MINISTRY OF HEALTH
MANATŪ HAUORA

New Zealand Government

Code of Practice for Unsealed Radioactive Material

Draft for consultation

2019

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Contents

This consultation

This document sets out possible wording for a new code of practice to be issued under the Radiation Safety Act 2016 for the use of unsealed radioactive material for non-medical purposes. Section 86(2) of the Act requires that anyone likely to be affected by the code is consulted before it is issued. The purpose of this document is to provide suggestions to assist in that consultation process.

The Introduction to the Code, Key roles, Definitions, Appendix sections set out the proposed wording for the new code. The Submission form contains specific questions that submitters may wish to answer. These questions are included for convenience only and submitters should feel free to provide any information they feel is relevant to the development of the code.

Why are we consulting

In January 2017, ORS conducted a public consultation on a draft Code of Practice for Non-medical Uses of Ionising Radiation. The target audience for this consultation included all facilities using radiation or radioactive material for industrial, veterinary, agricultural, legal or security purposes. It also included facilities that use radiation or radioactive material for education, training or research, mining and procession of raw materials. The intention was to publish a single code for all non-medical activity categories supported by more detailed individual compliance guides, however, most of the audience preferred to have an individual code specific to each type of non-medical ration use. Based on this feedback, ORS has drafted a separate code of practice for non-medical irradiators. During the drafting process, more detailed operational requirements were developed such as training, equipment and testing requirements. ORS would like invite feedback from the affected sectors on these requirements.

How to provide feedback

You can provide feedback by:

- using our online tool at **https://consult.health.govt.nz/radiation-safety/code-of-practice-for-unsealed-radioactive-draft**.

  This is our preferred way to get feedback. Note, you can complete your submission over a number of sessions and save it as you go. If you select 'Save and come back later', you will be sent an email with a unique link that will let you return to edit and submit your response. This link can be shared with your colleagues if you require their contribution to, or review of, the submission. Once you have completed your submission, you will be sent a pdf copy for your records, or
- sending an electronic submission to **orsenquiries@health.govt.nz** using the Consultation questions section of this consultation document.

The closing date for submissions is 8 November 2019.

Introduction

Purpose and commencement

This Code of Practice for Unsealed Radioactive Material ('code') is issued by the Director for Radiation Safety ('the Director') under section 86 of the Radiation Safety Act 2016 ('the Act'). It provides the operational information necessary to comply with the fundamental requirements in sections 9 to 12 of the Act. Appendix 1 sets out cross-references between clauses in this code and those fundamental requirements. The requirements in this code do not limit the general nature of the fundamental requirements. This code comes into force on a date to be determined following the consultation period.

Scope

This code applies to all activities associated with the use of unsealed radioactive material but excluding activities in the specific codes:

- *ORS C9: Code of Practice for Veterinary Radiation*
- *ORS C2: Code of Practice for Nuclear Medicine*.

Activities can include the manufacture, dispensing, possession, control, management, use, administration, storage, import, export, sale, supply, discharge and disposal of radioactive material and equipment.

Compliance with the code does not imply compliance in related areas such as occupational safety, hazards in the workplace and resource management.

Contact

The Director's contact details are:

Office of Radiation Safety
PO Box 5013
Wellington 6140

Email: **orsenquiries@health.govt.nz**
Fax: 04 496 2340

Roles and responsibilities

The following individuals and bodies have roles and responsibilities in relation to this code.

Director for Radiation Safety – the individual appointed under section 76 of the Act to perform functions and duties and exercise powers set out in the Act, including the power to issue this code.

Managing entity – the legal entity that manages or controls radiation sources and must, therefore, obtain a source licence as required by section 13(a) of the Act. This could be, for example, an independent company providing science services or an educational organisation.

Manufacturer/supplier – the person or organisation who designs, manufactures, produces, constructs, assembles, installs, distributes, sells, exports or imports unsealed radioactive material, sealed sources used for calibration and quality control tests, or ancillary equipment that could influence the successful outcome of a radiation procedure.

Qualified expert – an individual who is recognised as having expertise in a relevant field of specialisation such as radiation safety, occupational health, fire safety, quality management or any relevant engineering or safety speciality.

Radiation safety officer – a person competent in radiation protection and safety who the managing entity designates to oversee the application of regulatory requirements.

Definitions

Defined terms are identified in **bold** and have the following meanings.

Accident – any unintended event, including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection and safety.

Ancillary equipment – equipment other than **protective equipment** that has an impact on the successful outcome of a **radiation procedure**, such as activity meters, contamination meters, radiation measurement equipment and sealed sources used for calibration and quality control tests.

