ATOMIC ENERGY LICENSING ACT 1984

ATOMIC ENERGY LICENSING (BASIC SAFETY RADIATION PROTECTION) REGULATIONS 2010

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ATOMIC ENERGY LICENSING ACT 1984

ATOMIC ENERGY LICENSING (BASIC SAFETY RADIATION PROTECTION) REGULATIONS 2010

IN exercise of the powers conferred by subsection 25(6) and section 68 of the Atomic Energy Licensing Act 1984 [*Act 304*], the Minister makes the following regulations:

PART I

PRELIMINARY

Citation and commencement

1. (1) These regulations may be cited as the **Atomic Energy Licensing (Basic Safety Radiation Protection) Regulations 2010**.

(2) These Regulations come into operation on 15 February 2010.

Application

2. These Regulations shall apply to all activities involving ionizing radiation.

Interpretation

3. In these Regulations, unless the context otherwise requires—

"practice" means any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed;

"intervention level" means the level of dose at which a specific protective action or remedial action is taken in an emergency exposure or chronic exposure situation;

"clearance level" means the values established by the appropriate authority and expressed in terms of activity concentration and/or total activity, at or below which the source of radiation may be released from the control of the appropriate authority;

"recording level" means a level of dose, exposure or intake as specified by the appropriate authority at or above which the values of dose, exposure or intake received by workers are to be entered in the individual exposure records of the workers;

"reference level" means an action level, intervention level, investigation level or recording level, where such levels may be established for any of the quantities determined in the practice of radiation protection;

"investigation level" means the value of a quantity such as the effective dose, intake or contamination per unit area or volume at or above which an investigation should be conducted;

"action level" means the level of dose rate or activity concentration above which remedial action or protective action shall be carried out in an emergency exposure or chronic exposure situation;

"radioactive discharge" means radioactive material arising from a source within a practice which is discharged as gas, aerosol, liquid or solid into the environment;

"intervention" means any action intended to reduce or avert exposure or the likelihood of exposure to a radiation source which is not part of a practice or which is out of control as a consequence of an accident;

"exposure" means either the act or condition of being subject to irradiation, or the amount of ionization produced in the air by ionizing radiation;

"public exposure" means any exposure incurred by members of the public from radiation sources, excluding any occupational exposure or medical exposure and natural background radiation;

"normal exposure" means any exposure which is expected to be received under the normal operating conditions of an installation or radiation source;

"internal exposure" means an exposure resulting from a radiation source inside the body;

"emergency exposure" means a voluntary exposure justified in abnormal conditions for the purpose of bringing help to endangered individuals, preventing exposure to a large number of people or saving a valuable installation including a nuclear installation, where one or more of the dose limits specified for a worker are likely to be exceeded;

"chronic exposure" means an exposure persisting in time;

"external exposure" means an exposure resulting from a radiation source outside the body;

"occupational exposure" means all exposure of workers incurred in the course of their work;

"medical exposure" means the exposure incurred by—

(a) a patient as part of his medical or dental investigative or diagnostic procedures or treatment;

(b) a person who knowingly assists in the support and comfort of patients, other than a person who is occupationally exposed; or

(c) a volunteer in a medical research programme that involves radiation exposure;

"accidental exposure" means an unpredictable exposure that results in one or more persons receiving doses exceeding the dose limit;

"potential exposure" means an exposure that is not expected to be delivered with certainty, but that may result from an accident at a radiation source or owing to an event or sequence of events of a probabilistic nature, including equipment failures and operating errors;

"decontamination" means the removal or reduction of contamination in or on a material, human body, environment or other place;

"dose" means absorbed dose, organ dose, equivalent dose, effective dose, committed equivalent dose, committed effective dose or committed absorbed dose;

"effective dose" means the sum of each of the tissue equivalent doses multiplied by the appropriate tissue weighting factor;

"collective effective dose" means the total radiation dose which is obtained in a manner as described in the Fourth Schedule;

"committed effective dose" means the effective dose which an individual is committed to receive from an intake of radioactive material as specified in the Fourth Schedule;

"organ dose" means the mean dose in a specified tissue or organ of the human body;

"equivalent dose" means the product of the absorbed dose delivered by each type of radiation averaged over a tissue or organ and the radiation weighting factor for the same type of radiation;

"committed equivalent dose" means the equivalent dose which would be received by an organ or tissue from an intake of radioactive material as specified in the Fourth Schedule;

"annual dose" means the dose received over a period of one calendar year;

"absorbed dose" (D) means the quotient of de by dm, where de is the mean energy imparted by ionizing radiation to matter in a volume element and dm is the mass of matter in that volume element, represented by the formula—

$$D = de/dm;$$

"committed absorbed dose" means the absorbed dose which an individual is committed to receive from an intake of radioactive material over the time as specified in the Fourth Schedule;

"committed dose" means the committed effective dose and/or committed equivalent dose;

"equilibrium factor" means the ratio of the equilibrium equivalent concentration of radon to the actual radon concentration, where the equilibrium equivalent concentration is the activity concentration of radon in equilibrium with its short lived progeny having the same potential alpha energy concentration as the actual non-equilibrium mixture;

"radiation weighting factor" means the multipliers of absorbed dose used for radiation protection purposes to account for the relative effectiveness of different types of radiation in inducing health effects as specified in Table I of the Second Schedule;

"tissue weighting factor" means the multipliers of the equivalent dose to an organ or tissue used for radiation protection purposes to account for the different sensitivities of different organs and tissues to the induction of stochastic effects of radiation as specified in Table II of the Second Schedule;

"medical physics" means the field of specialization involving the use and application of physics in medicine;

"discharge limit" means the values of activity or activity concentration authorized by the appropriate authority for the maximum amount of radionuclide content in a discharge to the environment;

"dose limit" means the value of the effective dose or the equivalent dose to an individual from practice that shall not be exceeded;

"critical pathway" means the route by which any radioactive material, nuclear material or prescribed substance travels to reach a critical group and causes the highest radiation dose;

"total exposure" means the sum of the internal exposure and external exposure;

"clean area" means an area where the annual dose received by a worker is not likely to exceed the dose limit for a member of the public;

"controlled area" means any area in which specific protection measures and safety provisions are required for controlling normal exposures or preventing the spread of contamination during normal working conditions, and preventing or limiting the extent of potential exposures;

"supervised area" means an area for which occupational exposure conditions are kept under review even though specific protective measures and safety provisions are not normally needed;

"activity" (*A*) in respect of an amount of radionuclide in a particular energy state at a given time means the quotient of *dN* by *dt*, where *dN* is the expectation value of the number of spontaneous nuclear transformation from that energy state in the time interval *dt*, represented by the formula—

$$A = dN/dt;$$

"dose constraint" means a prospective restriction on dose, primarily intended to be used to discard undesirable options in an optimization calculation;

"consumer product" means a device, an article or a thing such as a smoke detector, luminous dial or ion generating tube that contains the amount of radioactive materials as determined by the appropriate authority;

"accident" means any unintended event, including operating errors, equipment failures or other mishaps, where the consequences or potential consequences are not negligible from the point of view of protection or safety;

"radioactive waste management facility" means the facility specifically designed to handle, treat, condition, temporarily store or permanently dispose of radioactive wastes;

"deterministic effect" means a radiation effect for which a threshold level generally exists above which the severity of the effect is greater for a higher dose;

"contamination" means the presence of radioactive material in or on a material, human body, environment or other place where they are undesirable or could be harmful;

"radioactive contamination" means the contamination of any material, surface or environment or of any person, including both external skin contamination and internal contamination irrespective of the method of intake, by any radioactive material, nuclear material or prescribed substance;

"critical group" means that group of the members of the public whose exposure is reasonably homogeneous and is typical of individuals receiving the highest dose;

"employer" means any person who has entered into a contract of service with an employee and includes—

(a) a manager, agent or person responsible for the payment of salary or wages to an employee;

(b) the occupier or owner of a place of work;

(c) the legal representative of the deceased occupier or owner of a place of work; and

(d) any statutory body;

"member of the public" means an individual in the population, but does not include a worker exposed to radiation in the course of his work;

"qualified expert" means an individual who by virtue of certification by any authority or society or professional licensee, or by virtue of his academic qualifications and experience, is duly recognized by the Board as having the expertise in a relevant field of specialization;

"radiation protection officer" means a technically competent person appointed by the licensee and approved by the appropriate authority to supervise the application of appropriate radiation protection regulations, measures and procedures;

"worker" means any person working under the instruction of the licensee, whether or not employed by the licensee, in the handling or use of, or who will come into contact with any radioactive material, nuclear material, prescribed substance or irradiating apparatus;

"emergency plan" means a set of procedures to be implemented in the event of an accident;

"monitoring" means the measurement of dose or contamination for reasons related to the assessment or control of exposure to radiation or radioactive materials, and the interpretation of the results;

"personnel monitoring" means radiation protection surveillance carried out on workers to ensure that the dose received does not exceed the dose limit for workers;

"area monitoring" means radiation protection surveillance carried out in a supervised area or controlled area;

"containment" means the methods or physical structures that prevent the dispersion of radioactive material;

"clearance" means the removal of radioactive material, nuclear material or prescribed substance within a practice licensed under this Act, from the control of the appropriate authority;

"activation" means the production of radionuclides by irradiation;

"approved registered medical practitioner" means a registered medical practitioner who is approved by the appropriate authority to be responsible for the medical surveillance of workers;

"intake" means the process of taking radionuclide into the body by inhalation or ingestion or through the skin;

"health surveillance" means medical supervision which is carried out to ensure the initial and continuous fitness of workers for their intended task;

"medical surveillance" means an activity which is carried out by any approved registered medical practitioner to ensure that the general health of workers are not affected by radiation exposure;

"Helsinki Declaration" means the Declaration of Helsinki adopted by the World Medical Association as revised by the 41st World Medical Assembly in 1989 as specified in the Fifth Schedule;

"health care professionals" means a medical practitioner, dental practitioner, pharmacist, radiographer, radiologist, radiotherapist, medical physicist, nuclear medical physicist, nurse, medical assistant, and any other persons involved in the giving of medical, health, dental, pharmaceutical and any other health care services under the jurisdiction of the Ministry of Health;

"safety assessment" means a review of the aspects of design and operation of a source which are relevant to the protection of persons or the safety of the radiation source, including the analysis of the provisions for safety and protection established in the design and operation of the radiation source and the analysis of risks associated with normal exposure and accidental exposure;

"nuclear medicine" means all applications of radioactive material in diagnosis or treatment or in medical research except the use of sealed source in radiotherapy;

"risk" means a multi-attribute probabilistic quantity expressing hazard, danger or chance of harmful or injurious consequences associated with actual or potential exposure;

"natural background radiation" means all ionizing radiation from natural sources, to the extent that the exposure which it causes is not increased by man;

"natural source" means any naturally occurring sources of radiation, including cosmic radiation and terrestrial sources of radiation;

"radiation source" means an apparatus or material capable of emitting ionizing radiation;

"sealed source" means a radiation source consisting of any radioactive material, nuclear material or prescribed substance firmly incorporated in solid and effectively inactive material, or sealed in an inactive container of sufficient strength to prevent any dispersion of its contents under normal conditions of use;

"remedial action" means action taken when an action level is exceeded, to reduce radiation doses that might otherwise be received, in an intervention involving chronic exposure;

"protective action" means an intervention intended to avoid or reduce doses to members of the public in a chronic exposure or emergency exposure situation.

PART II

SYSTEM OF RADIOLOGICAL PROTECTION

Justification of practice

4. (1) No person shall carry out or cause to be carried out any practice unless the practice is justified in accordance with subregulation (2).

(2) No practice or source within a practice shall be authorized unless the practice produces sufficient benefit to the exposed individuals or to society to offset the radiation harm that it might cause, that is unless the practice is justified, taking into account the social, economic and other relevant factors.

(3) Notwithstanding subregulation (1), the following practices are deemed to be unjustified whenever they result in an increase, by deliberate addition of radioactive material or by activation, in the activity of the associated commodities or products:

(a) practices involving food, beverages, cosmetics or any other commodity or product intended for ingestion, inhalation or percutaneous intake by, or an application to, a human being, except for justified practices involving medical exposure; and

(b) practices involving the frivolous use of radiation or radioactive material, nuclear material or prescribed substance in commodities or products such as toys and personal jewellery or adornments.

Optimization of protection and safety

5. Every licensee shall ensure that for all exposure from any particular radiation source within a practice, except for therapeutic medical exposures, protection and safety shall be optimized in order that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposures be kept as low as reasonably achievable, taking into account the economic and social factors, provided that the doses to individuals delivered by the radiation source is subject to the dose constraint.

Dose constraint

6. Every licensee shall ensure that, except for medical exposure, the optimization of the protection and safety measures associated with any particular radiation source for which he is responsible shall—

(a) not exceed the dose constraint or values which can cause the dose limits to be exceeded; and

(b) ensure that for any radiation source and radioactive waste management facility that can release radioactive material into the environment, the cumulative effects of each annual release from the radiation source are restricted so that the effective dose in any year to any member

of the public, including people distant from the radiation source and people of future generations, is unlikely to exceed any relevant dose limit, taking into account the cumulative releases and the exposures expected to be delivered by all other relevant radiation sources and practices.

Dose limit

7. (1) Every licensee shall ensure that no worker, apprentice, student or member of the public receives exposure from a practice that exceeds the relevant dose limit.

(2) Notwithstanding subregulation (1), the dose limit shall not apply to—

(a) a person involved in emergency exposure;

(b) an exposure from natural background radiation; or

(c) medical exposure from a practice.

