

3.2.5 Radiation management plan

Before the commencement of disposal operations, the operator shall establish a radiation management plan for operations at the facility which meets the requirements of, and is approved by, the appropriate authority. The purpose of this plan is to establish management practices and procedures to ensure that when waste handling, packaging and disposal operations are carried out there will be no unacceptable risk to employees or members of the public.

The radiation management plan shall address operational aspects of radiation safety. The plan shall include 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.

The radiation management plan shall 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 appropriate authority.

3.2.6 Contingency plans/emergency response procedures

Contingency plans shall be prepared by the operator of the facility and be approved by the appropriate authority. The purpose of the plans shall be to address possible emergencies, such as fires, operational accidents, and other sources of potential releases from the facility, and to provide a response guide to such events. The on-site manager of the facility should have the authority to respond quickly to these or any other unusual conditions that might compromise the performance of the facility. However, the operator of the facility shall advise the appropriate authority without delay of any change in circumstances which may affect the operational safety of the facility. In such situations the operator shall take into account guidance from the appropriate authority.

3.2.7 Records and inventory keeping

Detailed records shall be kept by the operator and by the appropriate authority of all waste consigned to, and received at, the facility. For each shipment the waste generator, the type of the waste, its volume and weight, and the nature and concentration of radionuclides in the waste shall be recorded. Any conditioning of the waste shall also be recorded.

Details of any accidents and incidents at the facility shall be kept together with information on the impact on personnel, the public and the environment.

The occupational exposure records of all employees exposed to radiation in the course of their work shall be retained in a form specified by the

appropriate authority. All data from environmental and area monitoring at and around the facility shall also be retained.

Furthermore, site records shall be kept at least until the end of the institutional control period in two widely separated locations, one of which shall be the appropriate State or Federal government archives, and shall include:

a. the location of any disposal structures;

b. the location of the waste packages or containers within the structures and the date of their emplacement;

c. details of the contents of waste packages or containers; and

d. details of the backfilling and cover materials.

3.3 Disposal facility closure

Operations shall cease at the disposal facility when the authorised disposal space is Filled or the limit on total site radioactivity is reached. Unrestricted public access to the site or alternative use of the site shall not be permitted for the duration of the established period of institutional control. At the end of the established institutional control period the status of the site shall be reviewed to determine whether any further management or control should be instituted.

Prior to the commencement of operations the operator shall prepare draft or conceptual plans for decommissioning the facility and rehabilitating the site, and submit them to the appropriate authority for approval. These plans shall be reviewed every five years and resubmitted for approval. The operator shall apply to the appropriate authority to cease operations at the facility at least three years prior to the proposed date of closure. At this time detailed plans for the decommissioning of the facility and for site rehabilitation shall be submitted to the appropriate authority for approval.

Site rehabilitation plans should include the proper provision of site markers and exclusion barriers to remain for the duration of the institutional control period, and the removal of all superfluous surface structures which may encourage occupation of the site and buildings.

The operator shall remain responsible for the site and all necessary site rehabilitation work until the work is formally accepted to be satisfactory by the appropriate authority. After this time responsibility for measures in the case of an accident should be assumed by this authority.

The appropriate authority shall ensure that a program of surveillance involving site inspections and environmental monitoring is carried out during the institutional control period, and that historical records of waste disposed at the site are preserved. The perimeter fence and site markers shall be maintained during this period. The location and purpose of the disposal site shall be marked on land titles as caveats or mentions for the institutional control period.

3.4 Post-institutional control land use

At the end of the institutional control period the site shall be cleared of any remaining fences, site markers, etc.

Ideally the institutional control period should have been selected to permit unrestricted future use of the site. Following expiry of the institutional control period, any proposed new use for the former site should require an assessment of the new proponent's proposal. Appropriate caveats or mentions indicating the former use of the site for the disposal of radioactive waste should be retained on relevant land titles.

3.5 Financial indemnities

The appropriate authority may consider the imposition of a levy, a surcharge on the operator's charges or some other means to ensure that the decommissioning can be completed if the operator experiences financial difficulties during the operation of the facility or at its closure.