Annual limit on intake – the ingested or inhaled activity that will give a total committed effective dose of 20 millisieverts in an average adult. Limits for common radionuclides are set out in Schedule 3 of the Act.

Committed effective dose – the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the **committed equivalent doses** to those organs or tissues.

Committed equivalent dose – the **equivalent dose** to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Constraint – a prospective and source-related value of individual dose (dose constraint) or of individual risk (risk constraint) that is used in **planned exposure situations** as a parameter for the **optimisation** of **protection and safety** for the source, and that serves as a boundary in defining the range of options in **optimisation**. Constraints for **occupational exposure** and **public exposure** are established or approved by the Director and, if established, are published in a compliance guide issued under this code.

Controlled area – an area in which specific protection measures and safety provisions are or could be required for controlling exposures in normal working conditions, and preventing or limiting the extent of **potential exposures**.

Dose limit – the value of **effective dose** or **equivalent dose** set out in Schedule 3 of the Act.

Effective dose – the tissue-weighted sum of **equivalent doses** in all specified tissues and organs of the body.

Emergency – any non-routine situation that necessitates prompt action, primarily to mitigate actual or perceived hazards or adverse consequences for human health and safety, quality of life, property or the environment. This includes **radiation emergencies** and conventional emergencies such as fires, release of hazardous chemicals, storms or earthquakes.

Employer – the legal entity that employs **workers**. A self-employed person is regarded as being both an employer and a worker.

Equivalent dose – the radiation-weighted dose in a tissue or organ of the body.

Facility – the location at which **radiation procedures** are performed and radiation sources and ancillary equipment are installed, used, handled or stored.

Incident – any **accident** or other unintended event, including initiating events, accident precursors, near misses or other mishaps; or unauthorised acts, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of **protection and safety.**

Individual monitoring – **monitoring** using equipment worn by individuals.

In-room protective equipment – equipment used to reduce exposure to radiation but not worn on the person, such as shields for bench tops, vials, syringes, activity meters, and equipment to prepare radioactive material; tools to remotely handle radioactive material, including tongs and forceps; containers to transport radioactive waste and sources; and fume hoods.

Investigation level – value of a quantity such as effective dose, intake or contamination per unit area or volume at or above which an investigation would be conducted.

Justify – determine that the expected benefits to individuals and society from introducing or continuing a practice outweigh the harm, including the radiation detriment, resulting from the practice. 'Justifies', 'justified' and 'justification' have corresponding meanings.

Medical exposure – exposure to ionising radiation experienced by patients for the purposes of medical diagnosis or medical treatment, by comforters/carers while providing care, support or comfort to patients undergoing **radiation procedures**, and by volunteers in a programme of biomedical research.

Member of the public – for purposes of **protection and safety**, any individual in the population except when subject to **occupational exposure** or **medical exposure**.

Monitoring – the measurement of radioactive contamination, dose or dose rate to enable the assessment or control of exposure due to radiation, and the interpretation of the results.

Occupational exposure – exposure of **workers** incurred in the course of their work.

Occupationally exposed person – any person who is subject to **occupational exposure**.

Optimise – implement a level of **protection and safety** that results in the magnitude of individual doses, the number of individuals (**workers** and **members of the public**) subject to exposure and the likelihood of exposure being as low as reasonably achievable, taking economic and social factors into account. 'Optimises', 'optimised' and 'optimisation' have corresponding meanings.

Personal protective equipment – equipment worn on the person to reduce their exposure to radiation, such as a protective apron, or to prevent the transfer of contamination, such as a laboratory gown, waterproof gloves, overshoes, and respiratory protection.

Planned exposure situation – situation of exposure that arises from the planned use of **radiation sources** or from a planned activity that results in an exposure due to a **radiation source.**

Potential exposure – possible future exposure that may result from an anticipated operational occurrence or **accident** at a source or due to an event or sequence of events of a probabilistic nature, including equipment faults and operating errors.

Protection and safety – the protection of people against exposure to ionising radiation, the safety of **radioactive sources**, including the means for achieving this, and the means for preventing **accidents** and the mitigation of consequences of **accidents** if they do occur.

Protective equipment – **personal protective equipment** and **in-room protective equipment**.

Public exposure – exposure to ionising radiation experienced by a **member of the public** but excluding any **occupational exposure** or **medical exposure**.

Radiation emergency – an emergency in which there is, or is perceived to be, a hazard due to radiation exposure.

Radiation procedure – a procedure involving the use of a **radiation source**.