Dose limit for workers

8. (1) Subject to regulations 11 and 76, the limit on the effective dose for a worker shall be 20 millisieverts (mSv) in a calendar year, where the maximum effective dose on the worker averaged over a period of five consecutive years shall not exceed 20 mSv commencing from the time as specified by the appropriate authority.

(2) The limit on equivalent dose to the lens of the eye of a worker shall be 150 mSv in a calendar year.

(3) The limit on equivalent dose to the skin of a worker shall be 500 mSv in a calendar year, averaged over an area of one square centimetre, regardless of the area exposed.

(4) The limit on equivalent dose to the hands and feet of a worker shall be 500 mSv in a calendar year.

(5) When a female worker is confirmed to be pregnant under subregulation 40(9), the foetus shall, from the date of the confirmation, be afforded the level of protection so that the dose to the foetus shall not exceed 1 mSv for the remaining period of the pregnancy.

Dose limit for members of the public

9. (1) The limit on effective dose for a member of the public shall be 1 mSv in a calendar year.

(2) The limit on equivalent dose to the lens of the eye of a member of the public shall be 15 mSv in a calendar year.

(3) The limit on equivalent dose to the skin of a member of the public shall be 50 mSv in a calendar year, averaged over an area of one square centimeter, regardless of the area exposed.

(4) The dose limits as specified in subregulations (1), (2) and (3) shall apply to the average dose to the critical group of the population.

(5) The limit on effective dose for a person who knowingly assists in the support of a patient shall not exceed 5 mSv during the period of diagnostic examination or treatment of the patient.

(6) A person specified in subregulation (5) shall not be allowed to continue to assist in the support of a patient when he has received the effective dose exceeding the limit of 5 mSv, unless the approved registered medical practitioner gives strong clinical justification and has reasonable reasons for allowing the person to continue with such support.

(7) The limit on effective dose for a person below the age of sixteen years visiting a patient undergoing treatment or diagnostic examination involving radioactive material shall not exceed 1 mSv during the period of the treatment or examination of the patient.

Dose limit for apprentices and students

10. The dose limits for apprentices aged between sixteen years and eighteen years who are training for employment involving exposure to radiation, and for students aged between sixteen years and eighteen years who are required to use radiation source in the course of their studies, shall be—

(a) an effective dose of 6 mSv in a calendar year;

(b) an equivalent dose to the lens of the eye of 50 mSv in a calendar year;

(c) an equivalent dose to the hands and feet of 150 mSv in a calendar year; and

(d) an equivalent dose to the skin of 150 mSv in a calendar year, averaged over an area of one square centimeter, regardless of the area exposed.

Dose limit in special circumstances

11. (1) A licensee may, in special circumstances, apply to the appropriate authority for a temporary change in the dose limit requirement for specified workers.

(2) In making an application for a temporary change in the dose limit requirement, every licensee shall comply with any procedures as specified by the appropriate authority and supply any information required by the appropriate authority that is relevant to the application.

(3) Notwithstanding subregulation (2), every licensee shall, in an application to the appropriate authority for a temporary change in the dose limit requirement, provide evidence to demonstrate that—

(a) all reasonable efforts have been made to reduce exposure and protective measures and safety provisions have been optimized in accordance with these Regulations;

(b) the relevant employers and workers, through their representatives where appropriate, have been consulted and their agreement obtained on the need for the temporary change and on the conditions of the temporary change;

(c) all reasonable efforts are being made to improve the working conditions to the extent that the dose limit requirements can be met; and

(d) the monitoring and recording of the exposure of workers are sufficient to demonstrate compliance with relevant requirements of the Third Schedule and are sufficient to facilitate the transfer of exposure records between relevant employers as required by the appropriate authority.

(4) The appropriate authority may authorize a temporary change in the dose limit requirements by—

(a) an extension of the averaging period for effective dose to not more than 10 consecutive years, and the effective dose for any worker shall not exceed 20 mSv per year averaged over this period and shall not exceed 50 mSv in any one calendar year, and the circumstances shall be reviewed when the dose accumulated by any worker since the start of the extended averaging period reaches 100 mSv; or

(b) a change in the limit on average effective dose per year to a value not exceeding 50 mSv for a period of not more than five consecutive years, subject to a limit of 50 mSv in any one calendar year.

(5) Any temporary change in the dose limit shall—

(a) be reviewed when the dose accumulated by any worker since the start of the extended averaging period reaches 100 mSv;

(b) be subject to annual review;

(c) not be renewable; and

(d) relate to specified work areas and specified workers, who shall not include pregnant workers, or apprentices or students between the ages of sixteen years and eighteen years.

(6) No temporary change in the dose limit requirement shall be made by the licensee without the prior written approval of the appropriate authority.

Verification of compliance with dose limit

12. The dose limits as specified in regulations 8, 9, 10 and 11 shall be deemed to have been complied with if the requirements laid down in the Third Schedule are met.

Evaluation of equivalent dose and effective dose

13. For the purpose of complying with regulations 8, 9, 10 and 11, the values for the equivalent dose and effective dose shall be evaluated in accordance with the methods as specified in the Second Schedule.

Other methods of compliance with dose limit

14. Notwithstanding regulations 12 and 13, other methods of compliance with the requirements of regulations 8, 9, 10 and 11 which are acceptable to the appropriate authority may be used.

PART III

OCCUPATIONAL EXPOSURE

Responsibilities of licensee and employer

15. (1) Every licensee and employer of workers who are engaged in activities involving normal exposures or potential exposures shall be responsible for—

(a) the protection of workers from occupational exposure; and

(b) complying with any other relevant requirements as determined by the appropriate authority.

(2) The licensee shall apply the requirements of this regulation to any occupational exposure, either from man-made sources or natural sources which have been specified in paragraphs 7(2)*(b)* and *(c)*.

(3) The licensee shall ensure that every worker who is exposed to ionizing radiation from sources other than natural sources that are not directly related to his work or not required by his work, receives the same level of protection as prescribed in regulation 9.

(4) The licensee shall establish and maintain a radiation protection programme and safety procedure, including emergency plans to ensure the protection of the health of workers and members of the public and to minimize the danger to life, property and the environment.

(5) The licensee shall ensure that any work involving occupational exposure is adequately supervised and all reasonable steps have been taken to ensure that the radiation protection programme, safety procedures, protective measures and safety provisions are observed.

(6) The licensee shall provide the workers with adequate information on health risks due to their occupational exposure, whether normal exposure or potential exposure, instruction and training on protection and safety, and information on the significance of protection and safety of their actions.

(7) The licensee shall inform female workers of—

(a) the risk to the foetus due to exposure during pregnancy;

(b) the importance of notifying the employer and the licensee as soon as the pregnancy is confirmed; and

(c) the risk to an infant ingesting radioactive material by breast-feeding.

(8) The licensee or the employer shall provide appropriate training, retraining and facilities for updating the skills and knowledge of the workers.

(9) If workers are to be engaged in work that involves or could involve a radiation source which is not under the control of their employer, the licensee who is responsible for the radiation source shall—

(a) provide appropriate information to the employer for the purpose of demonstrating that the workers are provided with protection in accordance with all the requirements of the appropriate authority and with other applicable laws and regulations governing work place hazards;

(b) provide such additional available information as approved by the appropriate authority, as the employer may request prior to, during and after the engagement of the workers by the licensee;

(c) co-operate with the employer to achieve a clear allocation and documentation of the respective responsibilities of the employer and the licensee for occupational protection and safety;

(d) co-operate with the employer to develop and use specific exposure restrictions and other means to ensure that the protective measures and safety provisions for such workers are at least as good as those provided for employees of the licensee; and

(e) provide the employer with specific assessments of the doses received by the workers.

(10) The licensee shall establish in writing such local rules and procedures as are necessary to ensure adequate levels of protection and safety of workers and other persons.

(11) The licensee shall establish investigation levels and intervention levels where appropriate and such levels shall be subject to the approval of the appropriate authority.

(12) The licensee shall include in the local rules and procedures as specified in subregulation (10) the values of any approved investigation level or intervention level, and the procedures to be followed by the workers in the event that any such value is exceeded.

(13) The licensee or employer shall ensure that the relevant local rules are communicated to the employees or other persons who may be affected by the rules.

(14) For the purpose of this regulation, "local rules" means a set of written rules for a specific work area which sets out the requirements under these Regulations that shall be complied with in relation to work with ionizing radiation.

Employment of radiation protection officer and qualified expert

16. (1) The licensee shall employ a radiation protection officer.

(2) Notwithstanding subregulation (1), the licensee may employ a qualified expert as approved by the appropriate authority to carry out the duties of a radiation protection officer.

Classification of working areas

17. (1) The licensee shall classify the working areas into clean areas, supervised areas and controlled areas.

(2) The licensee shall, in determining the boundaries of any area, take into account—

(a) the likelihood and magnitude of potential exposure; and

(b) the nature and extent of the required protection and safety procedure.

(3) Notwithstanding subregulation (2), an area where the annual dose received by a worker is likely to exceed three-tenth of the dose limit as specified in subregulation 8(1) shall be classified as a controlled area.

(4) The licensee shall delineate controlled areas by physical means or, where this not reasonably practicable, by some other suitable means.

(5) The licensee shall take into account the nature and extent of radiation hazards in the supervised areas and delineate the supervised areas by appropriate means.

(6) The licensee shall ensure that supervised areas and controlled areas are clearly demarcated and appropriate legible notices and warning signs bearing the radiation symbol as specified in the First Schedule are posted conspicuously in strategic places.

(7) The notices mentioned in subregulation (6) shall be in the national language and, if necessary, in any other languages.

(8) The licensee shall, when required by the appropriate authority, provide at entrances to controlled areas, protective clothing and equipment and suitable storage for personal clothing.

(9) The licensee shall, when required by the appropriate authority, provide at exits from controlled areas—

(a) equipment for the monitoring of contamination of skin and clothing;

(b) equipment for the monitoring of contamination of any object being removed from the area;

(c) facilities for washing as may be appropriate; and

(d) suitable storage for contaminated protective clothing and equipment.

(10) The licensee shall ensure that operating instructions relevant to the controlled areas are posted conspicuously in such areas.

Administrative procedures in supervised area and controlled area

18. (1) The licensee shall restrict access to controlled areas by means of administrative procedures such as the use of work permits, and physical barriers which shall include, where appropriate, locks or interlocks.

(2) The degree of restriction under subregulation (1) shall commensurate with the magnitude and likelihood of the expected exposures.

(3) No person shall enter a controlled area unless he has been assigned to the area or has been authorized by the licensee to enter the area.

(4) Every person who has been given access to the controlled area shall comply with prevailing instructions applicable to the area issued by or under the authority of the licensee.

(5) The licensee shall periodically review the conditions to determine the possible need to revise the protection measures and safety provisions and the boundaries of the supervised areas and controlled areas.

Special conditions for young persons and pregnant workers

19. (1) Any person under the age of sixteen years shall not be allowed to work in a supervised area or controlled area.

(2) Any person aged sixteen years and above but under the age of eighteen years shall not be allowed to work in a controlled area unless the person is supervised and only for the purpose of training.

(3) When a female worker who works in a controlled area has confirmed that she is pregnant, her employer or licensee shall, if necessary, adapt the working conditions for that worker so as to comply with subregulation 8(5).

Personal protective equipment

20. (1) The licensee shall ensure that—

(a) workers are provided, where appropriate, with suitable and adequate personal protective equipment such as protective clothing, protective respiratory equipment, protective aprons, gloves and organ shields;

(b) when appropriate, workers receive adequate instruction in the proper use of protective equipment;

(c) tasks requiring the use of some specific personal protective equipment are assigned only to workers who on the basis of medical advice are capable of safely sustaining the extra effort necessary;

(d) all personal protective equipment is maintained in proper condition and, where appropriate, is tested at regular intervals;

(e) appropriate personal protective equipment is maintained for use in the event of intervention; and

(f) if the use of personal protective equipment is considered for any given task, account is taken of any additional exposure that could result owing to the additional time or inconvenience, and of any additional non-radiological risks that might be associated with performing the task while using protective equipment.

(2) The licensee shall minimize the need for relying on administrative controls and personal protective equipment for protection and safety during normal operations by providing appropriate protective measures and safety provisions, including well engineered controls and satisfactory working conditions.

Monitoring of work place

21. (1) The licensee shall establish, maintain and keep under review a monitoring programme in the supervised area and controlled area under the supervision of the radiation protection officer or qualified expert employed under regulation 16.

(2) The monitoring programme shall include—

(a) measurements of external radiation levels and contamination levels (where appropriate) at specified places, times and frequencies at all appropriate locations so as to evaluate the radiological conditions in all work places;

(b) exposure assessments in controlled areas and supervised areas;

(c) assessment of the levels of radiation risks associated with an accident or emergency situation;

(d) specification of the methods and procedures of monitoring; and

(e) the reference levels and the actions to be taken if they are exceeded.

(3) The licensee shall carry out work place monitoring periodically and whenever there are changes in processes or equipment which are likely to result in changes of exposure situations.

(4) The work place monitoring programme shall be reviewed periodically in the light of experience and also in the event of any major modification made to the installation or procedures.

(5) The frequency of work place monitoring carried out by the licensee shall depend on the levels of radiation and activity concentration, including their expected fluctuations and the likelihood and magnitude of potential exposures.

(6) The licensee shall keep all the appropriate records of the findings of the work place monitoring programme which shall be made available to the appropriate authority or to the workers upon request.

Personnel monitoring

22. (1) The licensee shall be responsible for arranging the assessment of the occupational exposure of workers on the basis of personnel monitoring, where appropriate, using the dosimetry services as approved by the appropriate authority.

(2) The licensee shall carry out personnel monitoring for all workers who normally work in a controlled area, and workers who occasionally work in a controlled area but may receive significant occupational exposure.

