

AIRNET SAMPLE ANALYSES FOR UNPLANNED RELEASES

Purpose This Meteorology and Air Quality Group (MAQ) procedure describes the group's response to a request for AIRNET data from the Emergency Management and Response (EM&R) office following an unplanned release of radioactive material.

Scope This procedure applies to the handling, measurement, and analysis of AIRNET samples in the event of an unplanned release of radioactive material.

In this procedure This procedure addresses the following major topics:

Topic	See Page
General Information About This Procedure	2
Who Requires Training to This Procedure?	2
Response to an Unplanned Release of Radioactive Material	4
Records Resulting from This Procedure	8

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General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Control Plan	3
2	Measurement of AIRNET samples using an E-600 with SHP380AB	2
3	Analysis of AIRNET data	4
4	Appendix A to 10 CFR 835	26

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	1/4/01	New document.
1	4/15/02	Quick-change revision to add step in attachment for uploading data from E-600 to databases.
2	04/25/05	Quick-change revision to convert HCP to HR for annual review.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- MAQ personnel assigned to collect and process AIRNET samples.

Annual retraining is required and will be by self-study (“reading”) training.

Training method

The training method for this procedure is **on-the-job training** conducted by a previously trained individual and is documented in accordance with the procedure for training (MAQ-024).

General information, continued

Prerequisites In addition to training to this procedure, the following training is also required prior to performing this procedure:

- MAQ-202 “Environmental Sampling of Airborne Particulate Nuclides”
- MAQ-204, “Sampling of Ambient Airborne Tritium”
- Radiological Worker (RW) training.

The following training is recommended but not required:

- LA-UR-99-5085, “Tritium Safety” (ESH-13 #11952)
- LA-UR-99-5087, “Plutonium Safety” (ESH-13 #11579)
- LA-UR-00-502, “Environmental Radioactivity”

Definitions specific to this procedure None.

References The following documents are referenced in this procedure:

- MAQ-202, “Environmental Sampling of Airborne Particulate Nuclides”
- MAQ-204, “Sampling of Ambient Airborne Tritium”
- MAQ-210, “Placing and Retrieving Field TLDS”
- LA-UR-00-502, “Environmental Radioactivity”
- LA-UR-99-5085, “Tritium Safety”
- LA-UR-99-5087, “Plutonium Safety”
- LANL Hazards Assessment Document (Rev. 3) compiled by Gerald Ramsey and Dennis Armstrong (1999)
- EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

Note Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).

Response to an unplanned release of radioactive material

EM&R

The Emergency Management and Response (EM&R) personnel in group S-8 coordinate all emergencies at the Laboratory, including unplanned releases. They monitor 911 calls, and may be contacted directly by phone at 7-6211.

In the event of an unplanned release of radioactive material, EM&R personnel might contact MAQ and request AIRNET data. This procedure describes the MAQ response. The goal of this procedure is to provide limited information within 24 hours of the request.

Meteorology team

The **MAQ meteorology team** makes dispersion predictions based on real-time meteorology and estimates of source terms, e.g., from the LANL Hazards Assessment Document, available from EM&R. The meteorology team will assist EM&R in determining which AIRNET samples should be analyzed.

AIRNET

The **AIRNET project leader** (or designee) decides whether to change the tritium samples, the particulate filters, or both, and whether to make measurements in addition to those described in this procedure.

As one option, AIRNET samples might be analyzed by the Health Physics Analysis Laboratory, HPAL. HPAL may be contacted by phoning 5-8888 or the emergency digital pager: 505-996-1380. The main HPAL laboratory is at the south end of the HPAL group buildings, TA-3-2010.

Tritium samples could be distilled using MAQ apparatus, as described in MAQ-204, and counted in an HPAL liquid scintillation counter. MAQ should keep some distillation equipment in Los Alamos for this purpose.

Alternatively, samples could be sent to the laboratories that analyze routine AIRNET samples.

TLDs

The **DPRNET (TLD) project leader** (or designee) decides whether to change the co-located TLDs at the same time as the AIRNET samples are retrieved. TLDs should be changed only if: (a) the release includes significant gamma emitters, and (b) replacement TLDs are available.

Response to an unplanned release, continued

Exercises Exercises are simulations or practice “games” that are performed periodically for training. In an exercise, you may use simulated AIRNET samples so as not to disturb the real AIRNET filters and cartridges.

Emergencies Even in a real emergency, don't rush and don't do anything you believe to be unsafe.

Preparation Understand what information is being requested.

- Is this an exercise or a real emergency? Will you use real or simulated samples?
- Is tritium data requested, or particulate data, or both? Do you need to change the filter, the silica-gel cartridge, or both?

Understand the hazards before you proceed. In an emergency, ask EM&R about the hazards. The EM&R phone number is 7-6211. Ask about the following.

- What personal protective equipment (PPE) will you need? At a minimum, wear a lab coat and latex gloves while handling filter heads.
- Will you need a respirator? If you are not trained to wear a respirator, avoid areas where a respirator is needed.
- Which AIRNET stations will you visit and by what route? What locations should you avoid?
- Is RCT coverage needed or available? If not, what type of contamination is expected and how can you detect it?
- What type of communication is required (e.g., radio)?

Proceed carefully. Do not become another victim.

Note: rules and regulations are intended for routine operations and for emergency planning; they should not prevent you from using your best judgement during an actual emergency.

Date of latest changeout Write down the time and date of the previous AIRNET changeout for each station of interest and make a copy of this information available to EM&R.

Response to an unplanned release, continued

Equipment needed

In addition to the supplies needed for a normal changeout, take

- a box of latex gloves
- lab coats
- plastic bags (preferably ziplock)
- tissues and Fantastik cleaner
- an E-600 detector kit and a radioactive source (lantern mantle)
- a copy of this procedure including the form in attachment 2
- radio or other emergency communication as determined by EM&R

Take fresh silica-gel cartridges and/or filter heads according to which type of samples were requested.

Steps to obtain AIRNET samples

To obtain AIRNET samples in response to a request from EM&R, perform the following steps. If any steps seem questionable under the particular emergency conditions at the time, consult EM&R by phoning 7-6211.

Step	Action
1	Inform the AIRNET and DPRNET program managers and the group office by phone, leaving messages as appropriate.
2	Make a plan, assemble a team, and gather the equipment, as discussed on pages 4-6. Identify which AIRNET samples to change.
3	Before leaving, check the performance of the E-600 by doing a source check as described in attachment 2.
4	Follow the standard procedures (MAQ-202 pages 4-8, MAQ-204 pages 5-10, and MAQ-210) to change AIRNET samples and TLDs at those stations requested by EM&R, except as follows. <ul style="list-style-type: none"> • Before touching the filter head, wear latex gloves and a lab coat. • Before removing the filter head, use the E-600 to measure and log the alpha and beta activity on the filter, following the instructions in attachment 2. Typical activities are on page 1 of attachment 3. • After changing the filter head, use the E-600 to measure and log the alpha and beta background from a fresh filter in the same location. • Change the silica-gel cartridges only if this was requested. • Place the filter head in a ziplock bag. • Use the E-600 to monitor for contamination after you place the filter head in the vehicle, and use tissues and Fantastik cleaner to decontaminate as needed. • Remove your latex gloves and put them with other potentially contaminated items in a ziplock bag to be dealt with by an RCT after the emergency.

Steps continued on next page.

Response to an unplanned release, continued

Step	Action
5	Report the data to the AIRNET project leader or designee. Take the filter heads and/or tritium cartridges to an MAQ lab and await further instructions. (Note: the activity on the filters will decrease as the radon daughters decay, as described in attachment 3.)
6	If any TLDs were recovered from the field, place them in the safe in the Cave and await instructions from the DPRNET project leader.
7	Contact an RCT (e.g., by phoning the RCT group) and check for contamination. Do not leave for home until you are free of contamination.
8	After the emergency is over, the AIRNET housings, their contents, the vehicle, and all equipment used during the emergency must be checked by an RCT.

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted **within 3 weeks** as records to the records coordinator:

- Air Monitoring Field Data Form and Chain of Custody Record as specified in procedures MAQ-202 and MAQ-204.
- Data sheets from attachment 2 of this procedure.

HAZARD REVIEW FOR AIRNET SAMPLE ANALYSES FOR UNPLANNED RELEASES

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
Collect AIRNET samples according to steps in this procedure.	Thermal burns--skin burns from pumps Occasional/Negligible = Minimal	Use care to avoid these injuries.	Low
As part of sampling work, enter radiation areas and explosives testing areas.	Site-specific hazards such as high explosives testing (TA-15, TA-16, TA-49) or radiation Areas (TA-54- Area G, TA-16) Remote / Negligible = Minimal	Comply with all site-specific access requirements. Existing facility access controls include site-specific training, sign-in/sign-out, and scheduling procedures. Area G and TA-15 require entry through manned access control gates.	Low
As part of sampling work at AIRNET stations, work around electrical equipment.	Electrical shock in wet conditions Remote / Catastrophic = Low Electrical shock from electrical conduit damaged by vehicle or large animal Improbable / Catastrophic = Medium	For wet conditions, all stations were retrofitted with GFCI (ground fault interrupts). If damaged station is found with potential for electrical contact in damaged conduit, contact electrician to shut off power prior to any further work.	Low

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
Collect AIRNET filters that are potentially contaminated from a rad accident, according to steps in this procedure or instructions from EM&R.	Radioactive material, especially on filter head or in silica-gel cartridge.	Guidance on exceptionally high count rates on air filters is contained in the ESH-1 Air Monitoring Procedure, ESH-1-05-02.2 section 4.6.2, which states "if the count rate is > 20,000 dpm alpha or > 100,000 dpm beta ... notify ... supervision and HPAL before sending the filter to HPAL." Use personnel protective equipment as instructed in Rad. Worker Training.	Low

Wastes or residual materials resulting from process

Filters and silica gel will be processed according to steps in MAQ-202 and -204. Contaminated gloves, left in AIRNET housing, disposed by an RCT after the emergency.

Emergency actions to take in event of control failure

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible. For any exposed, energized electrical wires, contact an electrician or the appropriate authority to turn off the power. Follow all site-specific emergency plans for any radiation or explosives emergencies.

MEASUREMENT OF AIRNET SAMPLES USING AN E-600 WITH SHP380AB

Steps to measure AIRNET samples

To measure the alpha and beta activity on AIRNET filters, perform the following steps.

Step	Action
1	On the form (reverse side), record the station location, date, names of personnel, property numbers and calibration void dates, and note any physical damage to the equipment (if applicable).
2	Connect the SHP380AB probe to the E-600 with the cable. Turn the switch to "check" and record the battery condition (%).
3	Place the SHP380AB probe as follows: a) without the radioactive material, for background data (see step 7); b) 0.25 inch from a source such as a lantern mantle for a source check (with all protective covers, plastic bags, etc., removed); c) 0.25 inch from a used filter, e.g., against the brass filter holder (with all protective covers, plastic caps, etc., removed); d) 0.25 inch from a new filter in the same location (to measure the background with the setup identical to 3c except for the new filter). Then perform steps 4 thru 6 to measure and record the data.
4	Turn the switch to "scaler" and press "Chnl" to select " α " or " β "; (collect data for both " α " and " β ").
5	Press "*" to begin a 60-second count. At the end of the 60-second count, record the data on the form.
6	At the end of each 60-second count, press "Log" <u>twice</u> to log the data into the E-600 memory. Record the log#, which will be displayed momentarily, on the form.
7	Repeat steps 3c, 3d, and 4 through 6 as needed.
8	At your convenience, obtain the help of an expert (e.g., from an RCT) to transfer the data from the E-600 to a PC computer and clear the E-600 memory. The "log" function of the E-600 will record 500 readings before the memory becomes full. Turn the E-600 switch to "off" before disconnecting the cable; squeeze the connector at the 6 small ridges to release it.
9	Transfer the E-600 data into Excel and store it in the E-600 folder on the Users network drive. Name the file by the date it was acquired. Insert a column for "Station ID" and a column for "Sample or Background" and fill the cells accordingly. Note comments or whether a sample should be rejected in the first available column.