Radiation source – a source that spontaneously emits ionising radiation, including unsealed radioactive material or a sealed source used for calibration and quality control tests.

Reportable incident – an **incident** resulting in (a) a **dose limit** being exceeded or (b) **radioactive sources** that are lost, missing or beyond regulatory control.

Safety assessment – assessment of all aspects of a practice that are relevant to **protection and safety** to determine the adequacy of provisions for **protection and safety**.

Supervised area – an area other than a **controlled area** in which occupational exposure conditions need to be kept under review, even though specific protection measures or safety provisions are not normally needed.

Unsealed radioactive material – radioactive material that is neither permanently sealed in a capsule nor closely bonded in solid form.

Worker – an individual who works, whether full time, part time or temporarily, for the managing entity and who has recognised rights and duties in relation to occupational radiation protection.

Workplace monitoring – **monitoring** carried out in the working environment.

Managing entity

General

1. The managing entity must:

   (a) take prime responsibility for protection and safety

   (b) establish a management system to enhance protection and safety that includes:

      (i) effectively integrating protection and safety into the overall management system of the organisation

      (ii) making a commitment to protection and safety from the highest level of management at the facility, and by providing all required resources

      (iii) promoting continuous improvement and a safety culture

      (iv) appointing a radiation safety officer to oversee the application of regulatory requirements for radiation protection and safety

      (v) consulting with and engaging the services of qualified experts and interested parties as necessary

   (c) for all appointments under subclause 1(b)(iv):

      (i) ensure appointees are notified of their duties in relation to protection and safety and assume responsibility for performing them

      (ii) fully document the appointments

   (d) ensure that:

      (i) all activities associated with radiation sources are justified and optimised for protection and safety

      (ii) dose limits[1] for occupational and public exposure are not exceeded as a result of those activities.

[1] Appendix 3 sets out annual limits on intake for common radionuclides. These limits are the levels that, if ingested or inhaled, would give a total committed effective dose of 20 millisieverts in an average adult.

Safety assessment

2. The managing entity must conduct, document and keep up to date a safety assessment to:

   (a) identify the ways in which occupational and public exposures could be incurred

   (b) determine the expected likelihood and magnitudes of exposures in normal operation and, to the extent reasonable and practicable, assess potential exposures

   (c) assess the adequacy of provisions for protection and safety in respect of siting, design and operation.

Facilities

3. The managing entity must:

   (a) provide facilities that are sited, located, designed, manufactured, constructed, assembled, commissioned, operated, maintained and decommissioned in accordance with good engineering practice, taking into account workload and minimising the need to rely on administrative controls and personal protective equipment for protection and safety

   (b) provide suitable areas for source storage and preparation, personal contamination monitoring, decontamination, and radioactive waste storage and predisposal processing

   (c) provide as appropriate:

      (i) taps and soap dispensers that are operable without direct hand contact, an emergency shower, and an eyewash in areas where unsealed radioactive material is handled, and

      (ii) a ventilation system in areas where radioactive aerosols or gases are produced or handled

   (d) shield the facility to ensure that expected doses to any person are as low as reasonably achievable and that rooms housing sensitive instruments maintain a sufficiently low level of background radiation to avoid interference

   (e) verify and document the adequacy of shielding required in subclause 3(d) whenever circumstances change that could increase the risks

   (f) designate and delineate appropriate areas as controlled areas or supervised areas and periodically review those designations and delineations

   (g) restrict access as appropriate to controlled areas and supervised areas

(h) prominently display signs:

(i) specifying the actual or potential presence of ionising radiation using the symbol recommended by the International Organization for Standardization at access points to controlled areas and supervised areas and at appropriate locations within controlled areas

(ii) controlling access by members of the public to controlled areas and supervised areas

(i) ensure that floors, walls and other surfaces are covered with smooth, continuous non-absorbent materials that can be easily cleaned and decontaminated in areas where unsealed radioactive material is used or stored.

Radiation sources and equipment

4. The managing entity must:

(a) ensure that radiation sources are fit for their intended purpose

(b) provide, maintain, test and regularly service protective equipment and ancillary equipment so that:

(i) it is fit for its intended purpose

(ii) it fulfils its design requirements for protection and safety

(iii) sealed sources are subject to leak tests before their first use and every two years after that

(c) provide, as appropriate, at entrances to controlled areas:

(i) personal protective equipment

(ii) equipment for individual monitoring and workplace monitoring

(iii) equipment to monitor contamination of skin and clothing

(d) provide, as appropriate, kits for dealing with spills, including items such as:

(i) protective clothing, for example, gowns, disposable overshoes and impermeable gloves

