

**RADIATION HEALTH SERIES**

**No. 5**

**CODE OF PRACTICE**

**FOR**

**THE MANAGEMENT OF LOW LEVEL RADIOACTIVE WASTE**

**AND DISUSED SOURCES**

**(INCLUDING THEIR HANDLING, STORAGE,  
PACKAGING, TRANSPORTATION AND DISPOSAL)**

**RADIATION HEALTH DIVISION**

**DEPARTMENT OF HEALTH**

Radiation Health Series is a series of information brochures, guidance notes, and recommendations prepared by the Radiation Health Division, Department of Health, The Government of the Hong Kong Special Administrative Region. It is intended to provide some basic information on the safe handling of sources of ionizing radiation used in medicine, industry and education.

Each publication in the series normally covers a specific type of activities involving ionizing radiation. You will probably be able to find some titles of interest to you or relevant to your work.

We have prepared these documents on the basis of the recommendations made by notable international authorities, such as the International Commission on Radiological Protection (ICRP), the World Health Organization (WHO), the International Labour Organization (ILO) and the International Atomic Energy Agency (IAEA). We hope you find the information useful in safeguarding your own health, as well as the health of your neighbours and the well being of the environment, when you work with ionizing radiation.

If you have questions on the contents of these documents or have suggestions on improvements, please contact us at the

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## **Preface**

Radioactive substances have been used for many years in Hong Kong, in various applications in medicine, industry, education, research, and consumer and safety products. These radioactive substances, depending on their applications, could be encapsulated in the form of sealed sources, or could be dispensed in the form of unsealed sources.

Radioactive substances used in all these applications, which are justified, will eventually end up as waste. A proper management of the waste generated as a result of these applications, including disused or waste sources, is necessary for the protection of workers, members of the public, and the environment.

In Hong Kong, the management of radioactive waste is controlled by the Radiation Ordinance Cap.303, Laws of Hong Kong. Any activities involving handling, storage, transportation, packaging and disposal of radioactive wastes shall be approved by the Radiation Board and shall be carried out in such a way that the exposure to persons, besides being kept well within the prescribed limits, is reduced to as low as reasonably achievable.

This Code of Practice is mainly concerned with the management of radioactive waste of low levels of radioactivity, or radionuclides of relatively short half-lives, such as those commonly generated from medical, industrial and research uses of radioactive substances in Hong Kong. The radioactive waste considered in this Code is that which is in the lowest category of radioactivities and which presents such a low hazard to the human body that it is considered safe enough to be disposed of by the waste producer.

The purpose of this Code is to recommend standard practices, which have been found helpful in achieving the above objectives for small quantities of radioactive waste. Due to the complex nature of the subject it is impractical to include in this Code every detail which can apply to all situations. In such circumstances advice should be sought from the Radiation Board on interpretation and implementation wherever necessary to ensure compliance with the relevant Regulations of the Radiation Ordinance.

Due to the different nature (activity, physical form, half-life, international and local regulatory framework, etc.) of sealed radioactive sources, end-of-life management of these disused sources is described in a separate Section, namely Section 8 of this code.

## 1. General Introduction

### 1.1 Description of radioactive waste

According to the local Radiation Ordinance, **radioactive waste** means waste radioactive substances or waste material contaminated by radioactive substances or which, having regard to its use, may have become so contaminated. One description as given by the IAEA for legal and regulatory purposes is that **radioactive waste** is waste that contains or is contaminated with, radionuclides at concentrations or activities greater than clearance levels as established by the regulatory body.

### 1.2 Physical forms of radioactive wastes

**Airborne Wastes:** Airborne waste may be radioactive gases or vapours, or particulate material to which radioactive atoms are attached as contaminants.

**Liquid Wastes:** The usual forms of liquid radioactive wastes are aqueous solutions of radionuclides or suspensions of radioactive material in water or water-miscible liquid. Biological waste in the form of excreta or macerated material can also be regarded and treated as liquid waste. Another category of liquid wastes is that of organic solvents which, because they are flammable or toxic, usually require special methods of disposal.

**Solid Wastes:** Solid wastes can take the forms of sealed sources, unsealed sources and trash. Sealed sources are generally in the form in which they were originally purchased. Unsealed sources may include by-products of chemical analysis and residues of bulk supplies of radionuclides. Trash includes contaminated packing materials, laboratory glassware, pipette tips, plastic vials and trays, paper tissue, used syringes, tools, etc.