Notes on background. If the background and gross count rates are about equal, the background and gross count times should be about equal. Take a background reading at each AIRNET station. If a set of filters are to be counted at one location (e.g., in the TA-54 Cave) take background readings at the beginning and end of the set, and also every 15 minutes.

ANALYSIS OF AIRNET DATA FOLLOWING AN UNPLANNED RELEASE OF RADIOACTIVE MATERIAL

Purpose

This attachment is intended to aid technical staff members in interpreting the data. The general goal is to obtain limited information within 24 hours of a release.

Radon

AIRNET filters accumulate radon and thoron decay products. After subtracting background, the net count rate from these decay products will typically be within a factor of two of:

- 2k dpm α
- 4k dpm β

During an inversion, however, the count rates might be up to a factor of five higher. Guidance concerning very high count rates on air filters is contained in the ESH-1 Air Monitoring Procedure ESH-1-05-02.2 section 4.6.2, which states: "If the count rate is $> 20,000$ dpm alpha or $> 100,000$ dpm beta ... notify supervision".

A count rate of 10k dpm α from Pu-239 corresponds to 1 rem, CEDE. Therefore, the following corrections for the count rate from radon and thoron decay products are significant.

Typically, about half the activity is from short-lived radon decay products with half lives of 26.8 minutes or less, and about half is from longer-lived Pb-212 and its decay products, with a half life of 10.64 hours.

Five hours after the filter is removed from the pump, most of the residual activity decays with a half life of 10.64 hours. In this case, the long-lived activity, A , can be estimated from two measurements, A_0 and A_t , separated by time t , by using the equation:

$$A = [A_t - A_0 \exp(-\lambda t)] / [1 - \exp(-\lambda t)]$$

where λ is the decay constant ($\lambda = 0.693/10.64$ if t is in hours).

The long-lived activity, A , typically includes about 50 dpm of Bi-210 and about 5 dpm of Po-210. During the Cerro-Grande fire, typical filter activities were about 100 dpm for each of Pb-210, Bi-210, and Po-210.

Uncertainty

Note: the detector records the number of disintegrations, whereas the uncertainty depends on the number of counts. The efficiency is about 20%, so the count rate (cpm) is about 20% of the disintegration rate (dpm).

Limitations of AIRNET data

Subject to the limitations of radon and thoron background, AIRNET data can be used to estimate the committed effective dose equivalent, CEDE, that was accumulated from the time of the release to the time when the AIRNET filters and/or cartridges are collected from the field. AIRNET provides only retrospective data, because the radioactive material collected on the filters and cartridges consists of everything collected since the AIRNET station was last serviced.

It takes at least an hour to collect one sample, analyze it, and estimate the CEDE. Decisions such as whether to evacuate are based on the present release rate. Therefore, the retrospective information from AIRNET is of limited use during the early phase of a release.

AIRNET Locations

Approximately 50 AIRNET stations are located in Los Alamos county and approximately 5 are in nearby counties. Maps are available from <http://www.esh.lanl.gov/~AirQuality/airnet.htm>.

The locations are also marked on the FIMAD plot: ID: G105907 and listed in attachment 1 of the procedure MAQ-202 and Appendix A of the AIRNET Sampling and Analysis Plan. An older (1980) report is entitled "Environmental and emergency response capabilities of LANL's radiological air sampling program", LA-8379-MS, by Tom Gunderson.

Particulate Filters

Each AIRNET station collects particulates on 47-mm-diameter polypropylene filter material. The filters are designed to be dissolved and are not ideal for alpha spectroscopy, but are satisfactory for a gross-alpha count-rate measurement from recently deposited material.

Tritium Cartridges

Each station also has a silica-gel cartridge to collect water vapor, which is analyzed to measure the amount of tritiated water, HTO.

Note: Tritium gas, HT or T₂, is not collected in the silica gel.

HPAL

Filter and/or the distillate from tritium samples can be analyzed by the Health Physics Analysis Lab., HPAL. HPAL personnel may be contacted at 5-8888 or via the emergency digital pager: 505-996-1380.

Air Flow through the filter

The nominal flow rate through the filter is 4 cfm (7 m³/h) and is 6 times the standard breathing rate of 0.7 cfm (1.2 m³/h). Therefore, if C is the number of curies on the filter, the human intake by inhalation is $C/6$.

If the actual flow rate was significantly less, the calculations of H , using the equations below, will be larger. Multiply H by the ratio of the actual flow rate to the nominal flow rate.

Calculating the CEDE

The committed effective dose equivalent, CEDE, corresponding to the intake may be calculated from the Derived Air Concentration, DAC, listed in Appendix A of the Code of Federal regulations, 10 CFR 835, which is attachment 4 of this procedure.

For example, for Y-class U-235 and U238:

$$\text{DAC} = 2\text{E-}11 \text{ microCi/mL} = 2\text{E-}11 \text{ Ci/m}^3$$

Similarly, for W-class Pu-239:

$$\text{DAC} = 2\text{E-}12 \text{ microCi/mL} = 2\text{E-}12 \text{ Ci/m}^3$$

A person who breathes 2400 m^3 of air with a concentration of 1 DAC will receive 5 rem. Therefore, if the activity on the filter is C curies, the CEDE is:

$$H = (5 \text{ rem})(C/6)/(\text{DAC} * 2400) = 4\text{E-}4 * C / \text{DAC} \text{ rem}$$

Similar results can be calculated by multiplying the dose response level, DRL, listed in Table 5-4 of EPA 400-R-92-001, by the AIRNET flow rate of $7 \text{ m}^3/\text{h}$ to give the equation:

$$H = C / (7 * \text{DRL}) \text{ rem}$$

Examples

Using the equation $H = 4\text{E-}4 * C / \text{DAC}$:

$C = 5\text{E-}8 \text{ Ci}$ of U-238 results in $H = 4\text{E-}4 * 5\text{E-}8 / 2\text{E-}11 = 1 \text{ rem}$.

$C = 5\text{E-}9 \text{ Ci}$ of Pu-239 results in $H = 4\text{E-}4 * 5\text{E-}9 / 2\text{E-}12 = 1 \text{ rem}$.

Using the equation $H = C / (7 * \text{DRL})$:

$C = 5\text{E-}8 \text{ Ci}$ of U-238 results in $H = 5\text{E-}8 / (7 * 7\text{E-}9) = 1 \text{ rem}$

$C = 5\text{E-}9 \text{ Ci}$ of Pu-239 results in $H = 5\text{E-}9 / (7 * 1.9\text{E-}9) = 0.4 \text{ rem}$

Note: $5\text{E-}9 \text{ Ci} = 10,000 \text{ dpm}$.

Summary of particulate data

- 10,000 dpm α from Pu-239 on an AIRNET filter corresponds to 1 rem CEDE.
- 2,000 dpm α from radon and thoron decay products is typically observed on AIRNET filters, but it might be a factor of ten higher after a rainstorm.

Tritium

Note: AIRNET collects tritiated water but not tritium gas.

Tritiated water is collected in the silica-gel cartridge with a nominal flow rate of 0.2 liters/minute (L/min.), which is 0.01 times the breathing rate of the standard reference man: 20 L/min. The flow rate is measured just before an old cartridge is removed, and after a new cartridge is installed. Use the flow rate that was measured just before the old cartridge was removed. If the measured flow rate is significantly different from 0.2 L/min., calculate the actual ratio of the measured flow rate to 20 L/min. and substitute the actual ratio for the number 0.01.

An intake of 0.08 Ci of tritiated water results in 5 rem CEDE, so if C is the number of curies in the cartridge, the CEDE is:

$$H = (5 \text{ rem})(C/0.01)/0.08 = 6250 * C \text{ rem}$$

Tritium Example

Using EPA 400-R-92-001, the DRL = $1.3E-2 \text{ Ci-h/m}^3$. Multiplying the DRL by the nominal flow rate for the AIRNET cartridges, $1.2E-2 \text{ m}^3/\text{h}$, gives $1.6E-4 \text{ Ci}$. If $C=1.6E-4 \text{ Ci}$ then:

$$H = 6250 * 1.6E-4 = 1 \text{ rem.}$$

Element and Nuclide identification

For beta-gamma emitters, HPAL can determine the radionuclides by using gamma spectroscopy.

For alpha emitters, HPAL can determine the elements by measuring the characteristic x rays.

For alpha emitters, nuclide identification is not essential because $2E-12 \text{ Ci}$ is a reasonable estimate of the DAC for most transuranics. The specific nuclide is less important than the solubility class (D, W, or Y), which cannot be determined in a short time. When in doubt, assume the worst case, which is the smallest DAC.

APPENDIX A TO 10 CFR 835--DERIVED AIR CONCENTRATIONS (DAC) FOR CONTROLLING RADIATION EXPOSURE TO WORKERS AT DOE FACILITIES

The data presented in appendix A are to be used for controlling individual internal doses in accordance with § 835.209, identifying the need for air monitoring in accordance with § 835.403, and identifying and posting airborne radioactivity areas in accordance with § 835.603(d).

The DAC values are given for individual radionuclides. For known mixtures of radionuclides, determine the sum of the ratio of the observed concentration of a particular radionuclide and its corresponding DAC for all radionuclides in the mixture. If this sum exceeds unity (1), then the DAC has been exceeded. For unknown radionuclides, the most restrictive DAC (lowest value) for those isotopes not known to be absent shall be used.