(ii) decontamination materials for the affected areas, including absorbent materials for wiping up spills – for example, buckets, brushes, towels or absorbent pads, forceps or tongs – and decontaminating agents

(iii) decontamination materials for people, for example, mild soap or chelating detergent, sponge and iodide or iodate tablets if appropriate

(iv) warning notices and barrier tape

(v) portable monitoring equipment

(vi) bags for waste, together with tape, labels and pencils

(e) maintain control of radioactive sources to prevent loss or damage and to prevent any person from carrying out unauthorised activities, including by:

(i) maintaining an accurate inventory of all radioactive sources, including their location, description, activity and form

(ii) periodically checking that radioactive sources are under control and in the locations recorded in the inventory maintained under subclause 4(g)(i)

(iii) releasing radioactive sources only to people who are authorised to assume management and control under the Act

(f) take immediate steps to regain control of any radioactive sources that are abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation

(g) dispose of radioactive waste:

(i) as non-radioactive waste after storing it for a time that is sufficient to meet the criteria for clearance in Schedule 2 of the Act, or

(ii) by returning it to the manufacturer, or

(iii) via landfill, sewer and or discharge to the atmosphere in accordance with Appendix 4, or

(iv) in any other manner approved by the Director.

Training and authorisation

5. The managing entity must ensure that all people with responsibilities for protection and safety:

(a) are qualified, educated and trained in protection and safety so that they understand their duties and can perform them competently

(b) satisfy the training requirements set out in Appendix 2

(c) are named in a current list with details of their qualifications, education and training

(d) are notified of their duties in relation to protection and safety

(e) are authorised to assume their roles and responsibilities.

Restricted activities

6. The managing entity must not, without the prior written approval of the Director, allow:

   (a) practices, that result in an increase in activity by deliberately adding radioactive material or by activation, in food, feed, beverages, cosmetics or any other commodity or product intended for a person to ingest, inhale or take in through the skin, or to be applied to them

   (b) practices involving the frivolous use of radiation or radioactive material in commodities or in consumer products such as toys and personal jewellery or adornments, which result in an increase in activity by deliberately adding radioactive material or by activation

   (c) human imaging using radiation that is:

      (i) performed as a form of art or for publicity purposes

      (ii) performed for occupational, legal or health insurance purposes, and undertaken without referring to clinical indication

      (iii) used to detect concealed objects

   (d) devices or manufactured items into which radionuclides have deliberately been incorporated or produced by activation, or that generate ionising radiation and that can be sold or made available to members of the public without special surveillance or regulatory control after sale, to be made available to the public.

Policies, procedures and local rules

7. The managing entity must establish, implement and maintain policies and procedures to meet the requirements of this code including, without limitation, policies and procedures:

   (a) to control access to areas where people can be exposed to radiation

   (b) to use constraints to optimise protection and safety

   (c) for the management of radioactive waste and discharges of radioactive material

   (d) for routine radioactive material preparations and dispensing procedures

   (e) to prevent accidents and mitigate the consequences of any that occur

   (f) to report on and learn from accidents and other incidents

   (g) to comply with operational limits and conditions relating to public exposure

   (h) for staff who have indicated they may be pregnant

   (i) to minimise unnecessary exposure to the embryo or fetus

(j) to provide protection and safety by applying preventive measures in the following hierarchy:

(i) engineered controls

(ii) administrative controls

(iii) personal protective equipment

(k) to set an investigation level and establish procedures to follow if such a level is exceeded

(l) to implement procedures for verifying compliance with this code

(m) to periodically review the overall effectiveness of measures for protection and safety.

8. The managing entity must maintain, publish and enforce any written local rules that are necessary for protection and safety.

Monitoring and measurement

9. The managing entity must establish and maintain:

(a) a programme of continuous individual monitoring whenever appropriate, adequate and feasible, which is sufficient to assess occupational exposures for workers who usually work in a controlled area or who may receive a dose exceeding 10 percent of the dose limits

(b) a programme of workplace monitoring that is sufficient to:

(i) evaluate radiological conditions in all workplaces

(ii) assess exposures in controlled areas and supervised areas that are not assessed under subclause 9(a)

(iii) review the classification of controlled areas and supervised areas

(c) a monitoring programme for all workers who could be subject to exposure due to contamination, which is sufficient to:

(i) demonstrate the effectiveness of the measures for protection and safety

(ii) assess intakes of radionuclides and, if significant, calculate the committed effective doses

(d) programmes of source monitoring or environmental monitoring that are sufficient to assess public exposure arising from radiation equipment under the responsibility of the managing entity

(e) a capability that is sufficient to monitor unexpected increases in radiation levels due to an incident attributed to a source or facility for which the managing entity is responsible

(f) a programme to monitor areas after unsealed radioactive material has been used to ensure that all contaminated articles have been appropriately disposed of and that surface contamination levels are less than 0.4 becquerels per square centimetre for alpha radiation and 4 becquerels per square centimetre for beta radiation

(g) other monitoring or measurement programmes as necessary to verify compliance with the requirements in this code.