4 Duties and responsibilities

4.1 Appropriate authority

The appropriate authority is responsible for enforcing compliance with the provisions of this code. In carrying out this function it is expected that the appropriate authority would:

a. at each stage of the approval process for a new waste disposal facility, consider in detail all relevant submissions and proposals;

b. analyse all information supplied by the proponent in respect of the location, design, operation and closure of the facility to ensure compliance with criteria specified in this code, any imposed constraints applied below occupational or public dose limits, or any legislation embodying this code;

c. examine and, if satisfied, approve the quantitative and qualitative criteria for each of the categories of waste, including waste activity concentration limits and total site activity based upon a safety assessment of the proposed facility undertaken by the proponent;

d. examine and, if satisfied, approve proposals by the proponent/operator for site radiation and environmental monitoring programs to be carried out prior to, and during, operations at the facility;

e. establish or approve procedures and requirements for the treatment, packaging and conditioning of waste for disposal, and ensure that these are carried out in compliance with radiation protection criteria specified in this code and any legislation embodying this code, as amended from time to time;

f. communicate any concerns and requirements in relation to the facility to the proponent;

g. require modifications to plans, criteria, standards and characteristics as deemed necessary;

h. determine the extent of the buffer zone, allowable nearby land uses, and the duration of the institutional control period;

i. determine all reporting procedures to be followed in accordance with this code;

j. determine the means of indemnifying the appropriate authority against costs of surveillance, monitoring, premature closure and any rectification work which may become necessary during the post-operational institutional control period;

k. in accordance with Section 4.6, determine the contents of the annual reports required to be provided by the facility operator and assess such reports;

l. establish and be responsible for post-rehabilitation surveillance, monitoring and maintenance programs;

m. establish or approve a program, which includes the performance of random tests, to ensure agreement between labelling and documentation, and the contents of waste packages. This program should ensure that waste for disposal complies with acceptance criteria required under this code;

n. approve the appointment of an independent technical auditor to perform duties in accordance with the requirements of Section 4.5 of this code;

o. communicate and liaise with the general public and provide information to members of the public as required;

p. in the event of becoming aware of any non-compliance with this code, take appropriate action to return the operation to compliance as expeditiously as possible; and

q. consider and, if appropriate, approve applications from the operator for variations of this code provided that any modification does not diminish the standard of safety required by this code.

4.2 Approvals and authorisations

The following actions shall be required to proceed to the construction and continued operation of a disposal facility and its subsequent closure.

a. The proponent shall submit a preliminary disposal facility design and an analysis of potential sites for the facility to the appropriate authority. These shall be based upon the criteria contained within this code. Reference should be made to any guidelines to this code. Approval to proceed to the development of a detailed design and to carry out an environmental and radiation assessment of the preferred site shall be obtained from the appropriate authority.

b. The proponent/operator shall prepare an environmental and a radiation assessment, including a safety analysis of the proposed facility design and operation addressing the criteria detailed in Sections 2 and 3 of this code. In assessing the environmental impact of the proposed facility the approach to environmental assessment under the Commonwealth, State or Territory legislation should be adopted to ensure thorough investigation of potential issues. Relevant Commonwealth/State legislation shall be adhered to.

c. The public acceptability of the site and the design of the facility should be evaluated by an appropriate public consultative process.

d. Construction of a facility shall commence at the chosen site only with approval of the appropriate authority.

e. Following construction of the facility in accordance with the approvals given under 4.2d and, upon approval of detailed operational, public reporting, emergency, transport and monitoring procedures, the appropriate authority would be expected to issue an authorisation to operate the facility. This would be expected to be reviewed after one year and thereafter at regular intervals (not exceeding three years) by the appropriate authority.

f. The proponent/operator should submit an application for approval by the appropriate authority to cease operations and proceed to decommissioning three years before the proposed closure of the site.

g. The proponent/operator shall submit plans for decommissioning the facility to the appropriate authority prior to commencement of operations. These plans shall be reviewed and resubmitted for approval every five years.

4.3 Proponent/operator

During the planning, operation and closure of the waste disposal facility the proponent/operator shall:

a. prepare and submit all the necessary documentation for approvals and all authorisations required by the appropriate authority at each stage of the development, operation and closure of the disposal facility as outlined in Section 4.2;

b. operate the facility in accordance with written procedures that meet the requirements of this code and those of the appropriate authority;

c. provide the necessary specifications for the treatment and/or conditioning of particular shipments of waste to waste producers or their agents; alternatively, comply with these specifications for conditioning which may be carried out at the facility under exceptional circumstances;

d. instruct all employees in safe working practices as approved by the appropriate authority, provide adequate protective and monitoring equipment, and ensure that the precautions necessary to limit radiation exposure are followed;

e. ensure that, when averaged over the whole disposal structure, the concentrations of radionuclides in the waste do not exceed the limits on activity concentration and total site activity that have been approved, or specified, by the appropriate authority;

f. establish environmental and radiation management plans with the approval of the appropriate authority and perform any monitoring that is required within these plans, including the assessment and recording of radiation doses received by employees and others;