Radionuclide	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
H-3 (Water) ²	2. E-05	2. E-05	2. E-05	8. E+05	8. E+05	8. E+05	St/St/St
H-3 (Elemental) ²	5. E-01	5. E-01	5. E-01	2. E+10	2. E+10	2. E+10	St/St/St
Be-7	- ³	9. E-06	8. E-06	- ³	3. E+05	3. E+05	/St/St
Be-10	-	6. E-08	6. E-09	-	2. E+03	2. E+02	/St/St
C-11 (Org) ²	2. E-04	2. E-04	2. E-04	6. E+06	6. E+06	6. E+06	St/St/St
C-11 (CO) ²	5. E-04	5. E-04	5. E-04	2. E+07	2. E+07	2. E+07	St/St/St
C-11 (CO ₂) ²	3. E-04	3. E-04	3. E-04	1. E+07	1. E+07	1. E+07	St/St/St
C-14 (Org) ²	1. E-06	1. E-06	1. E-06	4. E+07	4. E+04	4. E+07	St/St/St
C-14 (CO) ²	7. E-04	7. E-04	7. E-04	3. E+07	3. E+07	3. E+07	St/St/St
C-14 (CO ₂) ²	9. E-05	9. E-05	9. E-05	3. E+06	3. E+06	3. E+06	St/St/St
F-18	3. E-05	4. E-05	3. E-05	1. E+06	1. E+06	1. E+06	St/St/St
Na-22	3. E-07	-	-	1. E+04	-	-	St/ /
Na-24	2. E-06	-	-	8. E+04	-	-	St/ /
Mg-28	7. E-07	5. E-07	-	3. E+04	2. E+04	-	St/St/
Al -26	3. E-08	3. E-08	-	1. E+03	1. E+03	-	St/St/
Si -31	1. E-05	1. E-05	1. E-05	4. E+05	5. E+05	4. E+05	St/St/St
Si -32	1. E-07	5. E-08	2. E-09	4. E+03	2. E+03	8. E+01	St/St/St
P-32	4. E-07	2. E-07	-	1. E+04	6. E+03	-	St/St/
P-33	3. E-06	1. E-06	-	1. E+05	4. E+04	-	St/St/
S-35	7. E-06	9. E-07	-	3. E+05	3. E+04	-	St/St/
S-35 (Gas)	-	6. E-06	-	-	2. E+05	-	/St/
Cl -36	1. E-06	1. E-07	-	4. E+04	4. E+03	-	St/St/
Cl -38	2. E-05	2. E-05	-	6. E+05	7. E+05	-	St/St/
Cl -39	2. E-05	2. E-05	-	8. E+05	9. E+05	-	St/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
K-40	2. E-07	-	-	6. E+03	-	-	St/ /
K-42	2. E-06	-	-	7. E+04	-	-	St/ /
K-43	4. E-06	-	-	1. E+05	-	-	St/ /
K-44	3. E-05	-	-	1. E+06	-	-	St/ /
K-45	5. E-05	-	-	2. E+06	-	-	St/ /
Ca-41	-	2. E-06	-	-	6. E+04	-	/E /
Ca-45	-	3. E-07	-	-	1. E+04	-	/St/
Ca-47	-	4. E-07	-	-	1. E+04	-	/St/
Sc-43	-	-	1. E-05	-	-	4. E+05	/ /St
Sc-44m	-	-	3. E-07	-	-	1. E+04	/ /St
Sc-44	-	-	5. E-06	-	-	2. E+05	/ /St
Sc-46	-	-	1. E-07	-	-	4. E+03	/ /St
Sc-47	-	-	1. E-06	-	-	5. E+04	/ /St
Sc-48	-	-	6. E-07	-	-	2. E+04	/ /St
Sc-49	-	-	2. E-05	-	-	8. E+05	/ /St
Ti -44	5. E-09	1. E-08	2. E-09	2. E+02	4. E+02	9. E+01	St/St/St
Ti -45	1. E-05	1. E-05	1. E-05	4. E+05	5. E+05	5. E+05	St/St/St
V-47	4. E-05	4. E-05	-	1. E+06	1. E+06	-	St/St/
V-48	4. E-07	3. E-07	-	2. E+04	1. E+04	-	St/St/
V-49	1. E-05	7. E-06	-	5. E+05	3. E+05	-	BS/St/
Cr-48	5. E-06	3. E-06	3. E-06	2. E+05	1. E+05	1. E+05	St/St/St
Cr-49	3. E-05	4. E-05	4. E-05	1. E+06	2. E+06	1. E+06	St/St/St
Cr-51	2. E-05	1. E-05	8. E-06	7. E+05	4. E+05	3. E+05	St/St/St
Mn-51	2. E-05	2. E-05	-	8. E+05	9. E+05	-	St/St/
Mn-52m	4. E-05	4. E-05	-	1. E+06	2. E+06	-	St/St/
Mn-52	5. E-07	4. E-07	-	2. E+04	1. E+04	-	St/St/
Mn-53	5. E-06	5. E-06	-	2. E+05	2. E+05	-	BS/St/
Mn-54	4. E-07	3. E-07	-	1. E+04	1. E+04	-	St/St/
Mn-56	6. E-06	9. E-06	-	2. E+05	3. E+05	-	St/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci}/\text{ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Fe-52	1. E-06	1. E-06	-	5. E+04	4. E+04	-	St/St/
Fe-55	8. E-07	2. E-06	-	3. E+04	6. E+04	-	St/St/
Fe-59	1. E-07	2. E-07	-	5. E+03	8. E+03	-	St/St/
Fe-60	3. E-09	8. E-09	-	1. E+02	3. E+02	-	St/St/
Co-55	-	1. E-06	1. E-06	-	4. E+04	4. E+04	/St/St
Co-56	-	1. E-07	8. E-08	-	5. E+03	3. E+03	/St/St
Co-57	-	1. E-06	3. E-07	-	4. E+04	1. E+04	/St/St
Co-58m	-	4. E-05	3. E-05	-	1. E+06	1. E+06	/St/St
Co-58	-	5. E-07	3. E-07	-	2. E+04	1. E+04	/St/St
Co-60m	-	2. E-03	1. E-03	-	6. E+07	4. E+07	/St/St
Co-60	-	7. E-08	1. E-08	-	3. E+03	5. E+02	/St/St
Co-61	-	3. E-05	2. E-05	-	1. E+06	9. E+05	/St/St
Co-62m	-	7. E-05	7. E-05	-	3. E+06	2. E+06	/St/St
Ni -56 (Inorg)	8. E-07	5. E-07	-	3. E+04	2. E+04	-	St/St/
Ni -56 (Vapor)	-	5. E-07	-	-	2. E+04	-	/St/
Ni -57 (Inorg)	2. E-06	1. E-06	-	7. E+04	5. E+04	-	St/St/
Ni -57 (Vapor)	-	3. E-06	-	-	1. E+05	-	/St/
Ni -59 (Inorg)	2. E-06	3. E-06	-	6. E+04	1. E+05	-	St/St/
Ni -59 (Vapor)	-	8. E-07	-	-	3. E+04	-	/St/
Ni -63 (Inorg)	7. E-07	1. E-06	-	3. E+04	4. E+04	-	St/St/
Ni -63 (Vapor)	-	3. E-07	-	-	1. E+04	-	/St/
Ni -65 (Inorg)	1. E-05	1. E-05	-	4. E+05	5. E+05	-	St/St/
Ni -65 (Vapor)	-	7. E-06	-	-	3. E+05	-	/St/
Ni -66 (Inorg)	7. E-07	3. E-07	-	3. E+04	1. E+04	-	St/St/
Ni -66 (Vapor)	-	1. E-06	-	-	5. E+04	-	/St/
Cu-60	4. E-05	5. E-05	4. E-05	1. E+06	2. E+06	2. E+06	St/St/St
Cu-61	1. E-05	2. E-05	1. E-05	5. E+05	6. E+05	5. E+05	St/St/St
Cu-64	1. E-05	1. E-05	9. E-06	5. E+05	4. E+05	3. E+05	St/St/St
Cu-67	3. E-06	2. E-06	2. E-06	1. E+05	8. E+04	7. E+04	St/St/St

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi/ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Zn-62	-	-	1. E-06	-	-	4. E+04	/ /St
Zn-63	-	-	3. E-05	-	-	1. E+06	/ /St
Zn-65	-	-	1. E-07	-	-	4. E+03	/ /St
Zn-69m	-	-	3. E-06	-	-	1. E+05	/ /St
Zn-69	-	-	6. E-05	-	-	2. E+06	/ /St
Zn-71m	-	-	7. E-06	-	-	3. E+05	/ /St
Zn-72	-	-	5. E-07	-	-	2. E+04	/ /St
Ga-65	7. E-05	8. E-05	-	3. E+06	3. E+06	-	St/St/
Ga-66	1. E-06	1. E-06	-	5. E+04	5. E+04	-	St/St/
Ga-67	6. E-06	4. E-06	-	2. E+05	2. E+05	-	St/St/
Ga-68	2. E-05	2. E-05	-	6. E+05	8. E+05	-	St/St/
Ga-70	7. E-05	8. E-05	-	3. E+06	3. E+06	-	St/St/
Ga-72	2. E-06	1. E-06	-	6. E+04	5. E+04	-	St/St/
Ga-73	6. E-06	6. E-06	-	2. E+05	2. E+05	-	St/St/
Ge-66	1. E-05	8. E-06	-	4. E+05	3. E+05	-	St/St/
Ge-67	4. E-05	4. E-05	-	1. E+06	2. E+06	-	St/St/
Ge-68	2. E-06	4. E-08	-	6. E+04	2. E+03	-	St/St/
Ge-69	6. E-06	3. E-06	-	2. E+05	1. E+05	-	St/St/
Ge-71	2. E-04	2. E-05	-	7. E+06	6. E+05	-	St/St/
Ge-75	3. E-05	3. E-05	-	1. E+06	1. E+06	-	St/St/
Ge-77	4. E-06	2. E-06	-	2. E+05	9. E+04	-	St/St/
Ge-78	9. E-06	9. E-06	-	4. E+05	3. E+05	-	St/St/
As-69	-	5. E-05	-	-	2. E+06	-	/St/
As-70	-	2. E-05	-	-	8. E+05	-	/St/
As-71	-	2. E-06	-	-	7. E+04	-	/St/
As-72	-	6. E-07	-	-	2. E+04	-	/St/
As-73	-	7. E-07	-	-	3. E+04	-	/St/
As-74	-	3. E-07	-	-	1. E+04	-	/St/
As-76	-	6. E-07	-	-	2. E+04	-	/St/
As-77	-	2. E-06	-	-	8. E+04	-	/St/
As-78	-	9. E-06	-	-	3. E+05	-	/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci}/\text{ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Se-70	1. E-05	2. E-05	-	6. E+05	7. E+05	-	St/St/
Se-73m	6. E-05	6. E-05	-	2. E+06	2. E+06	-	St/St/
Se-73	6. E-06	7. E-06	-	2. E+05	2. E+05	-	St/St/
Se-75	3. E-07	3. E-07	-	1. E+04	9. E+03	-	St/St/
Se-79	3. E-07	2. E-07	-	1. E+04	9. E+03	-	St/St/
Se-81m	3. E-05	3. E-05	-	1. E+06	1. E+06	-	St/St/
Se-81	9. E-05	1. E-04	-	3. E+06	4. E+06	-	St/St/
Se-83	5. E-05	5. E-05	-	2. E+06	2. E+06	-	St/St/
Br-74m	1. E-05	2. E-05	-	6. E+05	6. E+05	-	St/St/
Br-74	3. E-05	3. E-05	-	1. E+06	1. E+06	-	St/St/
Br-75	2. E-05	2. E-05	-	7. E+05	8. E+05	-	St/St/
Br-76	2. E-06	2. E-06	-	7. E+04	7. E+04	-	St/St/
Br-77	1. E-05	8. E-06	-	4. E+05	3. E+05	-	St/St/
Br-80m	7. E-06	6. E-06	-	3. E+05	2. E+05	-	St/St/
Br-80	8. E-05	9. E-05	-	3. E+06	3. E+06	-	St/St/
Br-82	2. E-06	2. E-06	-	6. E+04	6. E+04	-	St/St/
Br-83	3. E-05	3. E-05	-	1. E+06	1. E+06	-	St/St/
Br-84	2. E-05	3. E-05	-	9. E+05	1. E+06	-	St/St/
Rb-79	5. E-05	-	-	2. E+06	-	-	St/ /
Rb-81m	1. E-04	-	-	5. E+06	-	-	St/ /
Rb-81	2. E-05	-	-	8. E+05	-	-	St/ /
Rb-82m	7. E-06	-	-	3. E+05	-	-	St/ /
Rb-83	4. E-07	-	-	2. E+04	-	-	St/ /
Rb-84	3. E-07	-	-	1. E+04	-	-	St/ /
Rb-86	3. E-07	-	-	1. E+04	-	-	St/ /
Rb-87	6. E-07	-	-	2. E+04	-	-	St/ /
Rb-88	3. E-05	-	-	1. E+06	-	-	St/ /
Rb-89	6. E-05	-	-	2. E+06	-	-	St/ /
Sr-80	5. E-06	-	5. E-06	2. E+05	-	2. E+05	St/ /St
Sr-81	3. E-05	-	3. E-05	1. E+06	-	1. E+06	St/ /St
Sr-83	3. E-06	-	2. E-06	1. E+05	-	5. E+04	St/ /St
Sr-85m	3. E-04	-	3. E-04	9. E+06	-	1. E+07	St/ /St