10. To satisfy the monitoring and measurement requirements in clause 9, the managing entity must:

(a) use appropriate monitoring equipment

(b) for continuous individual monitoring under subclause 9(a), use an external service or internal capability only if that service or capability:

(i) is approved by the Director

(ii) returns results to the managing entity within 20 working days of receiving all necessary raw information.

11. The managing entity must:

(a) take all reasonable steps to obtain previous dose records

(b) maintain records of all monitoring and verification of compliance, including:

(i) records of occupational exposure during and after the worker's working life, at least until the worker attains or would have attained the age of 75 years, and for not less than 30 years after ceasing work where the worker was subject to occupational exposure

(ii) records and estimated doses to members of the public

(iii) records of the tests and calibrations carried out

(c) provide records of occupational exposure to:

(i) individual workers in respect of their own exposure

(ii) subsequent employers of workers, subject to satisfying confidentiality criteria

(iii) the Director on request or if the managing entity is no longer able to maintain records as required under subclause 11(b)

(d) provide records of source monitoring and environmental monitoring to assess public exposure to:

(i) members of the public on request

(ii) the Director on request

(iii) the Director immediately, if any levels exceed operational limits and conditions relating to public exposure or there is a significant increase in dose rate that could be attributed to the authorised practice.

Incidents, accidents and emergencies

12. The managing entity must:

    (a) take all practicable steps to minimise the likelihood of accidents, including a multilevel system of sequential, independent provisions for protection and safety, commensurate with the likelihood and magnitude of potential exposures

    (b) take timely action to mitigate the consequences of any accident that does occur and restore radiation equipment to a safe condition

    (c) promptly investigate any incident, including by:

        (i) calculating or estimating doses a person has received and, if applicable, the dose distribution within them

        (ii) identifying corrective actions required to prevent a recurrence

    (d) implement all corrective actions identified in subclause 12(c)(ii)

    (e) keep a written record of the incident, including the:

        (i) cause or suspected cause

        (ii) calculations made under subclause 12(c)(i)

        (iii) corrective actions identified under subclause 12(c)(ii)

        (iv) details of the implementation of corrective actions under subclause 12(d)

    (f) promptly notify any reportable incident to the Director.

13. If the safety assessment required by clause 2 indicates a reasonable likelihood of an emergency affecting either workers or members of the public, the managing entity must prepare an emergency plan to protect people and the environment, which includes:

    (a) arranging to promptly identify an emergency

    (b) determining the correct level of emergency response

    (c) providing individual monitoring and area monitoring and arranging for medical treatment

    (d) arranging to assess and mitigate any consequences of an emergency.

Records

14. The managing entity must maintain adequate records, and make them available as necessary, including:

    (a) the delegation of responsibilities of the managing entity

    (b) the names of all people with responsibility for protection and safety, including details of their qualifications, education and training

    (c) the quality assurance programme

    (d) information necessary to retrospectively assess doses

    (e) reports on investigations of incidents

    (f) radioactive waste that is generated, stored, transferred or disposed of

    (g) exemptions from this code granted under section 86(3) of the Act.

Quality assurance

15. The managing entity must establish a comprehensive quality assurance programme, including a documented annual audit, to provide confidence that the requirements in this code will be fulfilled.

Other parties

Radiation safety officer

16. The radiation safety officer must oversee the day-to-day implementation of regulatory requirements by the managing entity, including by:

    (a) maintaining source inventory records

    (b) inspecting and maintaining engineering controls, safety features and warning features

    (c) overseeing access control for controlled areas

    (d) establishing and periodically reviewing arrangements for personal dosimetry, including maintaining and reviewing occupational dose records

    (e) performing routine operational checks of monitoring instruments to ensure that they are working properly

    (f) ensuring that everyone with responsibilities for radiation protection and safety is suitably trained in the use of radioactive material and radiation protection, and that they receive regular refresher training

    (g) ensuring that emergency plans are established and practised regularly

    (h) supervising workplace monitoring arrangements

    (i) establishing, issuing and periodically reviewing local rules

    (j) investigating higher-than-usual exposures and overexposures

    (k) investigating and reporting incidents, including accidents.