(3) Personnel monitoring shall not be required for any worker who normally works in a supervised area, or who enters a controlled area only occasionally, but the occupational exposure of the worker shall be assessed on the basis of the results of work place monitoring as described in regulation 21.

(4) Personnel monitoring for external exposure shall be measured by the use of one or more approved personnel monitoring devices carried continuously on the person.

(5) Doses received from internal exposures shall be evaluated using techniques and procedures approved by the appropriate authority.

(6) The frequency of assessment under subregulations (4) and (5) shall be determined by the potential external exposure or potential internal exposure involved; and where the worker has or is suspected of having an accidental exposure or accidental intake of any radioactive material, nuclear material or prescribed substance, the assessment shall be carried out immediately.

Personnel monitoring results

23. (1) The licensee shall inform each worker in writing of the worker's personnel monitoring results and radiation exposure status not later than fourteen days from the date the licensee receives the results.

(2) In the case of workers who are engaged in work that involves or could involve exposure from a radiation source that is not under the control of the employer, the licensee responsible for the radiation source shall provide both the worker and the worker's employer with the relevant exposure records.

(3) The results of the personnel monitoring of every worker shall be entered into an exposure record referred to in regulation 24.

(4) In the case of exposure exceeding the dose limit for a single calendar year, the employer shall ensure that the results of personnel monitoring are submitted to an approved registered medical practitioner for further appropriate action.

(5) When a worker occupationally receives an exposure exceeding 100 mSv, the employer shall ensure that such worker undergoes a medical examination and investigation by an approved registered medical practitioner.

(6) Whenever an accident or emergency occurs, the licensee, in co-operation with the employer, shall ensure that the results of personnel monitoring are submitted to the approved registered medical practitioner immediately.

Exposure records

24. (1) The employer shall immediately transfer the exposure records of his workers to the appropriate authority—

(a) after the termination or the retirement of the worker; or

(b) when the employer ceases operation.

(2) When the licensee employs a worker who has been a radiation worker, the licensee shall obtain the exposure record in respect of that worker from the appropriate authority.

(3) The appropriate authority may, upon request made by the licensee under subregulation (2), submit the exposure record for the worker to the licensee.

(4) Notwithstanding subregulation (1), if an employer ceases operations and a new employer takes over the operation, the former employer shall transfer all the exposure records of the workers to the new employer.

(5) In the case of a worker who has worked with a licensee or employer who has ceased operation, the new licensee shall obtain the worker's exposure record from the appropriate authority.

(6) The doses received by a worker during normal operation, accidental exposure and emergency exposure shall be recorded.

(7) The doses received by a worker during accidental exposure and emergency exposure may be recorded together, but shall be made distinguishable.

(8) The procedures for keeping the records of exposure of workers who work in controlled areas under different licensees shall be as specified by the appropriate authority.

(9) The exposure records of a worker shall be kept and maintained by the employer and licensee up to the date he remains his worker.

Investigation of over exposure

25. If exposure in excess of the dose limits as specified in regulations 8, 9, 10 and 11 occurs or is suspected to have occurred, the licensee shall carry out an investigation to determine the circumstances in which the exposure took place and to determine its consequences, and he shall submit a report on the investigation to the appropriate authority.

Notification and report of all accidental exposure or emergency exposure

26. (1) The licensee shall notify the appropriate authority of an accidental exposure or emergency exposure within twenty-four hours after the occurrence of such accidental exposure or emergency exposure.

(2) The licensee shall submit to the appropriate authority a written report of an accidental exposure or emergency exposure within thirty days after the occurrence of such exposure and the report shall contain—

(a) the particulars of the licensee and the radiation protection officer;

(b) the time, date and place of occurrence of the accidental exposure or emergency exposure;

(c) a description of the material and/or irradiating apparatus involved, including its kind and quantity, and its chemical and physical forms, where appropriate;

(d) the results of the dose assessment of the individuals exposed or likely to have been exposed and a description of the circumstances under which the exposures could have been received;

(e) the results of the preliminary environmental assessment, whenever appropriate;

(f) the actions which have been taken, or will be taken, to ensure that any potential hazard arising from the occurrence is under control;

(g) the procedures or measures which have been or will be adopted to prevent the recurrence of such exposures; and

(h) any other information as the licensee deems necessary.

Medical surveillance of workers

27. (1) The employer shall cause medical surveillance to be carried out on his workers.

(2) Medical surveillance of workers shall be carried out by an approved registered medical practitioner.

Authority of an approved registered medical practitioner

28. An approved registered medical practitioner shall have the authority, on medical grounds—

(a) to declare a worker to be temporarily unfit to perform his normal duties;

(b) to advise the employer on the reinstatement of the worker as mentioned in paragraph *(a)* to his normal duties; and

(c) to advise the employer on the transfer of a worker to perform other duties.

Requirements of medical surveillance

29. The following medical surveillance of workers shall be carried out, where applicable:

(a) pre-employment medical examinations as specified in regulation 31;

(b) general health surveillance as specified in regulation 32;

(c) periodic reviews of health as specified in regulation 33; and

(d) medical examination at termination of employment or retirement as specified in regulation 34.

Prohibition on employment of workers

30. (1) No person shall employ any person as a worker if the person is found to be medically unfit to be a worker.

(2) No person shall continue to employ a worker who is found to be unfit to be a worker after a medical surveillance is carried out on him under regulation 29 or after the person has been advised under paragraph 28(*c*).

Pre-employment medical examination

31. (1) Every person who is to be employed in a controlled area shall undergo a pre-employment medical examination.

(2) A pre-employment medical examination shall include an inquiry into the person's medical history, including all known previous exposures to ionizing radiation resulting either from his previous employment or from previous medical examination or treatment or both, and shall also include any clinical or other investigation which may be necessary to determine his general state of health.

General health surveillance

32. (1) The employer or the licensee shall ensure that an approved registered medical practitioner is given access to the working premises and to any information which such approved registered medical practitioner may require in order to ascertain the state of health of a worker under surveillance.

(2) In the case where one or more workers are to be engaged in work that involves or could involve exposure from a radiation source that is not under the control of their employer, the licensee responsible for the radiation source shall as a pre-condition for such engagement make any special arrangements for health surveillance with the employer that are needed to comply with the requirements established by the appropriate authority.

Periodic reviews of health

33. (1) The employer shall ensure that the health of a worker is reviewed regularly to determine whether such worker remains fit to perform his duties.

(2) The nature of the periodic reviews of health shall depend on the type and extent of exposure to ionizing radiation and on the individual worker's state of health.

(3) Without prejudice to subregulations (1) and (2), the state of health of a worker shall be reviewed at least once in three years for a worker in a controlled area and more frequently if the worker's exposure conditions and state of health so requires.

Medical examination at termination of employment or retirement

34. (1) Every worker who has undergone pre-employment medical examination under regulation 31 shall undergo a medical examination at the termination of employment or retirement, as the case may be.

(2) The medical examination shall be carried out by an approved registered medical practitioner who shall indicate, based on his examination of the worker, if there is any need to continue the medical surveillance of the worker after the termination of employment or retirement.

(3) The period of surveillance after the termination of employment or retirement shall be as long as the approved registered medical practitioner carrying out the examination referred to in subregulation (1) deems necessary in order to safeguard the health of the person concerned.

Medical examinations, *etc.*

35. Where occupationally related radiation induced diseases are suspected, the employer shall provide medical examinations, investigations and treatments as appropriate.

Payment of medical expenses

36. Medical examinations, investigations and treatments shall be provided by the employer at no cost to the worker.

Contingency provisions for health care of workers

37. In addition to the periodic reviews of health as provided in regulation 33, the employer shall make contingency provisions to enable further examination and investigation or decontamination measures or urgent remedial treatment to be undertaken when considered necessary by an approved registered medical practitioner.

Worker to be informed of conclusions of medical examination and investigation

38. Where an approved registered medical practitioner carries out any medical examination and investigation on a worker, he shall inform the worker of the conclusions derived from such medical examination and investigation.

Maintenance of medical records of workers

39. (1) The employer and licensee shall keep and maintain a medical record for his worker up to the date he remains his worker.

(2) The medical record of a worker is confidential and every person who has access to it shall maintain the confidentiality of the record.

(3) The employer shall retain the medical record of a worker in the form and manner as determined by the appropriate authority.

(4) The medical record of a worker shall include the following:

(a) information regarding the general nature of the work involving occupational exposure;

(b) information on doses, exposures and intakes at or above the relevant recording levels and the data upon which the dose assessments have been based;

(c) results of pre-employment medical examination;

(d) results of general health surveillance and periodic reviews of health;

(e) records of any doses, exposures or intakes due to emergency interventions or accidents, which shall be distinguished from doses, exposures or intakes during normal operation including references to reports of any relevant investigations;

(f) for a worker who is or has been occupationally exposed while in the employment of more than one employer, information on the dates of employment with each employer and the doses, exposures and intakes in each employment;

(g) radiation exposure history for a worker who has worked in controlled areas under different licensees; and

(h) results of medical examinations at the termination of employment or retirement.

(5) The employer shall immediately transfer the medical records of his workers to the appropriate authority in all or any of the following circumstances—

(a) after the termination or the retirement of the worker;

(b) when the employer ceases operation.

(6) Notwithstanding subregulation (5), where an employer ceases operations and another employer takes over the operation, the former employer shall transfer all the medical records of the workers to the new employer.

Responsibilities of worker

40. (1) Every worker shall follow all instructions, rules and procedures issued by the licensee for the control of exposure to ionizing radiation and shall refrain from practices or actions that could result in unnecessary exposure to himself or other workers.

(2) Every worker shall use, as instructed by the licensee, all facilities, devices and protective equipment provided by the licensee or the employer to limit any possible exposure.

(3) Every worker shall use approved personnel monitoring devices provided by the licensee or the employer for assessing exposure.

(4) No worker, unless duly authorized by the licensee, shall interfere with, remove, alter or displace any safety device or other equipment furnished for his protection or the protection of others, or interfere with any method or process adopted for the control of exposure to ionizing radiation.

(5) Every worker shall take all reasonable precautions to prevent damage to such equipment furnished under subregulation (4) and to keep it in a good operating condition.

(6) Every worker shall immediately report all accidental exposures or intakes or any suspected exposure or intake of radioactive material, nuclear material or prescribed substance to his supervisor or the radiation protection officer or the qualified expert.

(7) Every worker shall immediately report any damage to or malfunction of any safety equipment to his supervisor or the radiation protection officer or the qualified expert.

(8) Every female worker shall, as soon as she suspects that she is pregnant, seek confirmation of such suspected pregnancy from any approved registered medical practitioner.

(9) Every female worker who is confirmed to be pregnant by an approved registered medical practitioner shall inform her employer or licensee as soon as practicable, so that appropriate measures may be taken to provide the level of protection as specified in subregulation 8(5).

PART IV

MEDICAL EXPOSURE

Responsibilities of licensee or employer

41. Every licensee or employer shall ensure that—

(a) no patient is administered with a diagnostic or therapeutic medical exposure unless the exposure is prescribed by an approved registered medical practitioner;

(b) an approved registered medical practitioner is assigned with the primary task and obligation of ensuring overall patient protection and safety in the prescription of, and during the delivery of, diagnostic or therapeutic medical exposure to the patient;

(c) an appropriate healthcare professional who is adequately trained to discharge assigned tasks to the patients in the conduct of the diagnostic or therapeutic procedures that the approved registered medical practitioner prescribes, is available;

(d) for diagnostic uses of radiation, the quality assurance programme specified by the appropriate authority is conducted by or under the supervision of a qualified expert in medical physics;

(e) for therapeutic uses of radiation including teletherapy and brachytherapy, the calibration, dosimetry and quality assurance programme specified by the appropriate authority is conducted by or under the supervision of a qualified expert in medical physics;

(f) subregulations 9(5) and (6) are complied with; and

(g) appropriate actions are taken to ensure compliance with the requirements of these Regulations in respect of protection and safety of patients upon being informed by an approved registered medical practitioner of any deficiency or need to comply with the dose requirements as specified in these Regulations.

Justification of medical exposure

42. (1) The medical exposure shall be justified by weighing the diagnostic or therapeutic benefits produced by the exposure against the radiation detriment caused, taking into account the benefits and risks of other available techniques that do not involve medical exposure.

(2) Any radiological examination for occupational, legal or health insurance purposes that is undertaken without reference to clinical indications shall be deemed to be unjustified unless—

(a) it is expected to provide useful information on the health of the individual; or

(b) the specified type of radiological examination is justified by the person requesting the examination and is approved by an approved registered medical practitioner.

(3) The mass screening of population groups involving medical exposure is deemed to be unjustified unless the expected advantages for the individuals examined or for the population as a whole are sufficient to compensate for the economic and social costs, including the radiation detriment from such exposure.

(4) In the justification of the potential of the mass screening procedure of population groups for detecting disease, account shall be taken of—

(a) the likelihood of effective treatment of cases detected; and

(b) the advantages to the community from the control of the disease.

(5) The medical exposure of humans for medical research is deemed to be unjustified unless it is—

(a) in accordance with the provisions of the Helsinki Declaration as specified in the Fifth Schedule; and

(b) approved by the relevant appropriate authority.

(6) The radiological examination for theft detection purposes are deemed to be unjustified, but if conducted, it shall not be considered as medical exposure and shall comply with the requirements as specified for occupational exposure and public exposure under Parts III and V, respectively.

Optimization of protection from medical exposure

43. (1) The requirements in respect of the optimization of protection from medical exposure shall be considered to be in addition to the optimization of protection and safety from exposure as specified in regulation 5.