Radio nuclide	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Sr-85	1. E-06	-	7. E-07	4. E+04	-	2. E+04	St/ /St
Sr-87m	5. E-05	-	6. E-05	2. E+06	-	2. E+06	St/ /St
Sr-89	3. E-07	-	6. E-08	1. E+04	-	2. E+03	St/ /St
Sr-90	8. E-09	-	2. E-09	3. E+02	-	6. E+01	BS/ /St
Sr-91	2. E-06	-	1. E-06	9. E+04	-	5. E+04	St/ /St
Sr-92	4. E-06	-	3. E-06	1. E+05	-	1. E+05	St/ /St
Y-86m	-	2. E-05	2. E-05	-	9. E+05	9. E+05	/St/St
Y-86	-	1. E-06	1. E-06	-	5. E+04	5. E+04	/St/St
Y-87	-	1. E-06	1. E-06	-	5. E+04	5. E+04	/St/St
Y-88	-	1. E-07	1. E-07	-	4. E+03	4. E+03	/St/St
Y-90m	-	5. E-06	5. E-06	-	2. E+05	2. E+05	/St/St
Y-90	-	3. E-07	2. E-07	-	1. E+04	9. E+03	/St/St
Y-91m	-	1. E-04	7. E-05	-	4. E+06	3. E+06	/St/St
Y-91	-	7. E-08	5. E-08	-	3. E+03	2. E+03	/St/St
Y-92	-	3. E-06	3. E-06	-	1. E+05	1. E+05	/St/St
Y-93	-	1. E-06	1. E-06	-	4. E+04	4. E+04	/St/St
Y-94	-	3. E-05	3. E-05	-	1. E+06	1. E+06	/St/St
Y-95	-	6. E-05	6. E-05	-	2. E+06	2. E+06	/St/St
Zr-86	2. E-06	1. E-06	1. E-06	6. E+04	4. E+04	4. E+04	St/St/St
Zr-88	9. E-08	2. E-07	1. E-07	3. E+03	7. E+03	5. E+03	St/St/St
Zr-89	2. E-06	1. E-06	1. E-06	5. E+04	4. E+04	4. E+04	St/St/St
Zr-93	3. E-09	1. E-08	2. E-08	1. E+02	4. E+02	9. E+02	BS/BS/BS
Zr-95	6. E-08	2. E-07	1. E-07	2. E+03	6. E+03	4. E+03	BS/St/St
Zr-97	8. E-07	6. E-07	5. E-07	3. E+04	2. E+04	2. E+04	St/St/St
Nb-88	-	1. E-04	9. E-05	-	4. E+06	3. E+06	/St/St
Nb-89 (66 min)	-	2. E-05	2. E-05	-	6. E+05	6. E+05	/St/St
Nb-89 (122 min)	-	8. E-06	7. E-06	-	3. E+05	2. E+05	/St/St
Nb-90	-	1. E-06	1. E-06	-	4. E+04	4. E+04	/St/St
Nb-93m	-	5. E-07	7. E-08	-	2. E+04	3. E+03	/St/St
Nb-94	-	8. E-08	6. E-09	-	3. E+03	2. E+02	/St/St
Nb-95m	-	1. E-06	9. E-07	-	4. E+04	4. E+04	/St/St
Nb-95	-	5. E-07	5. E-07	-	2. E+04	2. E+04	/St/St

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci}/\text{ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Nb-96	-	1. E-06	1. E-06	-	4. E+04	4. E+04	/St/St
Nb-97	-	3. E-05	3. E-05	-	1. E+06	1. E+06	/St/St
Nb-98	-	2. E-05	2. E-05	-	8. E+05	8. E+05	/St/St
Mo-90	3. E-06	-	2. E-06	1. E+05	-	7. E+04	St/ /St
Mo-93m	7. E-06	-	6. E-06	3. E+05	-	2. E+05	St/ /St
Mo-93	2. E-06	-	7. E-08	8. E+04	-	3. E+03	St/ /St
Mo-99	1. E-06	-	6. E-07	4. E+04	-	2. E+04	St/ /St
Mo-101	6. E-05	-	6. E-05	2. E+06	-	2. E+06	St/ /St
Tc-93m	7. E-05	1. E-04	-	2. E+06	5. E+06	-	St/St/
Tc-93	3. E-05	4. E-05	-	1. E+06	2. E+06	-	St/St/
Tc-94m	2. E-05	2. E-05	-	7. E+05	9. E+05	-	St/St/
Tc-94	8. E-06	1. E-05	-	3. E+05	4. E+05	-	St/St/
Tc-96m	1. E-04	1. E-04	-	4. E+06	4. E+06	-	St/St/
Tc-96	1. E-06	9. E-07	-	5. E+04	3. E+04	-	St/St/
Tc-97m	3. E-06	5. E-07	-	1. E+05	2. E+04	-	SW/St/
Tc-97	2. E-05	2. E-06	-	8. E+05	9. E+04	-	St/St/
Tc-98	7. E-07	1. E-07	-	3. E+04	5. E+03	-	St/St/
Tc-99m	6. E-05	1. E-04	-	2. E+06	4. E+06	-	St/St/
Tc-99	2. E-06	3. E-07	-	8. E+04	1. E+04	-	SW/St/
Tc-101	1. E-04	2. E-04	-	5. E+06	6. E+06	-	St/St/
Tc-104	3. E-05	4. E-05	-	1. E+06	1. E+06	-	St/St/
Ru-94	2. E-05	3. E-05	2. E-05	7. E+05	1. E+06	9. E+05	St/St/St
Ru-97	8. E-06	5. E-06	5. E-06	3. E+05	2. E+05	2. E+05	St/St/St
Ru-103	7. E-07	4. E-07	3. E-07	3. E+04	2. E+04	1. E+04	St/St/St
Ru-105	6. E-06	6. E-06	5. E-06	2. E+05	2. E+05	2. E+05	St/St/St
Ru-106	4. E-08	2. E-08	5. E-09	1. E+03	8. E+02	2. E+02	St/St/St
Rh-99m	2. E-05	3. E-05	3. E-05	9. E+05	1. E+06	1. E+06	St/St/St
Rh-99	1. E-06	9. E-07	8. E-07	5. E+04	3. E+04	3. E+04	St/St/St
Rh-100	2. E-06	2. E-06	2. E-06	8. E+04	6. E+04	6. E+04	St/St/St
Rh-101m	5. E-06	3. E-06	3. E-06	2. E+05	1. E+05	1. E+05	St/St/St
Rh-101	2. E-07	3. E-07	7. E-08	8. E+03	1. E+04	2. E+03	St/St/St

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci}/\text{ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Rh-102m	2. E-07	2. E-07	5. E-08	8. E+03	6. E+03	2. E+03	St/St/St
Rh-102	4. E-08	7. E-08	2. E-08	1. E+03	3. E+03	9. E+02	St/St/St
Rh-103m	4. E-04	5. E-04	5. E-04	2. E+07	2. E+07	2. E+07	St/St/St
Rh-105	5. E-06	3. E-06	2. E-06	2. E+05	1. E+05	9. E+04	St/St/St
Rh-106m	1. E-05	1. E-05	1. E-05	4. E+05	6. E+05	5. E+05	St/St/St
Rh-107	1. E-04	1. E-04	1. E-04	4. E+06	4. E+06	4. E+06	St/St/St
Pd-100	6. E-07	5. E-07	6. E-07	2. E+04	2. E+04	2. E+04	St/St/St
Pd-101	1. E-05	1. E-05	1. E-05	5. E+05	5. E+05	5. E+05	St/St/St
Pd-103	3. E-06	2. E-06	1. E-06	1. E+05	7. E+04	5. E+04	St/St/St
Pd-107	9. E-06	3. E-06	2. E-07	3. E+05	1. E+05	6. E+03	K /St/St
Pd-109	3. E-06	2. E-06	2. E-06	1. E+05	8. E+04	7. E+04	St/St/St
Ag-102	8. E-05	9. E-05	8. E-05	3. E+06	3. E+06	3. E+06	St/St/St
Ag-103	4. E-05	6. E-05	5. E-05	2. E+06	2. E+06	2. E+06	St/St/St
Ag-104m	4. E-05	5. E-05	5. E-05	2. E+06	2. E+06	2. E+06	St/St/St
Ag-104	3. E-05	6. E-05	6. E-05	1. E+06	2. E+06	2. E+06	St/St/St
Ag-105	4. E-07	7. E-07	7. E-07	2. E+04	3. E+04	3. E+04	St/St/St
Ag-106m	3. E-07	4. E-07	4. E-07	1. E+04	1. E+04	1. E+04	St/St/St
Ag-106	7. E-05	8. E-05	8. E-05	3. E+06	3. E+06	3. E+06	St/St/St
Ag-108m	8. E-08	1. E-07	1. E-08	3. E+03	4. E+03	4. E+02	St/St/St
Ag-110m	6. E-08	8. E-08	4. E-08	2. E+03	3. E+03	1. E+03	St/St/St
Ag-111	7. E-07	4. E-07	4. E-07	2. E+04	1. E+04	1. E+04	L /St/St
Ag-112	3. E-06	4. E-06	4. E-06	1. E+05	2. E+05	1. E+05	St/St/St
Ag-115	4. E-05	4. E-05	3. E-05	1. E+06	1. E+06	1. E+06	St/St/St
Cd-104	3. E-05	5. E-05	5. E-05	1. E+06	2. E+06	2. E+06	St/St/St
Cd-107	2. E-05	2. E-05	2. E-05	8. E+05	9. E+05	8. E+05	St/St/St
Cd-109	1. E-08	5. E-08	5. E-08	5. E+02	2. E+03	2. E+03	K /K /St
Cd-113m	1. E-09	4. E-09	5. E-09	4. E+01	1. E+02	2. E+02	K /K /St
Cd-113	9. E-10	3. E-09	6. E-09	4. E+01	1. E+02	2. E+02	K /K /St
Cd-115m	2. E-08	5. E-08	6. E-08	8. E+02	2. E+03	2. E+03	K /St/St
Cd-115	6. E-07	5. E-07	6. E-07	2. E+04	2. E+04	2. E+04	St/St/St
Cd-117m	5. E-06	7. E-06	6. E-06	2. E+05	3. E+05	2. E+05	St/St/St
Cd-117	5. E-06	7. E-06	6. E-06	2. E+05	3. E+05	2. E+05	St/St/St

Radi onucl i de	Inhaled Ai r-Lung Retenti on Cl ass			Inhaled Ai r-Lung Retenti on Cl ass			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
In-109	2. E-05	3. E-05	-	7. E+05	1. E+06	-	St/St/
In-110 (69 mi n)	2. E-05	2. E-05	-	7. E+05	9. E+05	-	St/St/
In-110 (5 h)	7. E-06	8. E-06	-	3. E+05	3. E+05	-	St/St/
In-111	3. E-06	3. E-06	-	1. E+05	1. E+05	-	St/St/
In-112	3. E-04	3. E-04	-	1. E+07	1. E+07	-	St/St/
In-113m	6. E-05	8. E-05	-	2. E+06	3. E+06	-	St/St/
In-114m	3. E-08	4. E-08	-	1. E+03	2. E+03	-	St/St/
In-115m	2. E-05	2. E-05	-	7. E+05	7. E+05	-	St/St/
In-115	6. E-10	2. E-09	-	2. E+01	8. E+01	-	St/St/
In-116m	3. E-05	5. E-05	-	1. E+06	2. E+06	-	St/St/
In-117m	1. E-05	2. E-05	-	5. E+05	7. E+05	-	St/St/
In-117	7. E-05	9. E-05	-	3. E+06	3. E+06	-	St/St/
In-119m	5. E-05	6. E-05	-	2. E+06	2. E+06	-	St/St/
Sn-110	5. E-06	5. E-06	-	2. E+05	2. E+05	-	St/St/
Sn-111	9. E-05	1. E-04	-	4. E+06	4. E+06	-	St/St/
Sn-113	5. E-07	2. E-07	-	2. E+04	9. E+03	-	St/St/
Sn-117m	5. E-07	6. E-07	-	2. E+04	2. E+04	-	BS/St/
Sn-119m	1. E-06	4. E-07	-	4. E+04	1. E+04	-	St/St/
Sn-121m	4. E-07	2. E-07	-	1. E+04	9. E+03	-	St/St/
Sn-121	6. E-06	5. E-06	-	2. E+05	2. E+05	-	St/St/
Sn-123m	5. E-05	6. E-05	-	2. E+06	2. E+06	-	St/St/
Sn-123	3. E-07	7. E-08	-	1. E+04	3. E+03	-	St/St/
Sn-125	4. E-07	2. E-07	-	1. E+04	5. E+03	-	St/St/
Sn-126	2. E-08	3. E-08	-	9. E+02	1. E+03	-	St/St/
Sn-127	8. E-06	8. E-06	-	3. E+05	3. E+05	-	St/St/
Sn-128	1. E-05	1. E-05	-	4. E+05	6. E+05	-	St/St/
Sb-115	1. E-04	1. E-04	-	4. E+06	5. E+06	-	St/St/
Sb-116m	3. E-05	6. E-05	-	1. E+06	2. E+06	-	St/St/
Sb-116	1. E-04	1. E-04	-	4. E+06	5. E+06	-	St/St/
Sb-117	9. E-05	1. E-04	-	3. E+06	4. E+06	-	St/St/
Sb-118m	8. E-06	9. E-06	-	3. E+05	3. E+05	-	St/St/
Sb-119	2. E-05	1. E-05	-	7. E+05	4. E+05	-	St/St/