17. The radiation safety officer must work in close cooperation with qualified experts, if appointed, to ensure that all necessary duties and tasks are performed.

Qualified expert

18. The qualified expert, if appointed, must work in close cooperation with the radiation safety officer to ensure that all necessary duties and tasks are performed.

Manufacturer/supplier

19. The manufacturer/supplier must supply:

    (a) well-designed, well-manufactured and well-constructed ancillary equipment and protective equipment that provides for protection and safety in accordance with the requirements of this code

    (b) radioactive sources that are manufactured in accordance with good manufacturing practice and fit for their intended purpose.

20. The manufacturer/supplier must make suitable arrangements with managing entities to share information on use and operating experience that may be important for protection and safety.

Appendix 1: Cross-reference to Radiation Safety Act 2016

As required by section 87(1) of the Radiation Safety Act 2016, clauses in this code apply to the fundamental requirements in sections 9–12 of the Act as follows.

Section in Act	Clauses in code
9(1)	1–2, 5–8, 15–18
9(2)	1–5, 8–11, 14–18
9(3)	1–5, 8–11, 14–18
10(1)	2, 4–5, 8, 12–14, 16–20
10(2)	2, 4–5, 8, 12–14, 16–20
10(3)	2, 4–5, 8, 12–14, 16–20
11	1, 4
12	2–5, 8, 14, 16–18

Appendix 2: Training requirements

	User	Radiation safety officer
Atomic structure, X-ray production and interaction of radiation	l	l
Nuclear structure and radioactivity	l	l
Radiological quantities and units	l	l
Fundamentals of radiation detection	m	m
Principle and process of justification	l	m
Fundamentals of radiobiology, biological effects of radiation	l	l
Risks of cancer and hereditary disease	l	l
Risks of deterministic effects	l	m
General principles of radiation protection, including optimisation	m	m
Operational radiation protection	h	h
Particular staff radiation protection aspects	h	h
Risks from fetal exposure	l	m
Quality control and quality assurance	l	m
National regulations and international standards	m	h

Level of knowledge

l – low level of knowledge (general awareness and understanding of principles)

m – medium level of knowledge (basic understanding of the topic sufficient to influence practices undertaken)

h – high level of knowledge (detailed knowledge and understanding sufficient to be able to educate others)

Appendix 3: Annual limits on intake

Radionuclide	Annual limit on intake
H-3	480 MBq
C-14	35 MBq
P-32	6.3 MBq
P-33	8.3 MBq
S-35	15 MBq
Ca-45	7.4 MBq
Cr-51	530 MBq
Co-57	21 MBq
Co-58	10 MBq
Ga-67	71 MBq
Se-75	7.7 MBq
Sr-89	2.7 MBq
Y-90	7.4 MBq
Mo-99	17 MBq
Tc-99m	690 MBq
In-111	65 MBq
I-123	95 MBq
I-125	1.3 MBq
I-131	910 kBq
Au-198	20 MBq
Tl-201	210 MBq
Th-nat	480 Bq
U-nat	2.7 kBq

Appendix 4: Waste disposal

Landfill

Radioactive material may be disposed by placement into landfill if the material:

1. is in solid form
2. is contained within packaging designed so that:
   (a) the smallest overall external dimension of each package is not less than 10 cm
   (b) the package can be easily handled
   (c) there are at least two complete layers of packaging between the radioactive material and the exterior of the package, one layer of which is waterproof
   (d) the outer layer of each package:
      (i) as far as practicable, prevents the collection and retention of water, and
      (ii) can be easily decontaminated
   (e) as far as practicable, the packaging will retain its contents during transport to the landfill site
   (f) no individual package contains more than the relevant Landfill Package Activity Value in column 2 of the table below
   (g) the dose-rate at the surface of any individual package does not exceed 5 μSv/h
   (h) the maximum non-fixed external contamination on any individual package does not exceed:
      (i) 4 Bq/cm^2 for beta and gamma emitters, or
      (ii) 0.4 Bq/cm^2 for alpha-emitters having a half-life greater than 10 days
3. is limited to no more than 10 packages containing radioactive material from the person initiating the disposal in any seven-day period at the one landfill site
4. is not placed in the recycling waste stream, and
5. is recorded in a register that is kept by the person initiating the disposal.