### 1.3 Radioactive waste hazards

Radioactive waste may present a range of external radiation hazards depending on their activities and emissions and may, if ingested or inhaled, present a variety of internal radiation hazards to the human body dependent upon the nuclide and its chemical and physical forms.

## 2. Responsibilities of the Waste Producer

The waste producer is responsible for

- 2.1 Complying with the licence conditions and the provisions of the Radiation Ordinance.
- 2.2 Obtaining the approval of the Radiation Board before disposing of any radioactive waste. When applying for the approval, the user should provide the Radiation Board with details of:

- the design of its proposed discharge system
  - the activities, volumes and types of radionuclides likely to be discharged
  - the expected frequency of discharge
  - any other information that the Radiation Board may require
- 2.3** Seeking approval from the Radiation Board for any changes which might affect the safety of the method of disposal of radioactive waste, with special attention being paid to:
- modification to the plumbing system carrying liquid radioactive effluents
  - modification to the extraction system for radioactive gaseous products
  - installation of new inlets for air-conditioning systems or the construction of buildings or building extensions in the vicinity of the outlets of extraction systems for radioactive gases
- 2.4** Reporting to the Radiation Board any accident or incident which might have resulted in a discharge of effluent in excess of the approved maximum activity, or in spillage of radioactive waste.
- 2.5** Informing the Radiation Board of any loss or suspected loss of radioactive sources.
- 2.6** Maintaining good management procedures and keeping accurate records of the purchase, use, storage and disposal of radioactive materials.
- 2.7** Providing all the necessary equipment for the safe handling and disposal of all radioactive waste.
- 2.8** Providing detailed instructions for the handling of all radioactive waste and ensuring that employees receive, understand and comply with them.
- 2.9** Storing all radioactive waste in adequately shielded containers or in a secure shielded room as appropriate to the nature of the waste and so as to comply with the dose-rate limitations specified by the Radiation Board.
- 2.10** Ensuring that all radioactive waste leaving the working area, either as gaseous or liquid effluent released to the environment or sewerage system, does so within the activity limits specified by the Radiation Board.
- 2.11** Ensuring that all radioactive waste being transported from the premises to the place of disposal or storage is packed and transported so that in the event of an accident, there will be negligible risk to the public. All packaging and transportation should comply with the Regulations for the Safe Transport of Radioactive Material promulgated by the International Atomic Energy Agency.

### **3. Handling of Radioactive Wastes**

- 3.1** Clearly defined working areas and adequate contamination and radiation control are essential components of radioactive waste management and are required to ensure that waste is produced and maintained under conditions appropriate to any subsequent transportation, storage and disposal operation.
- 3.2** Areas where radioactive materials are handled must be clearly labelled and demarcated in order to limit personal radiation exposures and the spread of contamination. A shoe/clothes change barrier may be required to limit the spread of contamination. Dedicated hand-washing facilities should always be provided.
- 3.3** Suitable radiation/contamination monitoring equipment is also necessary in order to limit personal radiation exposure and the spread of contamination.
- 3.4** The need to segregate radioactive wastes at source is dictated by subsequent treatment, storage and disposal requirements. Segregation of wastes by their 'physical or chemical properties' may be required if the waste is, for example, to be compacted. It may be necessary to segregate radioactive wastes by 'radionuclide half-life' to avoid long term storage and 'special disposal' of unnecessary large quantities of waste. If possible, short half-life (<120 days) waste should be decay-stored and disposed of as normal refuse. This disposal option may not be applicable if long-lived radionuclides are present in the waste. Guidelines for segregating both solid and liquid wastes from non-active wastes are given in Annex A.
- 3.5** A Radiation Protection Supervisor (RPS) should be appointed to advise on the handling of radionuclides and to coordinate the acquisition and disposal of radioactive materials. The RPS shall be a person who is regularly working in the area and shall have received suitable training in radiation protection. The RPS shall also be familiar with the appropriate guidelines and regulations on radiation protection, and have knowledge of the radiotoxicity of radionuclides and their safe handling.
- 3.6** It is essential that suitable radionuclide accountancy and assay systems are employed to determine the radionuclide activities present in the radioactive wastes. This is necessary in order to comply with subsequent transport, storage and disposal requirements. Radioactive wastes may be assayed at source by indirect measurements using, for example, hand held contamination or radiation monitors or by direct measurements using more sophisticated techniques such as liquid scintillation counting, or gamma or alpha spectrometry.
- 3.7** When radioactive waste is moved from one defined radiation/contamination area to another, via an inactive area, it should be labelled and monitored for contamination and radiation levels. The waste package should be supervised at all times, and should not be left unattended in insecure areas unless it is suitable for dustbin disposal. Documentation may be required for complicated

movements, and records of the movements may be required for future reference.