Radio nuclide	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Sb-120 (16 min)	2. E-04	2. E-04	-	7. E+06	8. E+06	-	St/St/
Sb-120 (6 d)	9. E-07	6. E-07	-	3. E+04	2. E+04	-	St/St/
Sb-122	1. E-06	4. E-07	-	4. E+04	2. E+04	-	St/St/
Sb-124m	3. E-04	3. E-04	-	1. E+07	9. E+06	-	St/St/
Sb-124	4. E-07	1. E-07	-	1. E+04	4. E+03	-	St/St/
Sb-125	1. E-06	2. E-07	-	4. E+04	8. E+03	-	St/St/
Sb-126m	8. E-05	8. E-05	-	3. E+06	3. E+06	-	St/St/
Sb-126	4. E-07	2. E-07	-	2. E+04	8. E+03	-	St/St/
Sb-127	9. E-07	4. E-07	-	3. E+04	1. E+04	-	St/St/
Sb-128 (9 h)	2. E-06	1. E-06	-	6. E+04	5. E+04	-	St/St/
Sb-128 (10 min)	2. E-04	2. E-04	-	6. E+06	7. E+06	-	St/St/
Sb-129	4. E-06	4. E-06	-	1. E+05	1. E+05	-	St/St/
Sb-130	3. E-05	3. E-05	-	1. E+06	1. E+06	-	St/St/
Sb-131	1. E-05	1. E-05	-	4. E+05	4. E+05	-	T /T /
Te-116	9. E-06	1. E-05	-	3. E+05	5. E+05	-	St/St/
Te-121m	8. E-08	2. E-07	-	3. E+03	6. E+03	-	BS/St/
Te-121	2. E-06	1. E-06	-	7. E+04	5. E+04	-	St/St/
Te-123m	9. E-08	2. E-07	-	3. E+03	8. E+03	-	BS/St/
Te-123	8. E-08	2. E-07	-	3. E+03	7. E+03	-	BS/BS/
Te-125m	2. E-07	3. E-07	-	7. E+03	1. E+04	-	BS/St/
Te-127m	1. E-07	1. E-07	-	4. E+03	4. E+03	-	BS/St/
Te-127	9. E-06	7. E-06	-	4. E+05	3. E+05	-	St/St/
Te-129m	3. E-07	1. E-07	-	1. E+04	4. E+03	-	St/St/
Te-129	3. E-05	3. E-05	-	1. E+06	1. E+06	-	St/St/
Te-131m	2. E-07	2. E-07	-	6. E+03	6. E+03	-	T /T /
Te-131	2. E-06	2. E-06	-	8. E+04	8. E+04	-	T /T /
Te-132	9. E-08	9. E-08	-	4. E+03	3. E+03	-	T /T /
Te-133m	2. E-06	2. E-06	-	8. E+04	8. E+04	-	T /T /
Te-133	9. E-06	9. E-06	-	4. E+05	4. E+05	-	T /T /
Te-134	1. E-05	1. E-05	-	4. E+05	4. E+05	-	T /T /
I -120m	9. E-06	-	-	3. E+05	-	-	St/ /
I -120	4. E-06	-	-	1. E+05	-	-	T / /
I -121	7. E-06	-	-	3. E+05	-	-	T / /

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi/ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
I-123	3. E-06	-	-	1. E+05	-	-	T / /
I-124	3. E-08	-	-	1. E+03	-	-	T / /
I-125	3. E-08	-	-	1. E+03	-	-	T / /
I-126	1. E-08	-	-	5. E+02	-	-	T / /
I-128	5. E-05	-	-	2. E+06	-	-	St / /
I-129	4. E-09	-	-	1. E+02	-	-	T / /
I-130	3. E-07	-	-	1. E+04	-	-	T / /
I-131	2. E-08	-	-	7. E+02	-	-	T / /
I-132m	4. E-06	-	-	1. E+05	-	-	T / /
I-132	3. E-06	-	-	1. E+05	-	-	T / /
I-133	1. E-07	-	-	4. E+03	-	-	T / /
I-134	2. E-05	-	-	7. E+05	-	-	E / /
I-135	7. E-07	-	-	2. E+04	-	-	T / /
Cs-125	6. E-05	-	-	2. E+06	-	-	St / /
Cs-127	4. E-05	-	-	2. E+06	-	-	St / /
Cs-129	1. E-05	-	-	5. E+05	-	-	St / /
Cs-130	8. E-05	-	-	3. E+06	-	-	St / /
Cs-131	1. E-05	-	-	5. E+05	-	-	St / /
Cs-132	2. E-06	-	-	6. E+04	-	-	St / /
Cs-134m	6. E-05	-	-	2. E+06	-	-	St / /
Cs-134	4. E-08	-	-	2. E+03	-	-	St / /
Cs-135m	8. E-05	-	-	3. E+06	-	-	St / /
Cs-135	5. E-07	-	-	2. E+04	-	-	St / /
Cs-136	3. E-07	-	-	1. E+04	-	-	St / /
Cs-137	7. E-08	-	-	2. E+03	-	-	St / /
Cs-138	2. E-05	-	-	9. E+05	-	-	St / /
Ba-126	6. E-06	-	-	2. E+05	-	-	St / /
Ba-128	7. E-07	-	-	3. E+04	-	-	St / /
Ba-131m	6. E-04	-	-	2. E+07	-	-	St / /
Ba-131	3. E-06	-	-	1. E+05	-	-	St / /
Ba-133m	4. E-06	-	-	1. E+05	-	-	St / /
Ba-133	3. E-07	-	-	1. E+04	-	-	St / /
Ba-135m	5. E-06	-	-	2. E+05	-	-	St / /

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Ba-139	1. E-05	-	-	5. E+05	-	-	St/ /
Ba-140	6. E-07	-	-	2. E+04	-	-	St/ /
Ba-141	3. E-05	-	-	1. E+06	-	-	St/ /
Ba-142	6. E-05	-	-	2. E+06	-	-	St/ /
La-131	5. E-05	7. E-05	-	2. E+06	3. E+06	-	St/St/
La-132	4. E-06	5. E-06	-	2. E+05	2. E+05	-	St/St/
La-135	4. E-05	4. E-05	-	2. E+06	2. E+06	-	St/St/
La-137	3. E-08	1. E-07	-	1. E+03	4. E+03	-	L /E /
La-138	2. E-09	6. E-09	-	5. E+01	2. E+02	-	St/St/
La-140	6. E-07	5. E-07	-	2. E+04	2. E+04	-	St/St/
La-141	4. E-06	5. E-06	-	1. E+05	2. E+05	-	St/St/
La-142	9. E-06	1. E-05	-	4. E+05	5. E+05	-	St/St/
La-143	4. E-05	4. E-05	-	2. E+06	1. E+06	-	St/St/
Ce-134	-	3. E-07	3. E-07	-	1. E+04	1. E+04	/St/St
Ce-135	-	2. E-06	2. E-06	-	6. E+04	5. E+04	/St/St
Ce-137m	-	2. E-06	2. E-06	-	7. E+04	6. E+04	/St/St
Ce-137	-	6. E-05	5. E-05	-	2. E+06	2. E+06	/St/St
Ce-139	-	3. E-07	3. E-07	-	1. E+04	1. E+04	/St/St
Ce-141	-	3. E-07	2. E-07	-	1. E+04	9. E+03	/St/St
Ce-143	-	8. E-07	7. E-07	-	3. E+04	2. E+04	/St/St
Ce-144	-	1. E-08	6. E-09	-	4. E+02	2. E+02	/St/St
Pr-136	-	1. E-04	9. E-05	-	4. E+06	4. E+06	/St/St
Pr-137	-	6. E-05	6. E-05	-	2. E+06	2. E+06	/St/St
Pr-138m	-	2. E-05	2. E-05	-	8. E+05	7. E+05	/St/St
Pr-139	-	5. E-05	5. E-05	-	2. E+06	2. E+06	/St/St
Pr-142m	-	7. E-05	6. E-05	-	3. E+06	2. E+06	/St/St
Pr-142	-	8. E-07	8. E-07	-	3. E+04	3. E+04	/St/St
Pr-143	-	3. E-07	3. E-07	-	1. E+04	1. E+04	/St/St
Pr-144	-	5. E-05	5. E-05	-	2. E+06	2. E+06	/St/St
Pr-145	-	4. E-06	3. E-06	-	1. E+05	1. E+05	/St/St
Pr-147	-	8. E-05	8. E-05	-	3. E+06	3. E+06	/St/St