Sewerage system

Radioactive material may be disposed into the sewerage system if the material:

1. consists of aqueous materials
2. is released so that:
   (a) the annual activity of a radioactive material from the site to a sewer does not exceed the value in column 3 of the table below, and
   (b) the concentration at the input to a waste water treatment plant, calculated as the activity in (i) divided by the annual flow[2] through the waste water treatment plant to which the sewer connects, does not exceed that in column 4 of the table below, and
3. is recorded in a register that is kept by the person initiating the disposal.

Atmosphere

Radioactive material may be disposed into the atmosphere if the material is:

1. limited so that the annual activity released at the point of discharge does not exceed the air discharge values in column 5 of table below, and
2. recorded in a register that is kept by the person initiating the disposal.

[2] The annual flow is calculated as the average dry weather flow applied over a full year.

Table: Landfill package activity, sewerage discharge and air discharge values for periodic disposal of very low-level radioactive material

Column 1	Column 2 Landfill disposal values	Column 3 Sewerage discharge values	Column 4 Sewerage discharge values	Column 5 Air discharge values
Radionuclide	Landfill package activity values[1],[2] (Bq)	Annual activity to sewer from a site[3],[4] (Bq)	Resultant concentration[3] at input to a waste water treatment plant (Bq/m^3)	Annual activity released to atmosphere from the point of discharge[3] (Bq)
^{3}H	10^{10}	2.0×10^{11}	9.1×10^{6}	1.0×10^{12}
^{14}C	10^{8}	1.8×10^{8}	1.0×10^{3}	1.0×10^{11}
^{18}F	10^{7}	2.3×10^{9}	1.0×10^{5}	2.5×10^{13}
^{22}Na	10^{7}	1.0×10^{6}	1.1×10^{0}	1.0×10^{7}
^{24}Na	10^{6}	1.0×10^{8}	1.1×10^{3}	1.0×10^{10}
^{32}P	10^{6}	1.0×10^{7}	7.1×10^{0}	1.0×10^{9}
^{33}P	10^{9}	3.0×10^{8}	6.3×10^{1}	3.0×10^{10}
^{35}S(inorganic)	10^{9}	3.3×10^{8}	1.1×10^{4}	1.0×10^{9}
^{36}Cl	10^{7}	7.1×10^{6}	3.3×10^{2}	1.0×10^{8}
^{45}Ca	10^{8}	3.0×10^{9}	1.1×10^{5}	1.0×10^{9}
^{51}Cr	10^{8}	1.0×10^{9}	1.1×10^{3}	1.0×10^{10}
^{59}Fe	10^{7}	1.0×10^{7}	1.1×10^{1}	1.0×10^{9}
^{57}Co	10^{7}	6.3×10^{8}	1.6×10^{2}	1.0×10^{10}
^{60}Co	10^{6}	5.6×10^{6}	7.9×10^{0}	8.3×10^{9}
^{63}Ni	10^{9}	6.3×10^{10}	6.6×10^{3}	8.3×10^{12}
^{65}Zn	10^{7}	7.0×10^{6}	3.2×10^{2}	3.0×10^{10}
^{67}Ga	10^{7}	1.0×10^{9}	1.1×10^{3}	1.0×10^{11}
^{85}Kr	10^{5}	–	–	7.7×10^{15}
^{89}Sr	10^{7}	2.0×10^{9}	1.7×10^{3}	1.0×10^{9}
^{90}Sr	10^{5}	1.0×10^{7}	4.6×10^{2}	3.0×10^{10}
^{90}Y	10^{6}	4.2×10^{10}	1.1×10^{5}	1.0×10^{11}
^{99}Mo	10^{7}	1.0×10^{9}	1.1×10^{3}	1.0×10^{10}
^{99}Tc	10^{8}	2.0×10^{6}	8.9×10^{1}	1.0×10^{8}
^{99m}Tc	10^{8}	7.0×10^{8}	1.1×10^{4}	1.0×10^{12}
^{111}In	10^{7}	1.0×10^{9}	1.1×10^{3}	1.0×10^{10}
^{123}I	10^{8}	8.3×10^{9}	1.1×10^{4}	1.0×10^{11}
^{125}I	10^{7}	1.0×10^{9}	1.1×10^{3}	1.0×10^{9}
^{129}I	10^{6}	1.8×10^{7}	8.3×10^{2}	1.3×10^{9}
^{131}I	10^{7}	1.0×10^{8}	1.1×10^{2}	1.0×10^{9}
^{137}Cs	10^{5}	1.7×10^{7}	5.1×10^{1}	1.4×10^{10}
^{147}Pm	10^{8}	1.0×10^{11}	1.1×10^{5}	1.0×10^{11}
^{153}Sm	10^{7}	3.2×10^{10}	1.5×10^{6}	6.3×10^{12}
^{201}Tl	10^{7}	1.0×10^{9}	1.1×10^{3}	1.0×10^{11}
^{223}Ra	10^{6}	1.3×10^{8}	5.7×10^{3}	5.9×10^{8}
^{241}Am	10^{5}	1.3×10^{8}	5.8×10^{3}	1.0×10^{8}

Notes

(1) When there is a mixture of radionuclides in the material to be disposed of to landfill:

$$\sum_i \frac{C_i}{X_i} \leq 10$$

Where C_i is the activity of each isotope *i* to be disposed of, and

X_i is the activity value given in table above for each isotope *i*.