- 3.8** Radiological protection measures required by the Radiation Board include monitoring of handling areas and prohibition of certain activities such as eating, drinking, smoking and the application of cosmetics.

#### **4. Storage of Radioactive Wastes**

A store designed to hold radioactive waste temporarily shall meet the following requirements:

- 4.1** It shall have signs and labels which clearly identify the purpose for which the store is used and shall be secured to avoid unauthorised entry. Appropriate advice to all persons who may enter it, including fire-fighting personnel, shall be clearly displayed at the entrance. The store should not be used for the storage of non-radioactive materials as these may become inadvertently contaminated.
- 4.2** The store should be dry to avoid deterioration of the waste packages and should be ventilated, if necessary, to remove toxic or radioactive emanation gases. Monitoring facilities should be provided in order to restrict exposure and the spread of radioactive contamination.
- 4.3** Internal and external dose rates should be in line with the limits specified in the Radiation (Control of Radioactive Substances) Regulations, and be at all times kept as low as reasonably achievable (ALARA), social and economic factors being taken into account.
- 4.4** Adequate records should be maintained in order to locate and fully identify the stored radioactive waste, and ascertain storage requirements.
- 4.5** It is important that the disposal of decay-stored solid or liquid waste is adequately controlled by management or assay procedures in order to prevent the occurrence of 'unauthorised' disposals.
- 4.6** The inside of the store shall be of such material and so designed as to allow for easy decontamination.

#### **5. Packaging of Radioactive Wastes**

- 5.1** Packaging of radioactive material for transport shall be secure and so designed that the package can be easily handled. The outer layer shall be of such material as to avoid as far as practicable the collection and retention of water, and finished so that it may be easily decontaminated. When a package requires no visible labelling the outer layer of packaging should be opaque.

5.2 Radioactive wastes to be disposed of shall be packaged in closed drums, opaque plastic bags or multi-layer bags at the user premises before transport. Suggested forms of packaging are:

(a) **Soft materials such as paper, cardboard and textiles, and light solid objects including empty vials and disposable syringes (but not needles or other objects with sharp edges or points):**

- (i) Put into a plastic bag (which may have been the liner of a waste receptacle in the working area) and the whole placed in another plastic garbage bag in a clean area of the user's premises. Both bags are to be securely sealed; or
- (ii) Put into a multi-layer paper bag having a plastic inner liner and the bag securely sealed.

(b) **Syringe needles, pipette tips and any other sharp objects:**

Put into an impenetrable sleeve or container so that they will not puncture the outer package. Then depending on the size of the containment, it may be treated as in (a) above, or as in (c) below.

(c) **Other materials regardless of size and weight:**

Put into a metal drum having a large plastic bag as a liner and a lid which can be sealed in position.

5.3 Detailed requirements for packaging are set out in the *IAEA Regulations for the Safe Transport of Radioactive Material* (IAEA Safety Standards, No. TS-R-1, 2005 Edition) and the corresponding Advisory Material (IAEA Safety Standards, No. TS-G-1.1). The Regulations specify five principal package types of generally increasing radioactivity contents: Excepted, Industrial (IP1, IP2, and IP3), Type 'A', Type 'B' and Type 'C' packaging. In the local scene, the most commonly encountered ones are the **Excepted** packaging, the **Type A** packaging, and occasionally the **Type B** packaging which is almost always used for transporting high activity sealed sources.

5.4 It is necessary to ensure that packages are suitable for the applications involved and that certain minimum design requirements have been satisfied. It is also important to determine whether packages have been subjected to approved tests (such as those required for Type 'A', for example) and whether re-usable packages are regularly inspected and maintained.

## 6. Transportation of Radioactive Wastes

6.1 Any transportation of radioactive materials in Hong Kong shall be accompanied with a valid *Removal Permit* issued by the Radiation Board.