Radio nuclide	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci/ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Nd-136	-	2. E-05	2. E-05	-	9. E+05	8. E+05	/St/St
Nd-138	-	3. E-06	2. E-06	-	1. E+05	8. E+04	/St/St
Nd-139m	-	7. E-06	6. E-06	-	3. E+05	2. E+05	/St/St
Nd-139	-	1. E-04	1. E-04	-	5. E+06	4. E+06	/St/St
Nd-141	-	3. E-04	3. E-04	-	1. E+07	9. E+06	/St/St
Nd-147	-	4. E-07	3. E-07	-	2. E+04	1. E+04	/St/St
Nd-149	-	1. E-05	1. E-05	-	4. E+05	4. E+05	/St/St
Nd-151	-	8. E-05	8. E-05	-	3. E+06	3. E+06	/St/St
Pm-141	-	8. E-05	7. E-05	-	3. E+06	3. E+06	/St/St
Pm-143	-	3. E-07	3. E-07	-	9. E+03	1. E+04	/St/St
Pm-144	-	5. E-08	5. E-08	-	2. E+03	2. E+03	/St/St
Pm-145	-	7. E-08	8. E-08	-	3. E+03	3. E+03	/BS/St
Pm-146	-	2. E-08	2. E-08	-	8. E+02	7. E+02	/St/St
Pm-147	-	6. E-08	6. E-08	-	2. E+03	2. E+03	/BS/St
Pm-148m	-	1. E-07	1. E-07	-	5. E+03	5. E+03	/St/St
Pm-148	-	2. E-07	2. E-07	-	8. E+03	8. E+03	/St/St
Pm-149	-	8. E-07	8. E-07	-	3. E+04	3. E+04	/St/St
Pm-150	-	8. E-06	7. E-06	-	3. E+05	3. E+05	/St/St
Pm-151	-	2. E-06	1. E-06	-	6. E+04	5. E+04	/St/St
Sm-141m	-	4. E-05	-	-	2. E+06	-	/St/
Sm-141	-	7. E-05	-	-	3. E+06	-	/St/
Sm-142	-	1. E-05	-	-	4. E+05	-	/St/
Sm-145	-	2. E-07	-	-	8. E+03	-	/St/
Sm-146	-	1. E-11	-	-	6. E-01	-	/BS/
Sm-147	-	2. E-11	-	-	6. E-01	-	/BS/
Sm-151	-	4. E-08	-	-	2. E+03	-	/BS/
Sm-153	-	1. E-06	-	-	4. E+04	-	/St/
Sm-155	-	9. E-05	-	-	3. E+06	-	/St/
Sm-156	-	4. E-06	-	-	1. E+05	-	/St/
Eu-145	-	8. E-07	-	-	3. E+04	-	/St/
Eu-146	-	5. E-07	-	-	2. E+04	-	/St/
Eu-147	-	7. E-07	-	-	3. E+04	-	/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi/ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Eu-148	-	2. E-07	-	-	6. E+03	-	/St/
Eu-149	-	1. E-06	-	-	5. E+04	-	/St/
Eu-150 (12 h)	-	3. E-06	-	-	1. E+05	-	/St/
Eu-150 (34 yr)	-	8. E-09	-	-	3. E+02	-	/St/
Eu-152m	-	3. E-06	-	-	1. E+05	-	/St/
Eu-152	-	1. E-08	-	-	4. E+02	-	/St/
Eu-154	-	8. E-09	-	-	3. E+02	-	/St/
Eu-155	-	4. E-08	-	-	1. E+03	-	/BS/
Eu-156	-	2. E-07	-	-	7. E+03	-	/St/
Eu-157	-	2. E-06	-	-	7. E+04	-	/St/
Eu-158	-	2. E-05	-	-	9. E+05	-	/St/
Gd-145	7. E-05	7. E-05	-	2. E+06	3. E+06	-	St/St/
Gd-146	5. E-08	1. E-07	-	2. E+03	4. E+03	-	St/St/
Gd-147	2. E-06	2. E-06	-	6. E+04	5. E+04	-	St/St/
Gd-148	3. E-12	1. E-11	-	1. E-01	5. E-01	-	BS/BS/
Gd-149	9. E-07	1. E-06	-	3. E+04	4. E+04	-	St/St/
Gd-151	2. E-07	5. E-07	-	6. E+03	2. E+04	-	BS/St/
Gd-152	4. E-12	2. E-11	-	2. E-01	6. E-01	-	BS/BS/
Gd-153	6. E-08	3. E-07	-	2. E+03	9. E+03	-	BS/St/
Gd-159	3. E-06	2. E-06	-	1. E+05	9. E+04	-	St/St/
Tb-147	-	1. E-05	-	-	5. E+05	-	/St/
Tb-149	-	3. E-07	-	-	1. E+04	-	/St/
Tb-150	-	9. E-06	-	-	3. E+05	-	/St/
Tb-151	-	4. E-06	-	-	1. E+05	-	/St/
Tb-153	-	3. E-06	-	-	1. E+05	-	/St/
Tb-154	-	2. E-06	-	-	7. E+04	-	/St/
Tb-155	-	3. E-06	-	-	1. E+05	-	/St/
Tb-156m (24 h)	-	3. E-06	-	-	1. E+05	-	/St/
Tb-156m (5 h)	-	1. E-05	-	-	4. E+05	-	/St/
Tb-156	-	6. E-07	-	-	2. E+04	-	/St/
Tb-157	-	1. E-07	-	-	5. E+03	-	/BS/
Tb-158	-	8. E-09	-	-	3. E+02	-	/St/
Tb-160	-	1. E-07	-	-	4. E+03	-	/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Tb-161	-	7. E-07	-	-	2. E+04	-	/St/
Dy-155	-	1. E-05	-	-	4. E+05	-	/St/
Dy-157	-	3. E-05	-	-	1. E+06	-	/St/
Dy-159	-	1. E-06	-	-	4. E+04	-	/St/
Dy-165	-	2. E-05	-	-	7. E+05	-	/St/
Dy-166	-	3. E-07	-	-	1. E+04	-	/St/
Ho-155	-	7. E-05	-	-	2. E+06	-	/St/
Ho-157	-	6. E-04	-	-	2. E+07	-	/St/
Ho-159	-	4. E-04	-	-	2. E+07	-	/St/
Ho-161	-	2. E-04	-	-	7. E+06	-	/St/
Ho-162m	-	1. E-04	-	-	4. E+06	-	/St/
Ho-162	-	1. E-03	-	-	4. E+07	-	/St/
Ho-164m	-	1. E-04	-	-	5. E+06	-	/St/
Ho-164	-	3. E-04	-	-	1. E+07	-	/St/
Ho-166m	-	3. E-09	-	-	1. E+02	-	/St/
Ho-166	-	7. E-07	-	-	3. E+04	-	/St/
Ho-167	-	2. E-05	-	-	9. E+05	-	/St/
Er-161	-	3. E-05	-	-	1. E+06	-	/St/
Er-165	-	8. E-05	-	-	3. E+06	-	/St/
Er-169	-	1. E-06	-	-	4. E+04	-	/St/
Er-171	-	4. E-06	-	-	2. E+05	-	/St/
Er-172	-	6. E-07	-	-	2. E+04	-	/St/
Tm-162	-	1. E-04	-	-	4. E+06	-	/St/
Tm-166	-	6. E-06	-	-	2. E+05	-	/St/
Tm-167	-	8. E-07	-	-	3. E+04	-	/St/
Tm-170	-	9. E-08	-	-	3. E+03	-	/St/
Tm-171	-	1. E-07	-	-	5. E+03	-	/BS/
Tm-172	-	5. E-07	-	-	2. E+04	-	/St/
Tm-173	-	5. E-06	-	-	2. E+05	-	/St/
Tm-175	-	1. E-04	-	-	4. E+06	-	/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Yb-162	-	1. E-04	1. E-04	-	5. E+06	4. E+06	/St/St
Yb-166	-	8. E-07	8. E-07	-	3. E+04	3. E+04	/St/St
Yb-167	-	3. E-04	3. E-04	-	1. E+07	1. E+07	/St/St
Yb-169	-	3. E-07	3. E-07	-	1. E+04	1. E+04	/St/St
Yb-175	-	1. E-06	1. E-06	-	5. E+04	5. E+04	/St/St
Yb-177	-	2. E-05	2. E-05	-	8. E+05	7. E+05	/St/St
Yb-178	-	2. E-05	1. E-05	-	6. E+05	6. E+05	/St/St
Lu-169	-	2. E-06	2. E-06	-	7. E+04	7. E+04	/St/St
Lu-170	-	9. E-07	8. E-07	-	3. E+04	3. E+04	/St/St
Lu-171	-	8. E-07	8. E-07	-	3. E+04	3. E+04	/St/St
Lu-172	-	5. E-07	5. E-07	-	2. E+04	2. E+04	/St/St
Lu-173	-	1. E-07	1. E-07	-	4. E+03	4. E+03	/BS/St
Lu-174m	-	1. E-07	9. E-08	-	4. E+03	3. E+03	/BS/St
Lu-174	-	5. E-08	7. E-08	-	2. E+03	2. E+03	/BS/St
Lu-176m	-	1. E-05	1. E-05	-	4. E+05	4. E+05	/St/St
Lu-176	-	2. E-09	3. E-09	-	7. E+01	1. E+02	/BS/St
Lu-177m	-	5. E-08	3. E-08	-	2. E+03	1. E+03	/BS/St
Lu-177	-	9. E-07	9. E-07	-	3. E+04	3. E+04	/St/St
Lu-178m	-	8. E-05	7. E-05	-	3. E+06	3. E+06	/St/St
Lu-178	-	5. E-05	5. E-05	-	2. E+06	2. E+06	/St/St
Lu-179	-	8. E-06	6. E-06	-	3. E+05	2. E+05	/St/St
Hf-170	2. E-06	2. E-06	-	9. E+04	7. E+04	-	St/St/
Hf-172	4. E-09	2. E-08	-	1. E+02	6. E+02	-	BS/BS/
Hf-173	5. E-06	5. E-06	-	2. E+05	2. E+05	-	St/St/
Hf-175	4. E-07	5. E-07	-	2. E+04	2. E+04	-	BS/St/
Hf-177m	2. E-05	4. E-05	-	9. E+05	1. E+06	-	St/St/
Hf-178m	6. E-10	2. E-09	-	2. E+01	8. E+01	-	BS/BS/
Hf-179m	1. E-07	3. E-07	-	5. E+03	9. E+03	-	BS/St/
Hf-180m	9. E-06	1. E-05	-	3. E+05	4. E+05	-	St/St/
Hf-181	7. E-08	2. E-07	-	3. E+03	7. E+03	-	BS/St/
Hf-182m	4. E-05	6. E-05	-	1. E+06	2. E+06	-	St/St/
Hf-182	3. E-10	1. E-09	-	1. E+01	5. E+01	-	BS/BS/
Hf-183	2. E-05	2. E-05	-	7. E+05	8. E+05	-	St/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci/ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Hf-184	3. E-06	3. E-06	-	1. E+05	1. E+05	-	St/St/
Ta-172	-	5. E-05	4. E-05	-	2. E+06	2. E+06	/St/St
Ta-173	-	8. E-06	7. E-06	-	3. E+05	3. E+05	/St/St
Ta-174	-	4. E-05	4. E-05	-	1. E+06	1. E+06	/St/St
Ta-175	-	7. E-06	6. E-06	-	3. E+05	2. E+05	/St/St
Ta-176	-	5. E-06	5. E-06	-	2. E+05	2. E+05	/St/St
Ta-177	-	8. E-06	7. E-06	-	3. E+05	3. E+05	/St/St
Ta-178	-	4. E-05	3. E-05	-	1. E+06	1. E+06	/St/St
Ta-179	-	2. E-06	4. E-07	-	8. E+04	1. E+04	/St/St
Ta-180m	-	3. E-05	2. E-05	-	1. E+06	9. E+05	/St/St
Ta-180	-	2. E-07	1. E-08	-	7. E+03	4. E+02	/St/St
Ta-182m	-	2. E-04	2. E-04	-	8. E+06	6. E+06	/St/St
Ta-182	-	1. E-07	6. E-08	-	5. E+03	2. E+03	/St/St
Ta-183	-	5. E-07	4. E-07	-	2. E+04	2. E+04	/St/St
Ta-184	-	2. E-06	2. E-06	-	8. E+04	7. E+04	/St/St
Ta-185	-	3. E-05	3. E-05	-	1. E+06	1. E+06	/St/St
Ta-186	-	1. E-04	9. E-05	-	4. E+06	3. E+06	/St/St
W-176	2. E-05	-	-	8. E+05	-	-	St/ /
W-177	4. E-05	-	-	1. E+06	-	-	St/ /
W-178	8. E-06	-	-	3. E+05	-	-	St/ /
W-179	7. E-04	-	-	3. E+07	-	-	St/ /
W-181	1. E-05	-	-	5. E+05	-	-	St/ /
W-185	3. E-06	-	-	1. E+05	-	-	St/ /
W-187	4. E-06	-	-	2. E+05	-	-	St/ /
W-188	5. E-07	-	-	2. E+04	-	-	St/ /
Re-177	1. E-04	2. E-04	-	4. E+06	5. E+06	-	St/St/
Re-178	1. E-04	1. E-04	-	4. E+06	4. E+06	-	St/St/
Re-181	4. E-06	4. E-06	-	1. E+05	1. E+05	-	St/St/
Re-182 (64 h)	1. E-06	9. E-07	-	4. E+04	3. E+04	-	St/St/
Re-182 (12 h)	5. E-06	6. E-06	-	2. E+05	2. E+05	-	St/St/
Re-184m	1. E-06	2. E-07	-	5. E+04	7. E+03	-	St/St/
Re-184	2. E-06	6. E-07	-	6. E+04	2. E+04	-	St/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Re-186m	7. E-07	6. E-08	-	3. E+04	2. E+03	-	SW/St/
Re-186	1. E-06	7. E-07	-	5. E+04	3. E+04	-	St/St/
Re-187	3. E-04	4. E-05	-	1. E+07	2. E+06	-	SW/St/
Re-188m	6. E-05	6. E-05	-	2. E+06	2. E+06	-	St/St/
Re-188	1. E-06	1. E-06	-	4. E+04	4. E+04	-	St/St/
Re-189	2. E-06	2. E-06	-	8. E+04	7. E+04	-	St/St/
Os-180	2. E-04	2. E-04	2. E-04	6. E+06	8. E+06	7. E+06	St/St/St
Os-181	2. E-05	2. E-05	2. E-05	7. E+05	7. E+05	7. E+05	St/St/St
Os-182	2. E-06	2. E-06	2. E-06	9. E+04	7. E+04	6. E+04	St/St/St
Os-185	2. E-07	3. E-07	3. E-07	8. E+03	1. E+04	1. E+04	St/St/St
Os-189m	1. E-04	9. E-05	7. E-05	4. E+06	3. E+06	3. E+06	St/St/St
Os-191m	1. E-05	9. E-06	7. E-06	4. E+05	3. E+05	3. E+05	St/St/St
Os-191	9. E-07	7. E-07	6. E-07	3. E+04	3. E+04	2. E+04	St/St/St
Os-193	2. E-06	1. E-06	1. E-06	7. E+04	5. E+04	4. E+04	St/St/St
Os-194	2. E-08	2. E-08	3. E-09	7. E+02	9. E+02	1. E+02	St/St/St
Ir-182	6. E-05	6. E-05	5. E-05	2. E+06	2. E+06	2. E+06	St/St/St
Ir-184	1. E-05	1. E-05	1. E-05	4. E+05	5. E+05	4. E+05	St/St/St
Ir-185	5. E-06	5. E-06	4. E-06	2. E+05	2. E+05	2. E+05	St/St/St
Ir-186	3. E-06	3. E-06	2. E-06	1. E+05	1. E+05	9. E+04	St/St/St
Ir-187	1. E-05	1. E-05	1. E-05	5. E+05	5. E+05	4. E+05	St/St/St
Ir-188	2. E-06	2. E-06	1. E-06	7. E+04	6. E+04	5. E+04	St/St/St
Ir-189	2. E-06	2. E-06	2. E-06	7. E+04	6. E+04	6. E+04	St/St/St
Ir-190m	8. E-05	9. E-05	8. E-05	3. E+06	3. E+06	3. E+06	St/St/St
Ir-190	4. E-07	4. E-07	4. E-07	1. E+04	2. E+04	1. E+04	St/St/St
Ir-192m	4. E-08	9. E-08	6. E-09	1. E+03	3. E+03	2. E+02	St/St/St
Ir-192	1. E-07	2. E-07	9. E-08	4. E+03	6. E+03	3. E+03	St/St/St
Ir-194m	4. E-08	7. E-08	4. E-08	2. E+03	3. E+03	2. E+03	St/St/St
Ir-194	1. E-06	8. E-07	8. E-07	5. E+04	3. E+04	3. E+04	St/St/St
Ir-195m	1. E-05	1. E-05	9. E-06	4. E+05	4. E+05	3. E+05	St/St/St
Ir-195	2. E-05	2. E-05	2. E-05	6. E+05	8. E+05	7. E+05	St/St/St
Pt-186	2. E-05	-	-	6. E+05	-	-	St/ /
Pt-188	7. E-07	-	-	3. E+04	-	-	St/ /