(2) For disposal of radioactive material to landfill where the radionuclides are not listed in this table, a package activity value of 10 times the exemption limit for that radionuclide, or mixture of radionuclides calculated in accordance with Note (1) above, applies.

(3) When there is a mixture of radionuclides in the material to be disposed of to a sewer or to air:

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

Where C_i is the activity or activity concentration of each isotope *i* to be disposed of, and

X_i is the activity or activity concentration discharge value, as appropriate, as given in table above for each isotope i.

(4) A 'site' may be, for example, a university or a hospital from which there could be several individual points of disposal to the one sewer. The activities in this column are the total activity discharged from that site to the one sewer.

Submission form

Your details

This submission was completed by: *(name)* _____

Address: *(street/box number)* _____

(town/city) _____

Email: _____

Organisation *(if applicable)*: _____

Position *(if applicable)*: _____

Additional information

I am, or I represent an organisation that is, based in:

☐ New Zealand ☐ Australia ☐ Other *(please specify)*: _____

I am, or I represent, a: *(tick all that apply)*

☐ Organisation that uses/stores material

☐ Radiation security officer

☐ Manufacturer/supplier

☐ Other *(please specify)*: _____

Privacy

We may publish submissions on the Ministry's website. If you are submitting as an individual, we will automatically remove your personal details and any identifiable information.

If you do not want your submission published on the Ministry's website, please tick this box:

☐ Do not publish this submission.

Your submission will be subject to requests made under the Official Information Act. If you want your personal details removed from your submission, please tick this box:

☐ Remove my personal details from responses to Official Information Act requests.

Please return this form:

By email to: orsenquiries@health.govt.nz (including 'unsealed radioactive material code' in the subject line)

By post to: Office of Radiation Safety, PO Box 5013, Wellington 6140.

Consultation questions

The Office of Radiation Safety is seeking comments on the following.

Scope

1. Do you agree that the scope of this code is appropriate?

   ☐ Yes

   ☐ No

   If no, please provide alternative suggestions for the scope of this code.

Roles and responsibilities

2. Are the roles and responsibilities of key parties adequately described?

   ☐ Yes

   ☐ No

   If no, please provide details of parties that should/should not be included and any changes that should be made to the descriptions.

Definitions

3. Are the definitions appropriate and comprehensive?

   ☐ Yes

   ☐ No

   If no, please provide suggestions for any new terms to be defined or changes to existing definitions.

Managing entity obligations

4. a. Are the subheadings within the 'Managing entity' section appropriate?

☐ Yes

☐ No

b. Are there other changes you think are necessary to the obligations of the managing entity?

☐ Yes

☐ No

c. Please provide any comments below.

Other parties

5. a. Are there other parties who should have defined responsibilities?

☐ Yes

☐ No

b. Are there other changes you think are necessary to the obligations of other parties?

☐ Yes

☐ No

c. Please provide any comments below.

Appendix 2: Training requirements

6. a. Is the information in this appendix appropriate and comprehensive?

☐ Yes

☐ No

b. Please provide any comments below.

Appendix 3: Annual limits on intake

7. a. Is the information in this appendix appropriate and comprehensive?

☐ Yes

☐ No

b. Please provide any comments below.

Appendix 4: Waste disposal

8. a. Is the information in this appendix appropriate and comprehensive?

☐ Yes

☐ No

b. Please provide any comments below.

Additional comments

9. a. Was the information in this code appropriately presented?

☐ Yes

☐ No

b. Was the information in this code easy to find?

☐ Yes

☐ No

c. Are there any changes you would like to suggest?

☐ Yes

☐ No

d. Are there circumstances that are not included in this code but should be? If yes, please provide more details in the comments box below.

☐ Yes

☐ No

e. Is the information easily understood?

☐ Yes

☐ No

f. Is there any other information or subject that should be included in this code?

- ☐ Yes
- ☐ No

g. Please provide any comments related to your answers to 9(a)–(f) below.