(2) The requirements of the optimization of protection from medical exposure shall include—

(a) design considerations as specified in regulation 44;

(b) operational considerations for diagnostic exposure as specified in regulation 48;

(c) operational considerations for nuclear medicine exposure as specified in regulation 49;

(d) operational considerations for therapeutic exposure as specified in regulation 50;

(e) calibration of radiation source and equipment as specified in regulation 51;

(f) clinical dosimetry as specified in regulation 52; and

(g) quality assurance for medical exposure as specified in regulation 53.

Design consideration

44. In designing any installation or facilities for radiation sources and equipment used in medical exposure, the licensee shall take into consideration the following:

(a) the general requirements as specified in regulation 45;

(b) the requirements for irradiating apparatus and equipment using sealed sources for diagnostic radiology as specified in regulation 46; and

(c) the requirements for irradiating apparatus and irradiation installations for radiotherapy as specified in regulation 47.

General requirements

45. (1) The radiological facilities used for medical exposure shall be so designed in accordance with the standard of radiation protection for medical X-ray diagnosis as recognized by the appropriate authority.

(2) The requirements for the safety of radiation sources as specified in these Regulations shall, where appropriate, also apply to radiation sources used in medical exposure.

(3) The equipment used in medical exposure shall be so designed that—

(a) failure of a single component of the system is promptly detectable so that any unplanned medical exposure of patients is minimized; and

(b) the incidence of human error in the delivery of unplanned medical exposure is minimized.

(4) The licensee shall—

(a) take into account information provided by seller of the equipment and identify possible equipment failures and human errors that could result in unplanned medical exposures;

(b) take all reasonable measures to prevent equipment failures and human error, including the selection of suitably qualified workers, the establishment of adequate procedures for the calibration, quality assurance and operation of diagnostic and therapeutic equipment, and provide the workers with appropriate training and periodic retraining in the procedure;

(c) take all reasonable measures to minimize the consequences of equipment failures and human errors that may occur; and

(d) develop appropriate emergency plans as mentioned in regulation 68 in order to respond to any event that may occur.

(5) With regard to equipment consisting of irradiating apparatus and containing sealed sources used for medical exposures, the licensee shall, in co-operation with the seller of the equipment, ensure that—

(a) the equipment conforms to the standards as recognized by the appropriate authority;

(b) the performance specifications, operating and maintenance instructions, including the protection and safety instructions, are provided in the national language and, in any other languages and are in compliance with the relevant standards as determined by the appropriate authority;

(c) where applicable, the operating terminology or its abbreviations and operating values are displayed on the operating consoles;

(d) the radiation beam control mechanisms are provided, including the devices that indicate clearly and in a fail-safe manner whether the beam is switched on or switched off;

(e) as practicable, the exposure is limited to the area being examined or treated by using collimating devices aligned with the radiation beam;

(f) the radiation field within the examination or treatment area without any radiation beam modifiers such as wedges is as uniform as practicable and the non-uniformity, if any, is stated by the seller of the equipment; and

(g) exposure rates outside the examination or treatment area due to radiation leakage or scattering is kept as low as reasonably achievable.

Requirements for irradiating apparatus and equipment using sealed sources for diagnostic radiology

46. The licensee shall, in co-operation with the seller of the equipment and consultants approved by the appropriate authority, ensure that—

(a) the irradiating apparatus system used for diagnostic radiology has been approved by the appropriate authority;

(b) the irradiating apparatus and their accessories are designed and manufactured so as to facilitate the keeping of medical exposures as low as reasonably achievable consistent with obtaining adequate diagnostic information;

(c) the operational parameters for irradiating apparatus such as generating tube potential, filtration, focal spot position, source image receptor distance, field size indication and either tube current and time or their product are clearly and accurately indicated;

(d) the radiographic equipment is provided with devices that automatically terminate the irradiation after a preset time, tube current time product or dose is reached; and

(e) the fluoroscopic equipment is provided with a device that energizes the x-ray tube only when continuously depressed such as a dead man's switch and is equipped with indicators of the elapsed time or entrance surface dose monitors.

Requirements for irradiating apparatus and irradiation installations for radiotherapy

47. The licensee shall, in co-operation with the seller of the equipment and consultants approved by the appropriate authority, ensure that—

(a) the irradiating apparatus and irradiation installations include provisions for selection, reliable indication and confirmation, when appropriate, and to the extent feasible of operational parameters such as the type of radiation, indication of energy, beam modifiers, treatment distance, field size, beam orientation and either treatment time or preset dose;

(b) the irradiation installations using radioactive material be fail-safe in the sense that the radiation source will be automatically shielded in the event of an interruption of power and will remain shielded until the beam control mechanism is re-activated from the control panel;

(c) the high energy radiotherapy equipment has at least two independent fail-safe systems for terminating the irradiation and shall be provided with safety interlocks or other means designed to prevent the machine from operating in a manner other than that selected at the control panel;

(d) the design of safety interlocks are such that operation of the installation during maintenance procedures, if the interlocks are bypassed, can be performed only under direct control of the personnel using appropriate devices, codes or keys;

(e) the radioactive material for either teletherapy or brachytherapy is so constructed that they conform to the definition of a sealed source; and

(f) when appropriate, the monitoring equipment is installed or is available to give warning of an unusual situation in the use of irradiating apparatus and radionuclide therapy equipment.

Operational consideration for diagnostic exposure

48. (1) For diagnostic radiology practices, the licensee shall ensure that—

(a) the exposure of patients is at the minimum level required in order to achieve the intended diagnostic objective;

(b) the relevant information from previous examinations is taken into account in order to avoid unnecessary additional examinations; and

(c) the relevant guidance levels as specified in the Sixth Schedule is taken into account.

(2) The licensee shall ensure that the diagnostic procedure chosen to produce the minimum exposure to patient is consistent with the acceptable image quality and the clinical purpose of the examination.

(3) The licensee shall ensure that the portable and mobile radiological equipment is used only for examinations where it is impractical or not medically acceptable to transfer patients to a stationary radiological installation, and only after proper attention has been given to the radiation protection measures that are required in its use.

(4) The licensee shall ensure that any radiological examination causing exposure to the abdomen or pelvis of women who are pregnant or suspected to be pregnant is avoided, unless there are strong clinical indications for such examinations.

(5) The licensee shall ensure that any diagnostic examination of the abdomen or pelvis of women of reproductive age is planned to deliver the minimum dose to the ovary or to any embryo or foetus that might be present.

(6) The licensee shall ensure that whenever feasible and appropriate, shielding of radiosensitive organs such as gonads, lens of the eye and thyroid is provided.

Operational consideration for nuclear medicine exposure

49. (1) For nuclear medicine diagnostic procedures, the licensee shall ensure that—

(a) the exposure of patients be at the minimum level required in order to achieve the intended diagnostic objective;

(b) the relevant information from previous examinations is taken into account in order to avoid unnecessary additional examinations; and

(c) the relevant guidance levels as specified in Sixth Schedule is taken into account.

(2) The licensee shall ensure that the minimum exposure to the patient is consistent with the acceptable image quality that is achieved by—

(a) the appropriate selection of the best available radiopharmaceuticals and its activity, noting the special requirements for children and for patients with impairment of organ functions;

(b) the use of methods for blocking the uptake in organs not under study and for accelerated excretion when applicable; and

(c) appropriate image acquisition and processing.

(3) The licensee shall ensure that the administration of radionuclides for diagnostic or radiotherapeutic procedures to women who are pregnant or suspected to be pregnant is avoided, unless there are strong clinical indications.

(4) The licensee shall ensure that for lactating mothers, discontinuation of breast-feeding is recommended until the radiopharmaceuticals is no longer secreted in an amount estimated to give an unacceptable effective dose to the child.

(5) The licensee shall ensure that the patient is recommended not to hold a child until the radiopharmaceuticals are no longer present in an amount estimated to give an unacceptable dose to the child.

(6) The licensee shall ensure that the administration of radionuclides to children for diagnostic procedures is carried out only if there is a strong clinical indication, and the amount of activity administered is reduced according to the body weight and the body surface area.

Operational consideration for therapeutic exposure

50. For therapeutic radiology practices, the licensee shall ensure that—

(a) the exposure of normal tissue during radiotherapy is kept as low as reasonably achievable and consistent with delivering the required dose to the planning target volume, and the organ shielding is used when feasible and appropriate;

(b) radiotherapeutic procedures causing exposure to the abdomen or pelvis of women who are pregnant or suspected to be pregnant is avoided, unless there are strong clinical indications for the procedures;

(c) the administration of radionuclides for therapeutic procedures to women who are pregnant or suspected to be pregnant or who are breast-feeding is avoided, unless there are strong clinical indications for the procedures;

(d) any therapeutic procedure for pregnant women shall be planned to deliver the minimum dose to any foetus; and

(e) the patient is informed of possible risks.

Calibration of radiation source and equipment

51. (1) The licensee shall ensure that—

(a) the calibration of radiation sources used for medical exposure is traceable to a standards dosimetry laboratory approved by the appropriate authority; and

(b) the radiotherapy equipment, sealed and unsealed sources are calibrated in accordance with the requirements as determined by the appropriate authority.

(2) The licensee shall ensure that the measuring equipment used in the calibration of a radiation source is calibrated in a standards dosimetry laboratory approved by the appropriate authority.

(3) The licensee shall ensure that calibration is carried out at the time of the commissioning of the radiation equipment and radiation source, after any maintenance procedure that may have an effect on the dosimetry and at the intervals as approved by the appropriate authority.

Clinical dosimetry

52. (1) For clinical dosimetry, the licensee shall ensure that the following items are determined and documented:

(a) in radiological examinations, the representative values for typical sized adult patients of entrance surface doses, dose-area products, dose rates and exposure times, or organ doses;

(b) for each patient treated with external beam radiotherapy equipment, the maximum and minimum absorbed doses to the planning target volume together with the absorbed dose to a relevant point such as the centre of the planning target volume, plus the dose to other relevant points selected by the approved registered medical practitioner prescribing the treatment;

(c) in brachytherapeutic treatment performed with sealed sources, the absorbed dose at selected relevant points in each patient;

(d) in diagnosis or treatment with unsealed sources, the representative absorbed dose to patients; and

(e) in all radiotherapeutic treatment, the absorbed doses to the relevant organs.

(2) In radiotherapeutic treatments, the licensee shall ensure that—

(a) the prescribed absorbed dose at the beam quality prescribed by the radiotherapist; and

(b) the doses to other tissues and organs,

is minimized.

Quality assurance for medical exposure

53. (1) In addition to applying the relevant requirements for quality assurance under this Part, the licensee shall establish a comprehensive quality assurance programme for medical exposure with the participation of appropriate qualified experts in the relevant fields as specified by the appropriate authority.

(2) The quality assurance programmes for medical exposure shall include—

(a) the measurement of the physical parameters of the irradiating apparatus, imaging devices and irradiation installations at the time of commissioning and periodically after the commissioning;

(b) verification of the appropriate physical and clinical factors used in patient diagnosis or treatment;

(c) written records of relevant procedures and results;

(d) verification of the appropriate calibration and conditions of operation of dosimetry and monitoring equipment; and

(e) regular and quality audit reviews of the quality assurance programmes for radiotherapy procedures.

Guidance levels

54. (1) The licensee shall ensure that guidance levels for medical exposure is determined in accordance with this regulation and is used as a guide by approved registered medical practitioners, in order that—

(a) corrective action is taken as necessary if doses or activities fall substantially below the guidance levels and the exposures do not provide useful diagnostic information and do not yield the expected medical benefit to patients; and

(b) review is considered if doses or activities exceed the guidance levels as an input to ensuring optimized protection of patients and maintaining appropriate levels of good practice.

(2) For diagnostic radiology and nuclear medicine examinations, the guidance levels are derived from data obtained from wide scale quality surveys, but in the absence of wide scale quality surveys, the performance of diagnostic radiography and fluoroscopy equipment and of nuclear medicine equipment shall be assessed in comparison with the guidance levels as specified in Tables I to IV of the Sixth Schedule, or any guidance level as determined by the appropriate authority.

(3) The guidance levels referred to in subregulation (2) shall not be regarded as a guide for ensuring optimum performance in all circumstances as account shall be taken of body size and age of a person.

Dose constraints

55. (1) The appropriate authority shall, upon request by the licensee, determine and specify the dose constraints to be applied on a case by case basis in the optimization of protection for persons who are exposed for medical research purposes, if such exposure does not produce direct benefit to the exposed individual.

(2) The licensee shall constrain any dose to a person who knowingly assists in the support of a patient undergoing medical diagnosis or treatment, and to visitors of patients who have received therapeutic amounts of radionuclides or who are being treated with brachytherapy sources, to a level that does not exceed the limit as specified in subregulation 9(5), except in circumstances as specified in subregulation 9(6).

Patient not to be discharged from hospital

56. (1) A patient who has undergone a therapeutic procedure with sealed or unsealed source shall not be discharged from hospital until the activity of radioactive material in the body falls below the guidance level as specified in Table IV of the Sixth Schedule.

(2) The licensee shall ensure that if necessary, the patient referred to subregulation (1) is provided with written instructions relating to contact with other persons and the relevant precautions for radiation protection.

Investigation, notification and reporting of accidental medical exposure

57. (1) The licensee shall notify the appropriate authority of all accidental medical exposures within twenty-four hours after the occurrence of such accidental medical exposures.

(2) The licensee shall immediately investigate the following accidental medical exposures:

(a) therapeutic treatment delivered to either a wrong patient or a wrong tissue, or using a wrong pharmaceutical, or with a dose or dose fractionation differing substantially from the values prescribed by an approved registered medical practitioner, or which may lead to undue acute secondary effects;

(b) diagnostic exposure substantially greater than intended or resulting in doses repeatedly and substantially exceeding the established guidance level as specified in the Sixth Schedule; and

(c) any equipment failure, accident, error, mishap or other unusual occurrence with the potential for causing a patient exposure significantly different from that which is intended.