Radi onucl i de	Inhal ed Ai r-Lung Retenti on Class			Inhal ed Ai r-Lung Retenti on Class			Stochasti c or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Pt-189	1. E-05	-	-	4. E+05	-	-	St/ /
Pt-191	3. E-06	-	-	1. E+05	-	-	St/ /
Pt-193m	2. E-06	-	-	9. E+04	-	-	St/ /
Pt-193	1. E-05	-	-	4. E+05	-	-	St/ /
Pt-195m	2. E-06	-	-	7. E+04	-	-	St/ /
Pt-197m	2. E-05	-	-	7. E+05	-	-	St/ /
Pt-197	4. E-06	-	-	2. E+05	-	-	St/ /
Pt-199	6. E-05	-	-	2. E+06	-	-	St/ /
Pt-200	1. E-06	-	-	5. E+04	-	-	St/ /
Au-193	1. E-05	8. E-06	8. E-06	4. E+05	3. E+05	3. E+05	St/St/St
Au-194	3. E-06	2. E-06	2. E-06	1. E+05	9. E+04	8. E+04	St/St/St
Au-195	5. E-06	6. E-07	2. E-07	2. E+05	2. E+04	6. E+03	St/St/St
Au-198m	1. E-06	5. E-07	5. E-07	4. E+04	2. E+04	2. E+04	St/St/St
Au-198	2. E-06	7. E-07	7. E-07	6. E+04	3. E+04	3. E+04	St/St/St
Au-199	4. E-06	2. E-06	2. E-06	1. E+05	6. E+04	6. E+04	St/St/St
Au-200m	1. E-06	1. E-06	1. E-06	5. E+04	4. E+04	4. E+04	St/St/St
Au-200	3. E-05	3. E-05	3. E-05	1. E+06	1. E+06	1. E+06	St/St/St
Au-201	9. E-05	1. E-04	9. E-05	3. E+06	4. E+06	4. E+06	St/St/St
Hg-193m (Org)	6. E-06	-	-	2. E+05	-	-	St/ /
Hg-193m (Inorg)	4. E-06	3. E-06	-	1. E+05	1. E+05	-	St/St/
Hg-193m (Vapor)	-	4. E-06	-	-	1. E+05	-	/St/
Hg-193 (Org)	3. E-05	-	-	1. E+06	-	-	St/ /
Hg-193 (Inorg)	2. E-05	2. E-05	-	7. E+05	6. E+05	-	St/St/
Hg-193 (Vapor)	-	1. E-05	-	-	5. E+05	-	/St/
Hg-194 (Org)	1. E-08	-	-	4. E+02	-	-	St/ /
Hg-194 (Inorg)	2. E-08	5. E-08	-	7. E+02	2. E+03	-	St/St/
Hg-194 (Vapor)	-	1. E-08	-	-	5. E+02	-	/St/
Hg-195m (Org)	3. E-06	-	-	9. E+04	-	-	St/ /
Hg-195m (Inorg)	2. E-06	2. E-06	-	8. E+04	6. E+04	-	St/St/
Hg-195m (Vapor)	-	2. E-06	-	-	6. E+04	-	/St/
Hg-195 (Org)	2. E-05	-	-	7. E+05	-	-	St/ /
Hg-195 (Inorg)	1. E-05	1. E-05	-	5. E+05	5. E+05	-	St/St/
Hg-195 (Vapor)	-	1. E-05	-	-	5. E+05	-	/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Hg-197m (Org)	4. E-06	-	-	1. E+05	-	-	St/ /
Hg-197m (Inorg)	3. E-06	2. E-06	-	1. E+05	8. E+04	-	St/St/
Hg-197m (Vapor)	-	2. E-06	-	-	8. E+04	-	/St/
Hg-197 (Org)	6. E-06	-	-	2. E+05	-	-	St/ /
Hg-197 (Inorg)	5. E-06	4. E-06	-	2. E+05	1. E+05	-	St/St/
Hg-197 (Vapor)	-	3. E-05	-	-	1. E+05	-	/St/
Hg-199m (Org)	7. E-05	-	-	3. E+06	-	-	St/ /
Hg-199m (Inorg)	6. E-05	7. E-05	-	2. E+06	3. E+06	-	St/St/
Hg-199m (Vapor)	-	3. E-05	-	-	1. E+06	-	/St/
Hg-203 (Org)	3. E-07	-	-	1. E+04	-	-	St/ /
Hg-203 (Inorg)	5. E-07	5. E-07	-	2. E+04	2. E+04	-	St/St/
Hg-203 (Vapor)	-	3. E-07	-	-	1. E+04	-	/St/
Tl -194m	6. E-05	-	-	2. E+06	-	-	St/ /
Tl -194	3. E-04	-	-	9. E+06	-	-	St/ /
Tl -195	5. E-05	-	-	2. E+06	-	-	St/ /
Tl -197	5. E-05	-	-	2. E+06	-	-	St/ /
Tl -198m	2. E-05	-	-	9. E+05	-	-	St/ /
Tl -198	1. E-05	-	-	5. E+05	-	-	St/ /
Tl -199	3. E-05	-	-	1. E+06	-	-	St/ /
Tl -200	5. E-06	-	-	2. E+05	-	-	St/ /
Tl -201	9. E-06	-	-	3. E+05	-	-	St/ /
Tl -202	2. E-06	-	-	8. E+04	-	-	St/ /
Tl -204	9. E-07	-	-	3. E+04	-	-	St/ /
Pb-195m	8. E-05	-	-	3. E+06	-	-	St/ /
Pb-198	3. E-05	-	-	1. E+06	-	-	St/ /
Pb-199	3. E-05	-	-	1. E+06	-	-	St/ /
Pb-200	3. E-06	-	-	1. E+05	-	-	St/ /
Pb-201	9. E-06	-	-	3. E+05	-	-	St/ /
Pb-202m	1. E-05	-	-	4. E+05	-	-	St/ /
Pb-202	2. E-08	-	-	8. E+02	-	-	St/ /
Pb-203	4. E-06	-	-	2. E+05	-	-	St/ /
Pb-205	6. E-07	-	-	2. E+04	-	-	St/ /
Pb-209	2. E-05	-	-	9. E+05	-	-	St/ /

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	$\mu\text{Ci}/\text{ml}$			Bq/m^3			
	D	W	Y	D	W	Y	(D/ W/ Y)
Pb-210	1. E-10	-	-	4. E+00	-	-	BS/ /
Pb-211	3. E-07	-	-	1. E+04	-	-	St/ /
Pb-212	1. E-08	-	-	5. E+02	-	-	St/ /
Pb-214	3. E-07	-	-	1. E+04	-	-	St/ /
Bi -200	3. E-05	4. E-05	-	1. E+06	2. E+06	-	St/St/
Bi -201	1. E-05	2. E-05	-	4. E+05	6. E+05	-	St/St/
Bi -202	2. E-05	3. E-05	-	6. E+05	1. E+06	-	St/St/
Bi -203	3. E-06	2. E-06	-	1. E+05	9. E+04	-	St/St/
Bi -205	1. E-06	5. E-07	-	4. E+04	2. E+04	-	St/St/
Bi -206	6. E-07	4. E-07	-	2. E+04	1. E+04	-	St/St/
Bi -207	7. E-07	2. E-07	-	3. E+04	5. E+03	-	St/St/
Bi -210m	2. E-09	3. E-10	-	7. E+01	1. E+01	-	K /St/
Bi -210	1. E-07	1. E-08	-	4. E+03	4. E+02	-	K /St/
Bi -212	1. E-07	1. E-07	-	4. E+03	4. E+03	-	St/St/
Bi -213	1. E-07	2. E-07	-	5. E+03	5. E+03	-	St/St/
Bi -214	3. E-07	4. E-07	-	1. E+04	1. E+04	-	St/St/
Po-203	3. E-05	4. E-05	-	1. E+06	1. E+06	-	St/St/
Po-205	2. E-05	3. E-05	-	6. E+05	1. E+06	-	St/St/
Po-207	1. E-05	1. E-05	-	4. E+05	4. E+05	-	St/St/
Po-210	3. E-10	3. E-10	-	1. E+01	1. E+01	-	E /St/
At-207	1. E-06	9. E-07	-	4. E+04	3. E+04	-	St/St/
At-211	3. E-08	2. E-08	-	1. E+03	8. E+02	-	St/St/
Rn-220	8. E-09 ⁴	- ⁴	- ⁴	3. E+02 ⁴	- ⁴	- ⁴	- ⁴
Rn-222	3. E-08 ⁴	- ⁴	- ⁴	1. E+03 ⁴	- ⁴	- ⁴	- ⁴
Fr-222	2. E-07	-	-	7. E+03	-	-	St/ /
Fr-223	3. E-07	-	-	1. E+04	-	-	St/ /
Ra-223	-	3. E-10	-	-	1. E+01	-	/St/
Ra-224	-	7. E-10	-	-	3. E+01	-	/St/
Ra-225	-	3. E-10	-	-	1. E+01	-	/St/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Ra-226	-	3. E-10	-	-	1. E+01	-	/St/
Ra-227	-	6. E-06	-	-	2. E+05	-	/BS/
Ra-228	-	5. E-10	-	-	2. E+01	-	/St/
Ac-224	1. E-08	2. E-08	2. E-08	4. E+02	8. E+02	7. E+02	BS/St/St
Ac-225	1. E-10	3. E-10	3. E-10	4. E+00	1. E+01	1. E+01	BS/St/St
Ac-226	1. E-09	2. E-09	2. E-09	5. E+01	8. E+01	7. E+01	BS/St/St
Ac-227	2. E-13	7. E-13	2. E-12	7. E-03	3. E-02	6. E-02	BS/BS/St
Ac-228	4. E-09	2. E-08	2. E-08	2. E+02	6. E+02	7. E+02	BS/BS/St
Th-226	-	7. E-08	6. E-08	-	2. E+03	2. E+03	/St/St
Th-227	-	1. E-10	1. E-10	-	5. E+00	5. E+00	/St/St
Th-228	-	4. E-12	7. E-12	-	2. E-01	3. E-01	/BS/St
Th-229	-	4. E-13	1. E-12	-	1. E-02	4. E-02	/BS/BS
Th-230	-	3. E-12	7. E-12	-	9. E-02	2. E-01	/BS/BS
Th-231	-	3. E-06	3. E-06	-	1. E+05	1. E+05	/St/St
Th-232	-	5. E-13	1. E-12	-	2. E-02	4. E-02	/BS/BS
Th-234	-	9. E-08	6. E-08	-	3. E+03	2. E+03	/St/St
Pa-227	-	5. E-08	4. E-08	-	2. E+03	2. E+03	/St/St
Pa-228	-	5. E-09	5. E-09	-	2. E+02	2. E+02	/BS/St
Pa-230	-	2. E-09	1. E-09	-	7. E+01	5. E+01	/St/St
Pa-231	-	7. E-13	2. E-12	-	2. E-02	6. E-02	/BS/BS
Pa-232	-	9. E-09	2. E-08	-	3. E+02	9. E+02	/BS/BS
Pa-233	-	3. E-07	2. E-07	-	1. E+04	9. E+03	/St/St
Pa-234	-	3. E-06	3. E-06	-	1. E+05	1. E+05	/St/St
U-230	2. E-10	1. E-10	1. E-10	6. E+00	5. E+00	4. E+00	BS/St/St
U-231	3. E-06	2. E-06	2. E-06	1. E+05	9. E+04	7. E+04	St/St/St
U-232	9. E-11	2. E-10	3. E-12	3. E+00	6. E+00	1. E-01	BS/St/St
U-233	5. E-10	3. E-10	2. E-11	2. E+01	1. E+01	6. E-01	BS/St/St
U-234	5. E-10	3. E-10	2. E-11	2. E+01	1. E+01	6. E-01	BS/St/St
U-235	6. E-10	3. E-10	2. E-11	2. E+01	1. E+01	6. E-01	BS/St/St
U-236	6. E-10	3. E-10	2. E-11	2. E+01	1. E+01	6. E-01	BS/St/St
U-237	1. E-06	7. E-07	6. E-07	4. E+04	3. E+04	2. E+04	St/St/St