- 6.2 When packages are transported it is essential that they are labelled as specified in the **IAEA Transport Regulations**, and that adequate documentation is supplied to the carriers describing the chemical and physical form of the radioactive material, its radionuclide activities etc.
- 6.3 Radiation warning label is not required for packages with a surface dose-rate of less than 5  $\mu\text{Sv/h}$  or meeting the 'Excepted package' requirements. However, the inner surface of packaging should be labelled so that the word 'Radioactive', or the appropriate radiation warning logo, is visible when the outer packaging is opened.
- 6.4 In order to safely move and transport radioactive materials it is necessary to ensure, by direct monitoring techniques, that the surface contamination of the package is less than 4  $\text{Bq/cm}^2$  for beta and gamma emitters, and less than 0.4  $\text{Bq/cm}^2$  for alpha emitters.
- 6.5 If any of these limits is exceeded, the Radiation Board shall be consulted for advice. One method of ensuring that contamination is eliminated is to enclose the package in a clean plastic garbage bag before it is being transported.

## 7. Disposal of Radioactive Wastes

- 7.1 Authorisations for the disposal of solid, liquid and possibly gaseous radioactive waste are normally considered on an individual basis, for each licensed site, each case being judged on its merits taking into account the needs of the waste producer, types of waste, disposal route, destination of the waste, and other relevant factors. Adequate protection of the workers, the public and the environment has to be ensured.
- 7.2 For disposal of very low level radioactive waste to the sewerage/drainage system, or through the normal refuse collection/treatment system, in the absence of more detailed information and assessment, a practical and conservative way is to limit the disposal quantity in reference to the **Annual Limits of Intake (ALIs)** of those radionuclides to be disposed of. The ALI of a radionuclide is defined as the activity which, depending on the exposure pathway, if ingested, or inhaled, would cause a person to incur a dose equal to the annual dose limit for workers, which is 20 mSv.
- 7.3 If the waste contains only a single radionuclide, it is the ratio of its activity to the ALI for that nuclide that is being considered. In the case of a mixture of radionuclides, it is the sum of the corresponding ratios of all the nuclides.
- 7.4 For most laboratories, we impose a **disposal limit per month** of the activities  $A_i$  of different radionuclides  $i$  such that the ratio  $R = \sum \frac{A_i}{ALI_i} \leq 1$ . For nuclear medicine departments and laboratories in hospitals, which usually have dedicated drainage system and whose patient care operations necessarily

generate sufficient amount of normal effluents for dilution, a disposal limit of  $R = 1$  per day for liquid radioactive waste through the dedicated suitable drainage system is normally authorised.

- 7.5** It is often necessary to temporarily store small amounts of radioactive waste containing relatively short-lived radionuclides at suitably shielded containers or delay storage tanks at waste producer's site to allow for sufficient decay of the radionuclides before they are discharged as ordinary refuse or sewage effluent. The requirements for a delay storage tank are given in **Annex B**.
- 7.6** It is a requirement of all users of radioactive substances to submit their waste disposal records to the Radiation Board at regular intervals. The disposal records include those by dustbin or sewage disposal of small quantities of solid or aqueous radioactive waste, as well as those by return of disused sealed sources to the source suppliers. Annex C provides a sample spreadsheet template for return of disposal records by licensees.

Some disposal options are described as follows:

### **Dust Bin Disposal**

- 7.7** Subject to the prior approval by the Radiation Board, small quantities of solid unsealed radioactive waste and trash may be authorised for disposal with ordinary refuse provided the activity level is below 400 kBq in any 0.1 m<sup>3</sup> and less than 40 kBq per article. **Strontium-90 and alpha emitters are excluded.** The limits may be relaxed by a factor of 10 for wastes contaminated solely with carbon-14 and/or tritium.

### **Direct to Landfill**

- 7.8** Within certain limits, and subject to the agreement and approval of the Radiation Board and the Environmental Protection Department (EPD), solid wastes that exceed the dustbin disposal limits may be disposed of at an approved landfill site as 'special precautions disposal'. In this case, conditions are placed on the containment of the waste, its carriage to the landfill site and its burial procedure. The usual limit placed on activity is that no sack should contain more than 4 MBq of radionuclides. That limit could be increased to 40 MBq for radionuclides with half-lives less than 1 year, with further relaxation for waste contaminated solely by carbon-14 and/or tritium where the limit is raised to 200 MBq per sack (0.1 m<sup>3</sup>). A permit to dispose of the waste is required and certain conditions regarding timing of delivery of the waste to the landfill site may be imposed by the EPD as the authority for disposal of special wastes at landfills.
- 7.9** Regardless of the activities of the radionuclides contained in a package, the maximum dose-rate at the surface of the package shall be less than 5 µSv/h and this shall be checked with a survey meter before the package leaves the premises of the user.