(3) The licensee shall, with respect to any investigation carried out under subregulation (2)—

(a) calculate or estimate the doses received and their distribution within the patient;

(b) indicate the corrective measures required to prevent recurrence of such an incident;

(c) implement all the corrective measures that are under his responsibility;

(d) submit to the appropriate authority, as soon as possible after the investigation or as otherwise specified by the appropriate authority, a written report within thirty days after the completion of the investigation stating the cause of the accidental medical exposure, including the information as specified in paragraphs *(a)*, *(b)* and *(c)*, as relevant, and any other information as required by the appropriate authority; and

(e) inform the patient and the approved registered medical practitioner about the incident.

Records

58. (1) The licensee shall keep for a period as may be specified by the appropriate authority and make available, when required, the following records:

(a) in diagnostic radiology, necessary information to allow retrospective dose assessment, including the number of exposures and the duration of fluoroscopic examinations;

(b) in nuclear medicine, types of radiopharmaceuticals administered and their activities;

(c) in radiation therapy—

(i) a description of the planning target volume;

(ii) the dose to the centre of the planning target volume;

(iii) the maximum and minimum doses delivered to the planning target volume;

(iv) the doses to other relevant organs;

(v) the dose fractionation; and

(vi) the overall treatment time; and

(d) the exposure of volunteers in medical research.

(2) The licensee shall keep and make available, when required by the appropriate authority, the results of the calibrations and periodic checks of the relevant physical and clinical parameters selected during treatments.

PART V

PUBLIC EXPOSURE

Protection of exposure to public

59. (1) The licensee shall be responsible, in respect of any radiation source under his supervision, for—

(a) the establishment, implementation and maintenance of protection and safety policies, procedures and organizational arrangements in relation to members of the public;

(b) the optimization of protection and the limitation of the normal exposure of the relevant critical group;

(c) measures for ensuring safety of the radiation source;

(d) the appropriate protection and safety training and retraining of workers involved in the protection of the public as required under these Regulations to ensure the necessary level of competency;

(e) appropriate monitoring equipment and surveillance programmes to assess public exposure to the satisfaction of the appropriate authority;

(f) keeping and maintaining adequate records of the surveillance and monitoring required by the appropriate authority; and

(g) emergency plans or procedures, commensurate with the nature and magnitude of the risk involved and kept ready to actuate as determined by the appropriate authority.

(2) The licensee shall be responsible for ensuring that the optimization process, which is carried out for measures to control radioactive discharge, is subjected to dose constraints as approved by the appropriate authority by taking into account—

(a) the dose contribution from other radiation sources and practices;

(b) the potential change in any condition that may affect public exposure;

(c) current good practice in the operation of similar radiation sources or practices; and

(d) any uncertainties in the assessment of exposure, especially in potential contributions to the exposures if the radiation source and the critical group are separated in distance or time.

Control of visitors

60. The licensee shall—

(a) ensure that every visitor to a controlled area is accompanied by a person who has knowledge about radiation protection and safety measures for that area;

(b) provide adequate information and instructions to visitors before they enter a controlled area to ensure appropriate protection of the visitors; and

(c) ensure adequate control over the entry of visitors to any supervised area.

Control of radiation source in respect of public

61. (1) The licensee shall ensure, for any radiation source that emits external radiation which can cause exposure to the public—

(a) that prior to the installation and commissioning of the radiation source, the floor plans and equipment arrangement for all new installations and all significant modifications to existing installations utilizing such radiation sources are subject to review and approval by the appropriate authority;

(b) that specific dose constraints for the operation of such radiation source are established to the satisfaction of the appropriate authority; and

(c) that shielding and other protective measures that are optimized in accordance with these Regulations are provided in order to restrict public exposure.

(2) The licensee shall take appropriate action to ensure that all radioactive contamination in an enclosed space which is accessible to the public is minimized.

(3) The licensee shall establish specific containment provisions for the construction and operation of a radiation source to avoid the possible spread of contamination into an area which is accessible to the public.

(4) The licensee shall ensure that the activity and volume of any radioactive waste is kept to the minimum practicable, and that the radioactive waste is managed in accordance with the requirements as determined by the appropriate authority.

Control and monitoring of radioactive discharge

62. (1) The licensee shall not discharge any radioactive material, nuclear material or prescribed substance into the environment unless—

(a) the discharge is within the discharge limit as authorized by the appropriate authority;

(b) the discharge is controlled;

(c) the public exposure caused by the discharge does not exceed the limit as specified in regulation 9; and

(d) the control of the discharge is optimized in accordance with regulation 5.

(2) Subject to subregulation 9(1), before discharging any solid, liquid or gaseous radioactive material, nuclear material or prescribed substance into the environment, the licensee shall, as appropriate—

(a) determine the characteristics and activity of the material to be discharged, the potential points of discharge and the methods of discharge;

(b) determine all significant exposure pathways by which discharged radionuclides can cause public exposure by a pre-operational environmental monitoring study for a period of not less than twelve months;

(c) identify the critical pathways;

(d) assess the doses to the critical group of members of the public due to the planned discharges; and

(e) submit the information mentioned in paragraph *(a)*, *(b)*, *(c)* and *(d)* to the appropriate authority for determining the discharge limit and conditions for discharge.

(3) During the operational stage of facilities that involve a radiation source under his responsibility, the licensee shall—

(a) keep all the radioactive discharge as far below the discharge limits as is reasonably achievable;

(b) monitor the discharge of radionuclides with sufficient detail and accuracy to demonstrate compliance with the discharge limits and to permit estimation of the exposure of critical groups;

(c) record the radioactive discharge monitoring results and estimated exposures;

(d) report the radioactive discharge monitoring results to the appropriate authority at the intervals approved by the appropriate authority;

(e) report immediately to the appropriate authority any discharge exceeding the discharge limits in the manner as determined by the appropriate authority; and

(f) whenever the appropriate authority so requires, complement the monitoring of radioactive discharge by environmental monitoring in the manner as approved by the appropriate authority.

(4) The licensee shall, as appropriate and with the consent of the appropriate authority, review and adjust his discharge control measures in the light of operating experience, taking into account any change in the exposure pathways and the composition of critical groups that may affect the assessment of dose due to the discharge.

Monitoring of public exposure

63. The licensee shall, whenever the appropriate authority so requires—

(a) establish and carry out an environmental monitoring programme to assess the public exposure;

(b) keep and maintain appropriate records of the results of the environmental monitoring programme and report a summary of the results to the appropriate authority at the intervals as determined by the appropriate authority;

(c) report immediately to the appropriate authority any significant increase in the environmental radiation fields or the contamination that may be attributed to the radiation or radioactive discharge emitted by the facility that involves a radiation source;

(d) establish and maintain a capability to carry out emergency monitoring in the case of accidental or other unusual events affecting a facility that involves a radiation source or an unexpected increase in radiation fields or radioactive contamination; and

(e) verify the adequacy of the assumptions made for the prior assessment of radiological consequences of the discharge.

Release of radioactive material, nuclear material and prescribed substance

64. The licensee shall not release any radioactive material, nuclear material or prescribed substance for disposal, recycling or re-use without the prior written authorization of the appropriate authority.

PART VI

POTENTIAL EXPOSURE AND SAFETY OF RADIATION SOURCES

Safety procedure for potential exposure

65. (1) The licensee shall ensure the safety of the radiation source and the system associated with the radiation source, which is in his possession or under his control.

(2) The licensee shall conduct either a generic or specific safety assessment for the radiation source which is in his possession or under his control.

(3) The safety assessment shall include, as appropriate, a systematic critical review of—

(a) the nature and magnitude of potential exposures and the likelihood of their occurrence;

(b) the limits and technical conditions for the operation of the radiation source;

(c) the ways in which structures, systems, components and procedures related to radiation protection and safety may fail, singly or in combination, or may lead to potential exposures, and the consequences of such failures;

(d) the ways in which changes in the environment could affect radiation protection and safety;

(e) the ways in which operating procedures related to radiation protection and safety might be erroneous and the consequences of such errors; and

(f) the implication of radiation protection and safety of any proposed modifications.

(4) The safety assessment shall be documented and reviewed when appropriate, in the light of operating experience or when significant modifications are made.

Requirements for radiation source

66. The licensee shall ensure that the radiation source and the system associated with the radiation source are designed, constructed, operated and maintained in a manner that would minimize the magnitude and likelihood of exposure of workers and members of the public.

Prevention of accidents

67. (1) The licensee shall make suitable arrangements to prevent as far as possible, any accident that could reasonably be foreseen for any radiation source which is in his possession or under his control, and to limit the consequences of any accident that occurs.

(2) The licensee shall ensure that—

(a) adequate procedures are established for the control of the radiation source and of any potential accident that is reasonably foreseeable;

(b) the system, components and equipment which are important for safety are inspected and tested in a manner as specified by the appropriate authority for any degradation that could lead to abnormal conditions or inadequate performance;

(c) appropriate maintenance, inspection and testing are carried out without undue occupational exposure;

(d) appropriate automatic systems for safely shutting off or reducing radiation output from the radiation source when the operating conditions exceed the operating ranges are provided; and

(e) a system which can detect and respond immediately to abnormal operating conditions that can significantly affect the protection or safety and to allow for timely corrective action to be taken, is provided.

Emergency plans

68. (1) The licensee shall establish an emergency plan for responding to and correcting every reasonably foreseeable emergency situation involving a radiation source.

(2) Every emergency plan established under subregulation (1) shall be subject to the approval of and the conditions imposed by the appropriate authority.

(3) An emergency plan shall include—

(a) the emergency organization;

(b) allocation of responsibilities for individuals identified in the emergency plan;

(c) identification of the various operating conditions and other conditions of the radiation source which could lead to the need for intervention;

(d) measures to be taken during an emergency;

(e) the establishment of intervention levels for different emergency situations;

(f) a list and description of equipment that is necessary during an emergency;

(g) a description of the public information arrangements in the event of an accident;

(h) protective actions to be taken subsequent to an emergency; and

(i) the criteria for terminating, the measures and protective actions mentioned in paragraph *(d)* and *(h)*, respectively.

(4) The licensee shall ensure that the content, features and extent of emergency plans take into account the results of any accident analysis, operating experience and accidents that have occurred with radiation sources of a similar type.

(5) The licensee shall review and update the emergency plan as determined by the appropriate authority.

(6) The licensee shall provide training for personnel who are or will be involved in implementing the emergency plan.

(7) The emergency plans shall be rehearsed at suitable intervals in conjunction with the relevant authorities.

(8) The licensee shall provide prior information to the members of the public who could be affected by an accident which may occur at his facility.

Accountability for radiation source

69. The licensee shall maintain an accountability system that includes records of—

(a) the location and description of each radiation source which is in his possession or under his control; and

(b) the activity and description of each radioactive material, nuclear material and prescribed substance which is in his possession or under his control.

Security and protection of radiation source

70. The licensee shall take all measures to ensure the security and protection of all radiation sources in his possession or under his control to prevent theft, loss or sabotage.

Notification of theft, loss or sabotage

71. (1) The licensee shall, upon discovering any theft, loss or sabotage of any radiation source in his possession or under his control—

(a) notify the appropriate authority of such theft, loss or sabotage within twenty-four hours after discovering the theft, loss or sabotage; and

(b) submit a complete report of the theft, loss or sabotage in writing to the appropriate authority within thirty days after the notification to the appropriate authority.

(2) The report to be submitted by the licensee under paragraph (1)*(b)* shall contain—

(a) where appropriate, a description of the radiation source, including its kind, quantity and its chemical and physical forms;

(b) a description of the circumstances under which the theft, loss or sabotage occurred;

(c) a statement of the location or probable location of the radiation source;

(d) the possible radiation exposure to individuals, circumstances under which the exposures may occur, and the extent of potential hazard to members of the public;

(e) the actions which have been taken, or will be taken, to recover the radiation source;

(f) the procedures or measures which have been or will be adopted to prevent a recurrence of the theft, loss or sabotage of the radiation source; and

(g) any other information as the licensee deems necessary.

PART VII

INTERVENTION

Requirements for intervention

72. (1) The licensee or employer shall carry out an intervention when—

(a) an emergency arises in which an intervention level established under paragraph 68 (3)*(e)* is or may be exceeded;

(b) the appropriate authority issues a directive in any other temporary exposure situation to reduce or avert temporary exposures; or

(c) the appropriate authority directs that remedial action be taken to reduce or avert chronic exposure due to radioactive residues from previous practices, radon in building or work place, or other chronic exposure situations as specified by the appropriate authority.

(2) The form, extent and duration of any protective actions or remedial actions shall be optimized to produce the maximum nett benefit in the social and economic circumstances.

Intervention in situation which requires protective action

73. (1) The licensee shall notify the appropriate authority immediately when a situation which requires protective action has arisen or is expected to arise, and shall keep the appropriate authority informed of—

(a) the situation as it develops and how it is expected to develop;

(b) the measures taken for the protection of workers and members of the public; and

(c) the exposure that has been incurred and is expected to be incurred.

(2) The licensee shall ensure that adequate provision for generating adequate information is made immediately and shall communicate it to the appropriate authority.

(3) The licensee shall implement the appropriate emergency plan established in accordance with regulation 68, and if necessary, modify the plan to take into account the prevailing circumstances.

(4) The licensee shall take immediate action in any circumstances where the projected dose or the dose rate to any individual may exceed the levels as specified in the Seventh Schedule.