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
U-238	6. E-10	3. E-10	2. E-11	2. E+01	1. E+01	6. E-01	BS/St/St
U-239	8. E-05	7. E-05	6. E-05	3. E+06	3. E+06	2. E+06	St/St/St
U-240	2. E-06	1. E-06	1. E-06	6. E+04	4. E+04	4. E+04	St/St/St
Np-232	-	1. E-06 ⁵	-	-	4. E+04 ⁵	-	/BS/
Np-233	-	1. E-03 ⁵	-	-	5. E+07 ⁵	-	/St/
Np-234	-	1. E-06 ⁵	-	-	4. E+04 ⁵	-	/St/
Np-235	-	5. E-07 ⁵	-	-	2. E+04 ⁵	-	/BS/
Np-236 (1. E+05 yr)	-	1. E-11 ⁵	-	-	4. E-01 ⁵	-	/BS/
Np-236 (22 h)	-	2. E-08 ⁵	-	-	6. E+02 ⁵	-	/BS/
Np-237	-	2. E-12 ⁵	-	-	9. E-02 ⁵	-	/BS/
Np-238	-	4. E-08 ⁵	-	-	1. E+03 ⁵	-	/BS/
Np-239	-	1. E-06 ⁵	-	-	4. E+04 ⁵	-	/St/
Np-240	-	3. E-05 ⁵	-	-	1. E+06 ⁵	-	/St/
Pu-234	-	9. E-08 ⁵	8. E-08 ⁵	-	3. E+03 ⁵	3. E+03 ⁵	/St/St
Pu-235	-	1. E-03 ⁵	1. E-03 ⁵	-	5. E+07 ⁵	4. E+07 ⁵	/St/St
Pu-236	-	7. E-12 ⁵	1. E-11 ⁵	-	3. E-01 ⁵	6. E-01 ⁵	/BS/St
Pu-237	-	1. E-06 ⁵	1. E-06 ⁵	-	5. E+04 ⁵	5. E+04 ⁵	/St/St
Pu-238	-	3. E-12 ⁵	7. E-12 ⁵	-	9. E-02 ⁵	3. E-01 ⁵	/BS/BS
Pu-239	-	2. E-12 ⁵	6. E-12 ⁵	-	8. E-02 ⁵	2. E-01 ⁵	/BS/BS
Pu-240	-	2. E-12 ⁵	6. E-12 ⁵	-	8. E-02 ⁵	2. E-01 ⁵	/BS/BS
Pu-241	-	1. E-10 ⁵	3. E-10 ⁵	-	4. E+00 ⁵	1. E+01 ⁵	/BS/BS
Pu-242	-	2. E-12 ⁵	6. E-12 ⁵	-	9. E-02 ⁵	2. E-01 ⁵	/BS/BS
Pu-243	-	1. E-05 ⁵	1. E-05 ⁵	-	5. E+05 ⁵	6. E+05 ⁵	/St/St
Pu-244	-	2. E-12 ⁵	6. E-12 ⁵	-	9. E-02 ⁵	2. E-01 ⁵	/BS/BS
Pu-245	-	2. E-06 ⁵	2. E-06 ⁵	-	7. E+04 ⁵	6. E+04 ⁵	/St/St
Am-237	-	1. E-04 ⁵	-	-	4. E+06 ⁵	-	/St/
Am-238	-	1. E-06 ⁵	-	-	4. E+04 ⁵	-	/BS/
Am-239	-	5. E-06 ⁵	-	-	2. E+05 ⁵	-	/St/
Am-240	-	1. E-06 ⁵	-	-	4. E+04 ⁵	-	/St/
Am-241	-	2. E-12 ⁵	-	-	8. E-02 ⁵	-	/BS/
Am-242m	-	2. E-12 ⁵	-	-	8. E-02 ⁵	-	/BS/
Am-242	-	3. E-08 ⁵	-	-	1. E+03 ⁵	-	/BS/

Radioisotope	Inhaled Air-Lung Retention Class			Inhaled Air-Lung Retention Class			Stochastic or Organ ¹
	μCi /ml			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Am-243	-	2. E-12 ⁵	-	-	8. E-02 ⁵	-	/BS/
Am-244m	-	2. E-06 ⁵	-	-	6. E+04 ⁵	-	/BS/
Am-244	-	7. E-08 ⁵	-	-	3. E+03 ⁵	-	/BS/
Am-245	-	3. E-05 ⁵	-	-	1. E+06 ⁵	-	/St/
Am-246m	-	7. E-05 ⁵	-	-	3. E+06 ⁵	-	/St/
Am-246	-	4. E-05 ⁵	-	-	2. E+06 ⁵	-	/St/
Cm-238	-	4. E-07 ⁵	-	-	2. E+04 ⁵	-	/St/
Cm-240	-	2. E-10 ⁵	-	-	8. E+00 ⁵	-	/BS/
Cm-241	-	9. E-09 ⁵	-	-	4. E+02 ⁵	-	/BS/
Cm-242	-	1. E-10 ⁵	-	-	4. E+00 ⁵	-	/BS/
Cm-243	-	3. E-12 ⁵	-	-	1. E-01 ⁵	-	/BS/
Cm-244	-	4. E-12 ⁵	-	-	2. E-01 ⁵	-	/BS/
Cm-245	-	2. E-12 ⁵	-	-	8. E-02 ⁵	-	/BS/
Cm-246	-	2. E-12 ⁵	-	-	8. E-02 ⁵	-	/BS/
Cm-247	-	2. E-12 ⁵	-	-	9. E-02 ⁵	-	/BS/
Cm-248	-	6. E-13 ⁵	-	-	2. E-02 ⁵	-	/BS/
Cm-249	-	6. E-06 ⁵	-	-	2. E+05 ⁵	-	/BS/
Bk-245	-	5. E-07	-	-	2. E+04	-	/St/
Bk-246	-	1. E-06	-	-	5. E+04	-	/St/
Bk-247	-	2. E-12	-	-	8. E-02	-	/BS/
Bk-249	-	9. E-10	-	-	3. E+01	-	/BS/
Bk-250	-	2. E-07	-	-	7. E+03	-	/BS/
Cf-244	-	2. E-07 ⁵	2. E-07 ⁵	-	9. E+03 ⁵	9. E+03 ⁵	/St/St
Cf-246	-	4. E-09 ⁵	4. E-09 ⁵	-	2. E+02 ⁵	1. E+02 ⁵	/St/St
Cf-248	-	4. E-11 ⁵	5. E-11 ⁵	-	1. E+00 ⁵	2. E+00 ⁵	/BS/St
Cf-249	-	2. E-12 ⁵	6. E-12 ⁵	-	8. E-02 ⁵	2. E-01 ⁵	/BS/BS
Cf-250	-	5. E-12 ⁵	1. E-11 ⁵	-	2. E-01 ⁵	4. E-01 ⁵	/BS/St
Cf-251	-	2. E-12 ⁵	5. E-12 ⁵	-	8. E-02 ⁵	2. E-01 ⁵	/BS/BS
Cf-252	-	1. E-11 ⁵	2. E-11 ⁵	-	4. E-01 ⁵	6. E-01 ⁵	/BS/St
Cf-253	-	8. E-10 ⁵	7. E-10 ⁵	-	3. E+01 ⁵	3. E+01 ⁵	/St/St
Cf-254	-	9. E-12 ⁵	7. E-12 ⁵	-	3. E-01 ⁵	3. E-01 ⁵	/St/St

Radi onucl i de	Inhaled Ai r-Lung Retenti on Cl ass			Inhaled Ai r-Lung Retenti on Cl ass			Stochastic or Organ ¹
	$\mu\text{Ci /ml}$			Bq/m ³			
	D	W	Y	D	W	Y	(D/ W/ Y)
Es-250	-	3. E-07	-	-	1. E+04	-	/BS/
Es-251	-	4. E-07	-	-	2. E+04	-	/BS/
Es-253	-	6. E-10	-	-	2. E+01	-	/St/
Es-254m	-	4. E-09	-	-	2. E+02	-	/St/
Es-254	-	4. E-11	-	-	2. E+00	-	/BS/
Fm-252	-	6. E-09	-	-	2. E+02	-	/St/
Fm-253	-	4. E-09	-	-	2. E+02	-	/St/
Fm-254	-	4. E-08	-	-	2. E+03	-	/St/
Fm-255	-	9. E-09	-	-	3. E+02	-	/St/
Fm-257	-	1. E-10	-	-	4. E+00	-	/E /
Md-257	-	4. E-08	-	-	2. E+03	-	/St/
Md-258	-	1. E-10	-	-	4. E+00	-	/BS/

FOOTNOTES FOR ATTACHMENT 4

¹ A determination of whether the DACs are controlled by stochastic (St) or nonstochastic (organ) dose, or if they both give the same result (E), for each lung retention class, is given in this column. The key to the organ notation for nonstochastic dose is: BS = Bone surface, K = Kidney, L = Liver, SW = Stomach wall, and T = Thyroid. A blank indicates that no calculations were performed for the lung retention class shown.

² The ICRP identifies tritiated water and carbon as having immediate uptake and distribution; therefore no solubility classes are designated. For the purposes of this table, the DAC values are shown as being constant, independent of solubility class. For tritiated water, the inhalation DAC values allow for an additional 50% absorption through the skin, as described in ICRP Publication No. 30: Limits for Intakes of Radionuclides by Workers. For elemental tritium, the DAC values are based solely on consideration of the dose-equivalent rate to the tissues of the lung from inhaled tritium gas contained within the lung, without absorption in the tissues.

³ A dash indicates no values given for this data category.

⁴ These values are appropriate for protection from radon combined with its short-lived daughters and are based on information given in ICRP Publication 32: Limits for Inhalation of Radon Daughters by Workers and Federal Guidance Report No. 11: Limiting Values of Radionuclide Intake and Air Concentrations, and Dose Conversion Factors for Inhalation, Submersion, and Ingestion (EPA 520/1-88-020). The values given are for 100% equilibrium concentration conditions of the radon daughters with the parent. To allow for an actual measured equilibrium concentration or a demonstrated equilibrium concentration, the values given in this table should be multiplied by the ratio (100%/actual %) or (100%/demonstrated %), respectively. Alternatively, the DAC values for Rn-220 and Rn-222 may be replaced by 1 WL* and 1/3 WL*, respectively, for appropriate limiting of daughter concentrations. Because of the dosimetric considerations for radon, no f_1 or lung clearance values are listed.

* A "Working Level" (WL) is any combination of short-lived radon daughters, in one liter of air without regard to the degree of equilibrium, that will result in the ultimate emission of $1.3 \text{ E}+05$ MeV of alpha energy.