g. prepare detailed procedures to be implemented in the event of an accident, incident or emergency at the facility, submit these contingency plans to the appropriate authority for approval prior to the commencement of operations, and then ensure that employees are familiar with these plans;

h. maintain all records related to the disposal of radioactive waste at the facility, including radiation and environmental monitoring, as specified in Section 3.2 in this code and as required by the appropriate authority;

i. submit regular reports, as detailed in Section 4.6 of this code, to the appropriate authority;

j. provide a plan for the rehabilitation of the site and decommissioning of the facility to the appropriate authority for approval prior to the commencement of operations, and subsequently revise and resubmit these plans for re-approval at Five yearly intervals;

k. apply to the appropriate authority for approval to decommission the waste facility not less than three years prior to the proposed closure date;

l. decommission the facility and rehabilitate the site in accordance with previously approved plans and any additional requirements of the appropriate authority;

m. provide any medical examinations for employees which are required by the appropriate authority;

n. report in detail to the appropriate authority all accidents or incidents, and action taken to prevent such occurrences as required by the appropriate authority; and

o. recommend to the appropriate authority a technical auditor as required under this code.

4.4 Employee responsibilities

Employees at the waste disposal facility shall:

a. prior to commencement of their employment, notify the employer of all previous work involving radiation and subsequently attend such familiarisation courses and re-training as required;

b. use protective equipment and radiation monitors as directed;

c. report any defects in plant or equipment to the proponent/operator as soon as they become aware of them;

d. modify equipment or plant only with the approval of the operator;

e. undergo all relevant medical examinations requested by the operator or by the appropriate authority;

f. follow work practices necessary for compliance with Section 4.3 of this code; and

g. report all incidents and accidents to their supervisor.

4.5 Technical auditor

The independent technical auditor, appointed under Sections 4.1n and 4.3o shall have expertise in radioactive waste management. The technical auditor shall review all the actions of the proponent/operator required by this code and provide publicly available reports to the appropriate authority:

a. prior to the commencement of actual burial operations; and

b. annually thereafter, within one month following the presentation of the proponent/operator's public annual report required under Section 4.6 of this code.

4.6 Reporting procedures

4.6.1 Proponent/operator

The proponent/operator shall consult with the appropriate authority regarding the information to be supplied and the manner in which the facility operations will be reported. Reporting shall include a public annual report which details at least the following information:

a. a list of all waste received, buried or in storage;

b. a statement that records of the waste material and its disposal location have been properly kept (see Section 3.2.7) and audited;

c. the state and condition of equipment and plant, necessary maintenance or major modifications foreseen as necessary to it and to the site;

d. details of all accidents and incidents at the facility together with information on the potential or actual impact on the site personnel, members of the public and the general environment, as reported to the appropriate authority (for the public report personal details shall remain confidential);

e. a summary and interpretation of results from the radiation and environmental management programs; and

f. a summary of the current rehabilitation and decommissioning plan and an indication of the expected date of closure of the facility.

4.6.2 Advice to responsible Minister

The appropriate authority would be expected to present a copy of the annual report by the proponent/operator to the responsible government Minister for his/her information. The appropriate authority should comment on the operator's annual report and furnish the Minister with the independent technical auditor's report.

Appendix

Generic activity concentration limits for an arid remote site

The activity concentration limits in the following tables are for an arid remote site in Australia. They have been derived in conformity with this code. Other values could be derived for a particular disposal site using specific environmental parameters or exposure scenarios relevant to that site. Furthermore, the values have been derived on the basis of an annual effective dose of 1 mSv being received by a member of the public from the presence of the waste. Note, however, that Section 2.6.1 requires that specific consideration shall be given to other sources of public exposure. This may lead to the adoption of more restrictive values in practice.

Table 1 Activity concentration limits for Category A waste

(Recommended values for 100 year and 200 year institutional control periods)

Radionuclide group	Concentration limit ($Bq.kg^{-1}$)	
	100 y	**200 y**
Tritium	$5x10^{8}$	10^{11}
Carbon-14	10^{7}	10^{7}
Alpha emitting radionuclides (including U-238, Pu-239, Am-241)	10^{5}	10^{5}
Thorium-232	10^{4**}	10^{4**}
Radium-226, Uranium*	$5x10^{3**}$	$5x10^{3**}$
Beta/gamma emitters with half lives > 5y,	$5x10^{5}$	$5x10^{6}$
Beta/gamma emitters with half lives ≤ 5y,	10^{9***}	10^{9***}

Note: * in secular equilibrium with progeny

** mass equivalent is 2.5 g/kg (2500 ppm) thorium and 0.4 g/kg (400 ppm) uranium

*** in practice, consideration of surface dose rates from waste packages during transport and handling operations lead to more restrictive values