Discontinuous of protective action after accident

74. The licensee may discontinue a protective action when further assessment shows that continuation of the action is no longer justified.

Assessment and monitoring after accident

75. (1) The licensee shall take all reasonable steps to assess the exposure incurred by workers and members of the public as a consequence of an accident involving a radiation source that is in his possession or under his control, and the results of the assessment shall be submitted to the appropriate authority in accordance with regulation 26.

(2) The assessment shall be based on the available information and shall be updated immediately to include any new information.

(3) The licensee shall submit follow-up records of the assessments and their updates, and of the monitoring results for workers, members of the public and the environment, as and when required by the appropriate authority.

Protection for workers undertaking intervention

76. (1) The licensee and employer shall ensure that no worker undertaking an intervention is exposed in excess of the maximum single year dose limit of 50 mSv, except—

(a) for the purpose of saving a life or preventing serious injury;

(b) when undertaking actions intended to avert a large collective dose; or

(c) when undertaking actions to prevent the development of catastrophic conditions.

(2) For the purposes of paragraphs (1)*(b)* and *(c)*, all reasonable efforts shall be made by the licensee and employer to keep doses to workers below twice the maximum single year dose limit as specified in subregulation (1).

(3) Subject to subregulation 76(4), for life saving actions, every effort shall be made to keep doses below ten times the maximum single year dose limit as specified in subregulation (1).

(4) A worker shall only undertake a life saving action in which the doses may reach or exceed ten times the maximum single year dose limit as specified in subregulation (1) when the benefits to others clearly outweigh his own risk.

(5) A worker who acts as a volunteer in an action where the dose may exceed the maximum single year dose limit as specified in subregulation (1) shall be clearly and comprehensively informed in advance by the licensee of the associated health risk, and the licensee shall to the extent feasible inform and demonstrate the necessary actions and the procedures to be carried out in that action.

(6) When the emergency phase of an intervention has ended, all workers undertaking recovery operations shall be subject to the requirements under Parts III.

(7) All reasonable steps shall be taken to provide appropriate protection during emergency intervention and to assess and record the doses received by workers involved.

(8) When the emergency intervention under subregulation (7) has ended, the doses received and the consequent health risk shall be communicated to the workers involved.

(9) A worker who has received emergency exposure shall not be precluded from incurring further occupational exposure, but the provisions of subregulation 23(5) shall be complied with before he is permitted to receive further emergency exposure.

PART VIII

SUBMISSION OF DOCUMENTS

Appropriate authority may require reports and documents

77. (1) The appropriate authority may require the licensee to submit any or all of the followings:

(a) a report on area monitoring;

(b) a report on environmental monitoring;

(c) a report on radioactive discharge;

(d) a report on personnel monitoring;

(e) a report on accidental exposures and emergency exposures;

(f) a report by approved registered medical practitioners;

(g) operational procedures, instructions and manuals;

(h) emergency plans and procedures;

(i) training programmes;

(j) physical protection measures; and

(k) other reports and records as the appropriate authority deems necessary.

(2) When the appropriate authority requires the licensee to submit any report, record or other document under subregulation (1), the licensee shall comply with such requirement.

PART IX

CESSATION OF OPERATIONS, DECOMMISSIONING OR ABANDONMENT OF LICENSED FACILITIES

Cessation of operations

78. (1) The licensee shall not—

(a) cease to operate;

(b) decommission; or

(c) abandon,

his licensed facility that involves a radiation source or radioactive waste management facility, except with the written approval of and in accordance with the instructions of the appropriate authority.

(2) The licensee who intends to cease to operate, decommission or abandon his licensed facility or radioactive waste management facility that involves a radiation source shall notify the appropriate authority in writing—

(a) of the proposed date of the cessation, decommissioning or abandonment; and

(b) of the plans for cessation of operations, decommissioning or abandonment to be undertaken, in the interest of the security of any radioactive material, nuclear material or prescribed substance and of the health and safety of the workers and members of the public.

PART X

GENERAL

Transitional provisions

79. A person who holds a licence issued under the Act in relation to activities involving ionizing radiation that is still in force at the date of commencement of these Regulations shall, within two years from the date of commencement, comply with the requirements under these Regulations.

Revocation

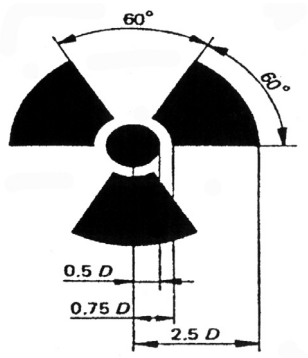
80. The Radiation Protection (Basic Safety Standards) Regulations 1988 [*P.U. (A) 61/1988*] are revoked.

FIRST SCHEDULE

RADIATION SYMBOL

[Subregulation 17(6)]

The radiation symbol shall consist of a three-blade design as shown below using the radiation caution colours, that is black for the three-blade design and yellow for the background. *D* is the diameter of the central circle. For warning signs, the minimum value of *D* shall be 8 millimetres.



SECOND SCHEDULE

EQUIVALENT DOSE AND EFFECTIVE DOSE

[regulation 13]

PART I

Methods of Evaluating Equivalent Dose

(1) Equivalent dose ($H_{T,R}$) shall be equal to the product of the absorbed dose, ($D_{T,R}$), the unit of absorbed dose is Joule per kilogram ($J.kg^{-1}$), termed the gray (Gy), delivered by the radiation type *R* averaged over a tissue or organ T, an radiation weighting factor W_R for radiation type *R*, represented by the formula—

$$H_{T,R} = D_{T,R} \cdot W_R;$$

and when the radiation field is composed of different radiation types with different values of W_R, the unit equivalent dose is $J.kg^{-1}$, termed the Sievert (Sv), represented by the formula—

$$H_T = \sum_R W_R \bullet D_{T,R}$$

The W_R value for the various types of ionizing radiation shall be as specified in Table I.

Table I

RADIATION WEIGHTING FACTOR VALUES, (W_R)

Type and energy range of radiation	*Radiation weighting factor W_R*
Photons, all energies	1
Electrons and muons, all energies	1
Neutrons, energy <10keV	5
10keV ke 100keV	10
>100keV ke 2MeV	20
>20MeV ke 20MeV	10
>20 MeV	5
Protons, other than recoil protons, energy >2MeV	5
Alpha particles, fission fragments, heavy nuclei	20

If calculation of the radiation weighting factor for neutrons requires a continuous function, the following approximation can be used, where E is the neutron energy in MeV:

$$W_R = 5 + 17\, e^{-(\ln (2E))^2 /6}$$

For radiation types and energies not included in Table I, W_R can be taken to equal to Q at 10 millimetres depth and can be obtained as follows:

$$\overline{Q} = \frac{1}{D} \int_0^\infty Q(L) D_L \, dL$$

where D is the absorbed dose, $Q(L)$ is the quality factor in terms of the unrestricted linear energy transfer L in water and D_L is the distribution of D in L.

$$Q(L) = \begin{cases} 1 & \text{for } L \le 10 \\ 0.32L - 2.2 & \text{for } 10 < L < 100 \\ 300/\sqrt{L} & \text{for } L \ge 100 \end{cases}$$

where L is expressed in $keV.\mu m^{-1}$.

PART II

Methods of Evaluating Effective Dose

(2) Effective dose *(E)* shall be equal to the sum of the tissue equivalent doses *(H_T)* where each of the dose multiplied by the appropriate tissue weighting factor (W_T) for tissue (T), the unit effective dose is Joule per kilogram ($J.kg^{-1}$), which is termed the Sievert (Sv), represented by the formula—

$$E = \sum_{T} W_T \bullet H_T$$

The values of W_T for various tissues shall be as specified in Table II.

Table II

TISSUE WEIGHTING FACTOR (W_T) FOR VARIOUS TISSUES

Tissue or organ	*Tissue weighting factor W_T*
Gonads	0.20
Bone marrow (red)	0.12
Colon [a]	0.12
Lung	0.12
Stomach	0.12
Bladder	0.05
Breast	0.05
Liver	0.05
Oesophagus	0.05
Thyroid	0.05
Skin	0.01
Bone surface	0.01
Remainder [b]	0.05

[a] The weighting factor for the colon is applied to the mass average of the equivalent does in the walls of the upper and lower large intestine

[b] For the purposes of calculation, the remainder is composed of adrenal glands, brain, extrathoracic region, small intestine, kidney, muscle, pancreas, spleen, thymus and uterus. In those exceptional cases in which the most exposed remainder tissue receives the highest committed equivalent dose of all organs, a weighting factor of 0.025 to the average dose in the rest of the tissue or organ.

THIRD SCHEDULE

COMPLIANCE WITH DOSE LIMITS

[regulations 8, 9, 10 and 11]

PART I

Verification of Compliance with Dose Limits

(1) For the purposes of this Schedule, the annual dose limits apply to the sum of the relevant doses from external exposures in the specified period and the relevant committed doses from intakes in the same period, where the period of time for calculating the committed doses shall normally be 50 years for intakes by adults and to age 70 years for intakes by children.

(2) For the purposes of demonstrating compliance with annual dose limits, the sum of personal dose equivalent from external expose to penetrating radiation[1] in the specified period and the committed equivalent does or committed effective dose, as appropriate, from the intakes of radioactive material in the same period shall be used.

(3) The requirements for the application of the annual dose limits on effective dose shall be determined by any one of the following methods:

(a) by comparing the total effective dose with the relevant dose limit, where the total effective dose E_T is calculated according to the formula—

$$E_T = H_p(d) + \sum_j e(g)_{j,ing} I_{j,ing} + \sum_j e(g)_{j,inh}\ I_{j,inh}$$

where $H_p(d)$ is the personal dose equivalent from penetrating radiation during the year; $e(g)_{j,ing}$ and $e(g)_{j,inh}$, respectively are the committed effective dose per ingested or inhaled unit intake for radionuclide j by the group of age g; and $I_{j,ing}$ and $I_{j,inh}$, respectively are the intake via ingestion or inhalation of radionuclide during the same period;

(b) by satisfying the following condition:

$$\frac{H_p(d)}{DL} + \sum_j \frac{I_{j,ing}}{I_{j,ingL}} + \sum_j \frac{I_{j,inh}}{I_{j,inh\ L}} \leq 1$$

where DL is the relevant limit on effective dose, and $I_{j,ingL}$ and $I_{j,inh,L}$ respectively are the annual limit of intake (ALI)[2] via ingestion or inhalation of radionuclide j (that is the intake by the relevant route of radionuclide j that leads to the relevant limit on effective dose); or

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[1] The use of the operational quantity personel dose equivalent, $H_P(d)$, for this purpose is appropriate for all radiations except neutrons in the range 1 eV to 30 keV. In situations in which neutrons in this energy range contribute a major fraction of the effective dose, additional information may be necessary to determine the relationship between the value of the personal dose equivalents and the corresponding effective dose.

[2] "annual limit on intake" (ALI) means a secondary limit for occupational exposure where the intake by inhalation, ingestion or through the skin of a given radionuclide in a year by the reference man which would result in a committed dose equal to the relevant dose limit which is expressed in units of activity.

(c) by any other method approved by the appropriate authority.

(4) Except for radon progeny and thoron progeny, the values of the committed effective dose per unit intake for ingestion $e(g)_{j,ing}$ and inhalation $e(g)_{j,inh}$ are given for occupational exposure in Table III and for public exposure in Tables VI and VII. The values of $I_{j,L}$ may be obtained from the relevant values of the committed effective dose per unit intake by the following relationship:

$$I_{j,L} = \frac{DL}{e_j}$$

where *DL* is the relevant annual dose limit on effective dose and e_j is the relevant value of dose per unit intake for radionuclide *j* from Tables III, VI or VII as appropriate.

(5) The committed effective dose per unit intake via ingestion corresponding to different gut transfer factors f_1, (that is the proportion of the intake transferred to body fluids in the gut) for various chemical forms; and the committed effective dose per unit intake via inhalation for the default lung absorption types (fast, moderate and slow) given in the new model for the respiratory tract, with appropriate f_1, values for the component of the intake cleared from the lung from the gastrointestinal tract and the ingestion and inhalation dose coefficients of each radionuclide for occupational exposure as shown in Table III.

(6) In the case of occupational exposure, the assumptions of$_{j,L}$ can be used as an ALI value and Tables IV and V show the f_1 values and the lung absorption types for various chemical forms of the elements respectively, on the basis that inhalation classes are given as days, weeks and years.

(7) In the case of public exposure, the dose coefficients for ingestion corresponding to different gut transfer factors f_1 for intakes of radionuclides by members of the public are shown in Table VI, where the f_1 values have been applied to three-month old infants. Table VII shows the dose coefficients for inhalation for the members of the public for different lung absorption types (F, M and S) and the lung absorption types and biokinetic models for systemic activity used as shown in Table VIII.

(8) The values of dose coefficients for gases and vapours for infants, children and adults and the values of effective dose rates for exposure of adults to inert gases which are applicable for both workers and members of the public are shown in Table IX and Table X, respectively.

(9) For radon progeny exposure by using a conversion coefficient of 1.4 millisieverts per $mJ.h.m^{-3}$, the dose limits referred to in regulation 8 are 20 millisieverts which corresponds with 14 $mJ.h.m^{-3}$ (4 working level months (WLMs)) and 50 millisieverts which corresponds with 35 $mJ.h.m^{-3}$ (10 WLMs).

(10) For exposure to radon progeny and thoron progeny $I_{j,inh}$ and $I_{j,jnh,L}$ as stated in paragraph (3) of this Schedule, it can be expressed in terms of potential alpha energy intake, using the relevant limits as specified in Tables I and II alternatively; $I_{j,inh}$ and $I_{j,inh,L}$ can be replaced by potential alpha energy exposure which is expressed in WLMs using the relevant limits as specified in Table I and Table II.