### **Disposal to Sewer**

- 7.10** Disposal of organic radioactive wastes, such as liquid scintillation cocktails, to the sewerage reticulation system is not permitted on grounds of chemical and enhanced radiochemical hazards. In fact, organic liquid scintillation cocktails always have negligible radioactivity and should be treated as organic waste rather than radioactive waste.
- 7.11** Disposal to sewer of radioactivity exceeding the disposal limits in Section 7.4 may be considered by the Radiation Board. The waste producer is then required to carry out a full safety assessment to establish radiation exposure pathways, identify critical groups (i.e. those most at risk from radiation exposure) and compare estimated predicted doses with appropriate safety limits. The safety assessment is necessary to prevent the accumulation of radioactive materials in sewers and drains. The authorisation will be subject to periodic review by the Radiation Board.

## **8. Management of Disused Sealed Sources**

- 8.1** Sealed sources are commonly used in Hong Kong, from irradiation sources or therapy sources of very high activities (up to TBq or higher), to check sources or calibration sources of very low activity (down to kBq or lower). The policy of the Radiation Board on the disposal of these disused sources is to as far as possible return them to the original suppliers or alternative suppliers or manufacturers of the same type of sealed radioactive substances outside Hong Kong. This policy is in fact laid down as one of the conditions of the licence to all users of sealed sources.
- 8.2** As for certain legacy sources, either by themselves or contained or embedded in some equipment or gauges, if the licensee can provide evidence that the original source and equipment suppliers are no longer in business, and that the licensee's efforts to send those sources to waste management facilities in the country of origin have failed, then the Radiation Board might consider approving of the transfer of these disused sources to the local Low Level Radioactive Waste Storage Facility.
- 8.3** Again, the transport or conveyance of these disused sources has to meet the **IAEA Transport Regulations**, with regard to such requirements as on packaging, documentation, declaration of waybills, etc., and to local requirements with regard to the need for a **Removal Permit** and supervision during conveyance.

<END>

## **Annex A**

### **Segregation of Radioactive Waste by the User**

It is sensible that the volume of radioactive waste be kept to a minimum and that it be categorised according to its method of disposal at as early a stage as possible. It is therefore advisable that the user sets up the appropriate organisation and educates his staff to achieve this.

The user of radioactive material should pay special attention to the management of working areas in which unsealed radioactive materials are used in view of the potential hazards of mishandling such material. A clean, well-ordered working environment, a well-instructed and disciplined staff and clear labels on cupboards, equipment and receptacles for radioactive waste are desirable elements in good management.

In planning the working environment, the user should take into account the range of radioactive waste likely to be produced, including the radionuclides which will be disposed of and the physical form and volume of each type of waste. Liquid waste which must be stored should be specified and segregated from that which may be discharged directly to the sewerage system. Solid waste for disposal at the tip should be segregated from that which may require storage.

Where liquid radioactive waste is being produced regularly at activities which may conceivably exceed the prescribed discharge limits, sinks connected to a delay tank system should be provided and labelled. These sinks should be restricted to uses involving radioactive waste products. Where the volume of liquid radioactive waste is small, a labelled screw top container in the working area may be adequate. Similarly, one or more fume cupboards should be reserved for work which might involve the release of radioactive gaseous products.

Receptacles should be provided for the receipt of various types of radioactive solid waste and these should be clearly and appropriately labelled and placed near to where the materials are being handled. The contents of the solid waste receptacles should be packaged for storage or disposal as soon as practicable and the activity and nature of the radioactive materials should be recorded. The use of a plastic garbage bag as the inner liner of the solid waste receptacle is strongly recommended for waste destined for the municipal tip, as this can be sealed when nearly full and, when placed inside a second garbage bag, becomes a durable package suitable for transport and ultimate disposal.

In the hospital environment, bed linen which may be contaminated with radioactive materials should remain segregated from other linen and laundered separately under instructions provided by the radiation safety officer in compliance with the requirements of the Radiation Ordinance. Linen and similar material contaminated with radionuclides shall be segregated from non-active waste and be appropriately disposed of as radioactive material. Toilets used by patients treated with radioiodine should be clearly marked and only used by these patients. The effluent from these toilets should be discharged to the sewerage system, so that they will be expected to be sufficiently diluted by other routine non-radioactive effluents from the hospital.