Table 2 Activity concentration limits for Category B waste

(Recommended values for 100 year and 200 year institutional control periods)

Radionuclide group	**Concentration limit ($Bq.kg^{-1}$)**	
	100 y	**200 y**
Tritium	10^{10}	$5x10^{12}$
Carbon-14	$5x10^{7}$	$5x10^{7}$
Alpha emitting radionuclides. (including U-238, Pu-239, Am-241)	10^{7}	10^{7}
Radium-226	$5x10^{5}$	$5x10^{5}$
Beta/gamma emitters with half lives > 5y	10^{8}	10^{9}
Beta/gamma emitters with half lives ≤ 5y	no limit*	no limit*

Note: * in practice, consideration of surface dose rates from waste packages during transport and handling operations will lead to more restrictive values

Table 3 Activity concentration limits for Category C waste

(Recommended values for 100 year and 200 year institutional control periods)

Radionuclide group	Concentration limit ($Bq.kg^{-1}$)	
	100 y	**200 y**
Tritium.	10^{10}	$5x10^{12}$
Carbon-14	$5x10^{7}$	$5x10^{7}$
Alpha emitting radionuclides. (including U-238, Pu-239, Am-241)	10^{7}	10^{7}
Radium-226, Thorium-232 & Uranium*	$5x10^{5**}$	$5x10^{5**}$
Beta/gamma emitters with. half lives > 5y	10^{8}	10^{9}
Beta/gamma emitters with half lives ≤ 5y	no limit***	no limit***

Note: * in secular equilibrium with progeny

** mass equivalent is 125 g/kg (12.5%) thorium and 40 g/kg (4%) uranium

*** in practice, consideration of surface dose rates from waste packages during transport and handling operations will lead to more restrictive values

Radiation Health Series

No.1 Recommended radiation protection standards for individuals exposed to ionising radiation, (1980).

No.2 Code of practice for the design of laboratories using radioactive substances for medical purposes, (1980).

No.3 Code of practice for the safe use of ionizing radiation in veterinary radiology: parts 1 and 2, (1982).

No.4 Code of practice for the safe use of radiation gauges, (1982).

No.5 Recommendations relating to the discharge of patients undergoing treatment with radioactive substances, (1983).

No.6 Code of practice for the safe use of lasers in secondary schools, (1983).

No.7 Guidelines for the safe use of lasers in the entertainment industry, (1983).

No.8 Code of nursing practice for staff exposed to ionizing radiation, (1984).

No.9 Code of practice for protection against ionizing radiation emitted from X-ray analysis equipment, (1984).

No.10 Code of practice for the safe use of ionizing radiation in veterinary radiology: part 3, Radiotherapy, (1984).

No.11 Code of practice for the safe use of soil density and moisture gauges containing radioactive sources, (1984).

No.12 Administration of ionizing radiation to human subjects in medical research, (1984).

No.13 Code of practice for the disposal of radioactive wastes by the user, (1985).

No.14 Recommendations for minimising radiological hazards to patients, (1985).

No.15 Code of practice for the safe use of microwave diathermy units, (1985).

No.16 Code of practice for the safe use of shortwave (radiofrequency) diathermy units, (1985).

No.17 Procedure for testing microwave leakage from microwave ovens, (1985).

No.18 Code of practice for the safe handling of corpses containing radioactive materials, (1986).

No.19 Code of practice for the safe use of ionizing radiation in secondary schools, (1986).

No.20 Code of practice for radiation protection in dentistry, (1987).

No.21 Statement on cabinet X-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes, (1987).

No22 Statement on enclosed X-ray equipment for special applications, (1987).

No.23 Code of practice for the control and safe handling of radioactive sources used for therapeutic purposes, (1988).

No.24 Code of practice for the design and safe operation of non-medical irradiation facilities, (1988).

No.25 Recommendations for ionization chamber smoke detectors for commercial and industrial fire protection systems, (1988).

No.26 Policy on stable iodine prophylaxis following nuclear reactor accidents, (1989).

No.27 Australia's radiation protection standards, (1989).

No.28 Code of practice for the safe use of sealed radioactive sources in borehole logging, (1989).

No.29 Occupational standards for exposure to ultraviolet radiation, (1989).

No.30 Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields, (1989).

No.31 Code of practice for the safe use of industrial radiography equipment, (1989).

No.32 Intervention in emergency situations involving radiation exposure, (1990).

No.33 Australian radiation protection standards, (1991).

No.34 Safety guidelines for magnetic resonance diagnostic facilities, (1991).

No.35 Code of practice for the near-surface disposal of radioactive waste in Australia (1992).

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