(11) The committed equivalent dose in an organ or tissue due to the intake by a given route of any radionuclide can be determined—

(a) by multiplying the estimated intake of the radionuclide through such a route by the appropriate value of the committed equivalent dose per unit intake corresponding with such an organ or tissue; or

(b) by any other method approved by the appropriate authority.

Table I

LIMITS ON INTAKE AND EXPOSURE
FOR RADON PROGENY AND THORON PROGENY

Quantity	*Unit*	*Value of radon progeny*[3]	*Value of thoron progeny*[4]
Annual average over 5 years			
Potential -energy intake	J	0.017	0.051
Potential -energy exposure	$J.h.m^{-3}$[d]	0.0140	0.042
	WLM [5,6]	4.0	12
Maximum in a single year			
Potential -energy intake	J	0.042	0.127
Potential -energy exposure	$J.h.m^{-3}$[d]	0.035	0.105
	WLM	10.0	30

[3] Radon progeny: short lived decay products of ^{222}Rn: ^{218}Po(RaA), ^{214}Bi(RaC), ^{214}Pb(RaB) and ^{214}Po(RaC').

[4] Thoron progeny: short lived decay products of ^{220}Rn: ^{216}Po(ThA), ^{212}Pb(ThB), ^{212}Bi(ThC), ^{212}Po(ThC') and $^{208}T1$(ThC").

[5] Working level month (WLM): A unit of exposure to radon progeny or thoron progeny. One working level month is 3.54 $mJ.h.m^{-3}$ or 170 WL•h, where one working level (WL) is any combination of radon progeny or thoron in one litre of air that will result in the ultimate emmission of 1.3 x 10^5 MeV of alpha energy. In S1, units the WL is equivalents 2.1 x 10^{-5} $J.m^{-3}$.

[6] Conversion coefficients as in Table II.

"potential alpha energy of radon progeny and thoron progeny" means the total alpha energy ultimately emitted during the decay of radon progeny and thoron progeny through the decay chain, up to but does not include Lead–210 for progeny of radon–222 and to stable Lead–208 for progeny of radon–200.

Table II

CONVERSION COEFFICIENTS FOR UNITS RADON AND RADON PROGENY

Quantity	*Unit*	*Value*
Radon progeny conversion	$(mJ.h.m^{-3})$ per WLM	3.54
Radon progeny/radon exposure	$(mJ.h.m^{-3})$ per $(Bq.h.m^{-3})$	2.22×10^{-6}
Conversions (equilibrium factor 0.4)	WLM per $(Bq.h.m^{-3})$	6.28×10^{-7}
Annual exposure to radon progeny per unit radon ceoncetration [a]:		
at home	$(mJ.h.m^{-3})$ per $(Bq.h.m^{-3})$	1.56×10^{-2}
at work	$(mJ.h.m^{-3})$ per $(Bq.h.m^{-3})$	4.45×10^{-3}
at home	WLM per $(Bq.h.m^{-3})$	4.40×10^{-3}
at work	WLM per $(Bq.h.m^{-3})$	1.26×10^{-3}
Dose conversion convention, effective dose per unit exposure to radon progeny:		
at home	mSv per $(mJ.h.m^{-3})$	1.1
at work	mSv per $(mJ.h.m^{-3})$	1.4
Dose conversion convention, effective dose per unit exposure to radon progeny:	mSv per WLM	4
at work	mSv per WLM	5
Radon progeny/radon concentration conversion		
with equilibrium factor F = 0.4	WL per $(Bq.m^{-3})$	1.07×10^{-4}
in general	WL per $(Bq.m^{-3})$	2.67×10^{-4}

[a] Assuming 7000 hours per year indoors or 2000 hours per year at work and equilibrium factor of 0.4.

Table III

COMMITTED EFFECTIVE DOSE PER UNIT INTAKE e(g)
VIA INHALATION AND INGESTION ($Sv.Bq^{-1}$) FOR WORKERS

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Hydrogen							
Tritiated Water	12.3 a					1.000	1.8×10^{-11}
OBT [a]	12.3 a					1.000	4.2×10^{-11}
Beryllium							
Be-7	53.3 d	M	0.005	4.8×10^{-11}	4.3×10^{-11}	0.005	2.8×10^{-11}
		S	0.005	5.2×10^{-11}	4.6×10^{-11}		
Be-10	1.60×10^{6} a	M	0.005	9.1×10^{-9}	6.7×10^{-9}	0.005	1.1×10^{-9}
		S	0.005	3.2×10^{-8}	1.9×10^{-8}		
Carbon							
C-11	0.340 h					1.000	2.4×10^{-11}
C-14	5.73×10^{3} a					1.000	5.8×10^{-10}
Fluorine							
F-18	1.83 h	F	1.000	3.0×10^{-11}	5.4×10^{-11}	1.000	4.9×10^{-11}
		M	1.000	5.7×10^{-11}	8.9×10^{-11}		
		S	1.000	6.0×10^{-11}	9.3×10^{-11}		
Sodium							
Na-22	2.60 a	F	1.000	1.3×10^{-9}	2.0×10^{-9}	1.000	3.2×10^{-9}
Na-24	15.0 h	F	1.000	2.9×10^{-10}	5.3×10^{-10}	1.000	4.3×10^{-10}

Notes: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

[a] OBT: originally bound tritium

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Magnesium							
Mg-28	20.9 h	F	0.500	6.4×10^{-10}	1.1×10^{-9}	0.500	2.2×10^{-9}
		M	0.500	1.2×10^{-9}	1.7×10^{-9}		
Aluminium							
A1-26	7.16×10^{5} a	F	0.010	1.1×10^{-8}	1.4×10^{-8}	0.010	3.5×10^{-9}
		M	0.010	1.8×10^{-8}	1.2×10^{-8}		
Silicon							
Si-31	2.62 h	F	0.010	2.9×10^{-11}	5.1×10^{-11}	0.010	1.6×10^{-10}
		M	0.010	7.5×10^{-11}	1.1×10^{-10}		
		S	0.010	8.0×10^{-11}	1.1×10^{-10}		
Si-32	4.50×10^{2} a	F	0.010	3.2×10^{-9}	3.7×10^{-9}	0.010	5.6×10^{-10}
		M	0.010	1.5×10^{-8}	9.6×10^{-9}		
		S	0.010	1.1×10^{-7}	5.5×10^{-8}		
Phosphorus							
P-32	14.3 d	F	0.800	8.0×10^{-10}	1.1×10^{-9}	0.800	2.4×10^{-9}
		M	0.800	3.2×10^{-9}	2.9×10^{-9}		
P-33	25.4 d	F	0.800	9.6×10^{-11}	1.4×10^{-10}	0.800	2.4×10^{-10}
		M	0.800	1.4×10^{-9}	1.3×10^{-9}		
Sulphur							
S-35	87.4 d	F	0.800	5.3×10^{-11}	8.0×10^{-11}	0.800	1.4×10^{-10}
(inorganic)		M	0.800	1.3×10^{-9}	1.1×10^{-9}	0.100	1.9×10^{-10}
S-35	87.4 d					1.000	7.7×10^{-10}
(organic)							

Chlorine							
Cl-36	3.01 x 10^5 a	F	1.000	3.4 x 10^{-10}	4.9 x 10^{-10}	1.000	9.3 x 10^{-10}
		M	1.000	6.9 x 10^{-9}	5.1 x 10^{-9}		
Cl-38	0.620 h	F	1.000	2.7 x 10^{-11}	4.6 x 10^{-11}	1.000	1.2 x 10^{-10}
		M	1.000	4.7 x 10^{-11}	7.3 x 10^{-11}		
Cl-39	0.927 h	F	1.000	2.7 x 10^{-11}	4.8 x 10^{-11}	1.000	8.5 x 10^{-11}
		M	1.000	4.8 x 10^{-11}	7.6 x 10^{-11}		
Potassium							
K-40	1.28 x 10^9 a	F	1.000	2.1 x 10^{-9}	3.0 x 10^{-9}	1.000	6.2 x 10^{-9}
K-42	12.4 h	F	1.000	1.3 x 10^{-10}	2.0 x 10^{-10}	1.000	4.3 x 10^{-10}
K-43	22.6 h	F	1.000	1.5 x 10^{-10}	2.6 x 10^{-10}	1.000	2.5 x 10^{-10}
K-44	0.369 h	F	1.000	2.1 x 10^{-11}	3.7 x 10^{-11}	1.000	8.4 x 10^{-11}
K-45	0.333 h	F	1.000	1.6 x 10^{-11}	2.8 x 10^{-11}	1.000	5.4 x 10^{-11}
Calcium							
Ca-41	1.40 x 10^5 a	M	0.300	1.7 x 10^{-10}	1.9 x 10^{-10}	0.300	2.9 x 10^{-10}
Ca-45	163 d	M	0.300	2.7 x 10^{-9}	2.3 x 10^{-9}	0.300	7.6 x 10^{-10}
Ca-47	4.53 d	M	0.300	1.8 x 10^{-9}	2.1 x 10^{-9}	0.300	1.6 x 10^{-9}
Scandium							
Sc-43	3.89 h	S	1.0 x 10^{-4}	1.2 x 10^{-10}	1.8 x 10^{-10}	1.0 x 10^{-4}	1.9 x 10^{-10}
Sc-44	3.93 h	S	1.0 x 10^{-4}	1.9 x 10^{-10}	3.0 x 10^{-10}	1.0 x 10^{-4}	3.5 x 10^{-10}
Sc-44m	2.44 d	S	1.0 x 10^{-4}	1.5 x 10^{-9}	2.0 x 10^{-9}	1.0 x 10^{-4}	2.4 x 10^{-9}
Sc-46	83.8 d	S	1.0 x 10^{-4}	6.4 x 10^{-9}	4.8 x 10^{-9}	1.0 x 10^{-4}	1.5 x 10^{-9}
Sc-47	3.35 d	S	1.0 x 10^{-4}	7.0 x 10^{-10}	7.3 x 10^{-10}	1.0 x 10^{-4}	5.4 x 10^{-10}
Sc-48	1.82 d	S	1.0 x 10^{-4}	1.1 x 10^{-9}	1.6 x 10^{-9}	1.0 x 10^{-4}	1.7 x 10^{-9}
Sc-49	0.956 h	S	1.0 x 10^{-4}	4.1 x 10^{-11}	6.1 x 10^{-11}	1.0 x 10^{-4}	8.2 x 10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Titanium							
Ti-44	47.3 a	F	0.010	6.1×10^{-8}	7.2×10^{-8}	0.010	5.8×10^{-9}
		M	0.010	4.0×10^{-8}	2.7×10^{-8}		
		S	0.010	1.2×10^{-7}	6.2×10^{-8}		
Ti-45	3.08 h	F	0.010	4.6×10^{-11}	8.3×10^{-11}	0.010	1.5×10^{-10}
		M	0.010	9.1×10^{-11}	1.4×10^{-10}		
		S	0.010	9.6×10^{-11}	1.5×10^{-10}		
Vanadium							
V-47	0.543 h	F	0.010	1.9×10^{-11}	3.2×10^{-11}	0.010	6.3×10^{-11}
		M	0.010	3.1×10^{-11}	5.0×10^{-11}		
V-48	16.2 d	F	0.010	1.1×10^{-9}	1.7×10^{-9}	0.010	2.0×10^{-9}
		M	0.010	2.3×10^{-9}	2.7×10^{-9}		
V-49	330 d	F	0.010	2.1×10^{-11}	2.6×10^{-11}	0.010	1.8×10^{-11}
		M	0.010	3.2×10^{-11}	2.3×10^{-11}		
Chromium							
Cr-48	23.0 h	F	0.100	1.0×10^{-10}	1.7×10^{-10}	0.100	2.0×10^{-10}
		M	0.100	2.0×10^{-10}	2.3×10^{-10}	0.010	2.0×10^{-10}
		S	0.100	2.2×10^{-10}	2.5×10^{-10}		
Cr-49	0.702 h	F	0.100	2.0×10^{-11}	3.5×10^{-11}	0.100	6.1×10^{-11}
		M	0.100	3.5×10^{-11}	5.6×10^{-11}	0.010	6.1×10^{-11}
		S	0.100	3.7×10^{-11}	5.9×10^{-11}		
Cr-51	27.7 d	F	0.100	2.1×10^{-11}	3.0×10^{-11}	0.100	3.8×10^{-11}
		M	0.100	3.1×10^{-11}	3.4×10^{-11}	0.010	3.7×10^{-11}
		S	0.100	3.6×10^{-11}	3.6×10^{-11}		