## **Annex B**

### **Requirements for a Delay Storage Tank for Liquid Waste**

Holding tanks are usually constructed in sets of two or more so that one may be filling while the contents of a full one is being sampled, analysed and discharged. The tank shall meet the following general requirements:

- a) It shall be leak-free and so constructed that it can be expected to remain leak-free.
- b) It shall have visual indicators of the volume of the contents at any time and have warning devices which operate when the tank is almost full so that the effluent may manually or automatically be switched to fill a second tank.
- c) It shall be enclosed in a secondary enclosure of sufficient volume to hold the contents if at any time there should be a loss of tank contents.
- d) It shall have facilities which allow easy withdrawal of representative samples of the contents.
- e) It shall have a trapdoor to allow visual inspection for the build-up of any internal deposits on the base and sides and to allow access for clearing, should this become necessary.
- f) Delay storage of human or animal wastes is not recommended. If that is really necessary, appropriate provision shall be made for sanitary control.

## Radioactive Waste Disposal Record (Sample 1)

Licensee: ABC Health Limited

Month: December 2007

RHD Ref: xxx/Z

R.S. Licence No.: yyyy

Annual dose limit = 20 mSv

### Solid Waste Disposal Record

Disposal route: as clinical waste to designated landfill

Disposal limit = 1 ALI per month

Nuclide	DCF (Sv/Bq)	ALI (MBq)	Half-life (d)	Activity	Waste generating factor*	Delay Period (d)	Disposed Activity (MBq/month)	Fraction of ALI
				dispensed to customers (GBq/month)				
Tc-99m	2.20E-11	9.09E+02	0.25	1609.8	0.5%	3	1.97	0.0022
Ga-67	1.90E-10	1.05E+02	3.26	5.9	0.5%	30	0.05	0.0005
TI-201	9.50E-11	2.11E+02	3.04	13.6	3.5%	30	0.51	0.0024
							<b>Sum:</b>	<b>0.005</b>

\* Remark: Waste generating factor accounts for such radioactivity as remaining in returned syringes, etc.

### Liquid Waste Disposal Record

Disposal route: designated drain to closed sewer

Disposal limit = 1 ALI per month

Nuclide	DCF (Sv/Bq)	ALI (MBq)	Half-life (d)	Usage (GBq/month)	Waste generating factor	Delay Period (d)	Disposed Activity (MBq/month)	Fraction of ALI
I-131	2.20E-08	9.09E-01	8.02	108.9	0.10%	60	0.61	0.6711
P-32	2.40E-09	8.33E+00	14.29	0.5	0.10%	15	0.24	0.0290
S-35	7.70E-10	2.60E+01	87.4	0.4	0.10%	15	0.36	0.0137
							<b>Sum:</b>	<b>0.714</b>

### Radioactive Waste Disposal Record (Sample 2)

Licensee: **ABC Health Limited**

Month: **December 2007**

RHD Ref: xxx/Z

R.S. Licence No.: yyyy

Annual dose limit = 20 mSv

#### Gaseous Waste Disposal Record

Disposal route: **vented through filter from fume hood**

Disposal limit = **1 ALI per month**

Nuclide	DCF (Sv/Bq)	ALI (MBq)	Half-life (d)	Usage (GBq/month)	Waste generating factor	Delay Period (d)	Disposed Activity (MBq/month)	Fraction of ALI
Tc-99m	2.20E-11	9.09E+02	0.25	100	0.5%	1	31.27	0.034
Ga-67	1.90E-10	1.05E+02	3.26	10	0.5%	1	40.42	0.384
Tl-201	9.50E-11	2.11E+02	3.04	10	1.0%	1	79.62	0.378
							<b>Sum:</b>	<b>0.797</b>

Remarks:

- 1 The Annual Limit of Intake (ALI, in Bq) for a particular radionuclide is obtained by dividing the annual dose limit of workers (20 mSv) by the appropriate dose conversion factor (Sv/Bq).
- 2 The appropriate dose conversion factor (ingestion or inhalation) has to match the chemical (e.g. elemental, organic, or inorganic) and physical form (e.g. solid, liquid, or gaseous) of the radioactive waste to be discharged.
- 3 Another way to find the ALI values is to look up such tables in some radionuclide data books (e.g. Radionuclide and Radiation Protection Data Handbook, D. Delacroix et al.), or relevant ICRP publications (e.g. Publication Nos. xxx).