Manganese							
Mn-51	0.770 h	F	0.100	2.4×10^{-11}	4.2×10^{-11}	0.100	9.3×10^{-11}
		M	0.100	4.3×10^{-11}	6.8×10^{-11}		
Mn-52	5.59 h	F	0.100	9.9×10^{-10}	1.6×10^{-9}	0.100	1.8×10^{-9}
		M	0.100	1.4×10^{-9}	1.8×10^{-9}		
Mn-52m	0.352 h	F	0.100	2.0×10^{-11}	3.5×10^{-11}	0.100	6.9×10^{-11}
		M	0.100	3.0×10^{-11}	5.0×10^{-11}		
Mn-53	3.70×10^{6} a	F	0.100	2.9×10^{-11}	3.6×10^{-11}	0.100	3.0×10^{-11}
		M	0.100	5.2×10^{-11}	3.6×10^{-11}		
Mn-54	312 d	F	0.100	8.7×10^{-10}	1.1×10^{-9}	0.100	7.1×10^{-10}
		M	0.100	1.5×10^{-9}	1.2×10^{-9}		
Mn-56	2.58 h	F	0.100	6.9×10^{-11}	1.2×10^{-10}	0.100	2.5×10^{-10}
		M	0.100	1.3×10^{-10}	2.0×10^{-10}		
Iron							
Fe-52	8.28 h	F	0.100	4.1×10^{-10}	6.9×10^{-10}	0.100	1.4×10^{-9}
		M	0.100	6.3×10^{-10}	9.5×10^{-10}		
Fe-55	2.70 a	F	0.100	7.7×10^{-10}	9.2×10^{-10}	0.100	3.3×10^{-10}
		M	0.100	3.7×10^{-10}	3.3×10^{-10}		
Fe-59	44.5 d	F	0.100	2.2×10^{-9}	3.0×10^{-9}	0.100	1.8×10^{-9}
		M	0.100	3.5×10^{-9}	3.2×10^{-9}		
Fe-60	1.00×10^{5} a	F	0.100	2.8×10^{-7}	3.3×10^{-7}	0.100	1.1×10^{-7}
		M	0.100	1.3×10^{-7}	1.2×10^{-7}		
Cobalt							
Co-55	17.5 h	M	0.100	5.1×10^{-10}	7.8×10^{-10}	0.100	1.0×10^{-9}
		S	0.050	5.5×10^{-10}	8.3×10^{-10}	0.050	1.1×10^{-9}
Co-56	78.7 d	M	0.100	4.6×10^{-9}	4.0×10^{-9}	0.100	2.5×10^{-9}
		S	0.050	6.3×10^{-9}	4.9×10^{-9}	0.050	2.3×10^{-9}
Co-57	271 d	M	0.100	5.2×10^{-10}	3.9×10^{-10}	0.100	2.1×10^{-10}
		S	0.050	9.4×10^{-10}	6.0×10^{-10}	0.050	1.9×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Co-58	70.8 d	M	0.100	1.5×10^{-9}	1.4×10^{-9}	0.100	7.4×10^{-10}
		S	0.050	2.0×10^{-9}	1.7×10^{-9}	0.050	7.0×10^{-10}
Co-58m	9.15 h	M	0.100	1.3×10^{-11}	1.5×10^{-11}	0.100	2.4×10^{-11}
		S	0.050	1.6×10^{-11}	1.7×10^{-11}	0.050	2.4×10^{-11}
Co-60	5.27 a	M	0.100	9.6×10^{-9}	7.1×10^{-9}	0.100	3.4×10^{-9}
		S	0.050	2.9×10^{-8}	1.7×10^{-8}	0.050	2.5×10^{-9}
Co-60m	0.174 h	M	0.100	1.1×10^{-12}	1.2×10^{-12}	0.100	1.7×10^{-12}
		S	0.050	1.3×10^{-12}	1.2×10^{-12}	0.050	1.7×10^{-12}
Co-61	1.65 h	M	0.100	4.8×10^{-11}	7.1×10^{-11}	0.100	7.4×10^{-11}
		S	0.050	5.1×10^{-11}	7.5×10^{-11}	0.050	7.4×10^{-11}
Co-62m	0.232 h	M	0.100	2.1×10^{-11}	3.6×10^{-11}	0.100	4.7×10^{-11}
		S	0.050	2.2×10^{-11}	3.7×10^{-11}	0.050	4.7×10^{-11}
Nickel							
Ni-56	6.10 d	F	0.050	5.1×10^{-10}	7.9×10^{-10}	0.050	8.6×10^{-10}
		M	0.050	8.6×10^{-10}	9.6×10^{-10}		
Ni-57	1.50 d	F	0.050	2.8×10^{-10}	5.0×10^{-10}	0.050	8.7×10^{-10}
		M	0.050	5.1×10^{-10}	7.6×10^{-10}		
Ni-59	7.50×10^4 a	F	0.050	1.8×10^{-10}	2.2×10^{-10}	0.050	6.3×10^{-11}
		M	0.050	1.3×10^{-10}	9.4×10^{-11}		
Ni-63	96.0 a	F	0.050	4.4×10^{-10}	5.2×10^{-10}	0.050	1.5×10^{-10}
		M	0.050	4.4×10^{-10}	3.1×10^{-10}	0.050	
Ni-65	2.52 h	F	0.050	4.4×10^{-11}	7.5×10^{-11}	0.050	1.8×10^{-10}
		M	0.050	8.7×10^{-11}	1.3×10^{-10}	0.050	
Ni-66	2.27 d	F	0.050	4.5×10^{-10}	7.6×10^{-10}	0.050	3.0×10^{-9}
		M	0.050	1.6×10^{-9}	1.9×10^{-9}		

Copper							
Cu-60	0.387 h	F	0.500	2.4×10^{-11}	4.4×10^{-11}	0.500	7.0×10^{-11}
		M	0.500	3.5×10^{-11}	6.0×10^{-11}		
		S	0.500	3.6×10^{-11}	6.2×10^{-11}		
Cu-61	3.41 h	F	0.500	4.0×10^{-11}	7.3×10^{-11}	0.500	1.2×10^{-10}
		M	0.500	7.6×10^{-11}	1.2×10^{-10}		
		S	0.500	8.0×10^{-11}	1.2×10^{-10}		
Cu-64	12.7 h	F	0.500	3.8×10^{-11}	6.8×10^{-11}	0.500	1.2×10^{-10}
		M	0.500	1.1×10^{-10}	1.5×10^{-10}		
		S	0.500	1.2×10^{-10}	1.5×10^{-10}		
Cu-67	2.58 h	F	0.500	1.1×10^{-10}	1.8×10^{-10}	0.500	3.4×10^{-10}
		M	0.500	5.2×10^{-10}	5.3×10^{-10}		
		S	0.500	5.8×10^{-10}	5.8×10^{-10}		
Zinc							
Zn-62	9.26 h	S	0.500	4.7×10^{-10}	6.6×10^{-10}	0.500	9.4×10^{-10}
Zn-63	0.635 h	S	0.500	3.8×10^{-11}	6.1×10^{-11}	0.500	7.9×10^{-11}
Zn-65	244 h	S	0.500	2.9×10^{-9}	2.8×10^{-9}	0.500	3.9×10^{-9}
Zn-69	0.950 h	S	0.500	2.8×10^{-11}	4.3×10^{-11}	0.500	3.1×10^{-11}
Zn-69m	13.8 h	S	0.500	2.6×10^{-10}	3.3×10^{-10}	0.500	3.3×10^{-10}
Zn-71m	3.92 h	S	0.500	1.6×10^{-10}	2.4×10^{-10}	0.500	2.4×10^{-10}
Zn-72	1.94 d	S	0.500	1.2×10^{-9}	1.5×10^{-9}	0.500	1.4×10^{-9}
Gallium							
Ga-65	0.253 h	F	0.001	1.2×10^{-11}	2.0×10^{-11}	0.001	3.7×10^{-11}
		M	0.001	1.8×10^{-11}	2.9×10^{-11}	0.001	
Ga-66	9.40 h	F	0.001	2.7×10^{-10}	4.7×10^{-10}	0.001	1.2×10^{-9}
		M	0.001	4.6×10^{-10}	7.1×10^{-10}		

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		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Ga-67	3.26 d	F	0.001	6.8×10^{-11}	1.1×10^{-10}	0.001	1.9×10^{-10}
		M	0.001	2.3×10^{-10}	2.8×10^{-10}		
Ga-68	1.13 h	F	0.001	2.8×10^{-11}	4.9×10^{-11}	0.001	1.0×10^{-10}
		M	0.001	5.1×10^{-11}	8.1×10^{-11}		
Ga-70	0.353 h	F	0.001	9.3×10^{-12}	1.6×10^{-11}	0.001	3.1×10^{-11}
		M	0.001	1.6×10^{-11}	2.6×10^{-11}		
Ga-72	14.1 h	F	0.001	3.1×10^{-10}	5.6×10^{-10}	0.001	1.1×10^{-9}
		M	0.001	5.5×10^{-10}	8.4×10^{-10}		
Ga-73	4.91 h	F	0.001	5.8×10^{-11}	1.0×10^{-10}	0.001	2.6×10^{-10}
		M	0.001	1.5×10^{-10}	2.0×10^{-10}		
Germanium							
Ge-66	2.27 h	F	1.000	5.7×10^{-11}	9.9×10^{-11}	1.000	1.0×10^{-10}
		M	1.000	9.2×10^{-11}	1.3×10^{-10}		
Ge-67	0.312 h	F	1.000	1.6×10^{-11}	2.8×10^{-11}	1.000	6.5×10^{-11}
		M	1.000	2.6×10^{-11}	4.2×10^{-11}		
Ge-68	288 d	F	1.000	5.4×10^{-10}	8.3×10^{-10}	1.000	1.3×10^{-9}
		M	1.000	1.3×10^{-8}	7.9×10^{-9}		
Ge-69	1.63 d	F	1.000	1.4×10^{-10}	2.5×10^{-10}	1.000	2.4×10^{-10}
		M	1.000	2.9×10^{-10}	3.7×10^{-10}		
Ge-71	11.8 d	F	1.000	5.0×10^{-12}	7.8×10^{-12}	1.000	1.2×10^{-11}
		M	1.000	1.0×10^{-11}	1.1×10^{-11}		
Ge-75	1.38 h	F	1.000	1.6×10^{-11}	2.7×10^{-11}	1.000	4.6×10^{-11}
		M	1.000	3.7×10^{-11}	5.4×10^{-11}		
Ge-77	11.3 h	F	1.000	1.5×10^{-10}	2.5×10^{-10}	1.000	3.3×10^{-10}
		M	1.000	3.6×10^{-10}	4.5×10^{-10}		

Ge-78	1.45 h	F	1.000	4.8×10^{-11}	8.1×10^{-11}	1.000	1.2×10^{-10}
		M	1.000	9.7×10^{-11}	1.4×10^{-10}		
Arsenic							
As-69	0.253 h	M	0.500	2.2×10^{-11}	3.5×10^{-11}	0.500	5.7×10^{-11}
As-70	0.876 h	M	0.500	7.2×10^{-11}	1.2×10^{-10}	0.500	1.3×10^{-10}
As-71	2.70 d	M	0.500	4.0×10^{-10}	5.0×10^{-10}	0.500	4.6×10^{-10}
As-72	1.08 d	M	0.500	9.2×10^{-10}	1.3×10^{-9}	0.500	1.8×10^{-9}
As-73	80.3 d	M	0.500	9.3×10^{-10}	6.5×10^{-10}	0.500	2.6×10^{-10}
As-74	17.8 d	M	0.500	2.1×10^{-9}	1.8×10^{-9}	0.500	1.3×10^{-9}
As-76	1.10 d	M	0.500	7.4×10^{-10}	9.2×10^{-10}	0.500	1.6×10^{-9}
As-77	1.62 d	M	0.500	3.8×10^{-10}	4.2×10^{-10}	0.500	4.0×10^{-10}
As-78	1.51 h	M	0.500	9.2×10^{-11}	1.4×10^{-10}	0.500	2.1×10^{-10}
Selenium							
Se-70	0.683 h	F	0.800	4.5×10^{-11}	8.2×10^{-11}	0.800	1.2×10^{-10}
		M	0.800	7.3×10^{-11}	1.2×10^{-10}	0.050	1.4×10^{-10}
Se-73	7.15 h	F	0.800	8.6×10^{-11}	1.5×10^{-10}	0.800	2.1×10^{-10}
		M	0.800	1.6×10^{-10}	2.4×10^{-10}	0.050	3.9×10^{-10}
Se-73m	0.650 h	F	0.800	9.9×10^{-12}	1.7×10^{-11}	0.800	2.8×10^{-11}
		M	0.800	1.8×10^{-11}	2.7×10^{-11}	0.050	4.1×10^{-11}
Se-75	120 d	F	0.800	1.0×10^{-9}	1.4×10^{-9}	0.800	2.6×10^{-9}
		M	0.800	1.4×10^{-9}	1.7×10^{-9}	0.050	4.1×10^{-10}
Se-79	6.50×10^{4} a	F	0.800	1.2×10^{-9}	1.6×10^{-9}	0.800	2.9×10^{-9}
		M	0.800	2.9×10^{-9}	3.1×10^{-9}	0.050	3.9×10^{-10}
Se-81	0.308 h	F	0.800	8.6×10^{-12}	1.4×10^{-11}	0.800	2.7×10^{-11}
		M	0.800	1.5×10^{-11}	2.4×10^{-11}	0.050	2.7×10^{-11}
Se-81m	0.954 h	F	0.800	1.7×10^{-11}	3.0×10^{-11}	0.800	5.3×10^{-11}
		M	0.800	4.7×10^{-11}	6.8×10^{-11}	0.050	5.9×10^{-11}
Se-83	0.375 h	F	0.800	1.9×10^{-11}	3.4×10^{-11}	0.800	4.7×10^{-11}
		M	0.800	3.3×10^{-11}	5.3×10^{-11}	0.050	5.1×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Bromine							
Br-74	0.422 h	F	1.000	2.8×10^{-11}	5.0×10^{-11}	1.000	8.4×10^{-11}
		M	1.000	4.1×10^{-11}	6.8×10^{-11}	1.000	
Br-74m	0.691 h	F	1.000	4.2×10^{-11}	7.5×10^{-11}	1.000	1.4×10^{-10}
		M	1.000	6.5×10^{-11}	1.1×10^{-10}		
Br-75	1.63 h	F	1.000	3.1×10^{-11}	5.6×10^{-11}	1.000	7.9×10^{-11}
		M	1.000	5.5×10^{-11}	8.5×10^{-11}		
Br-76	16.2 h	F	1.000	2.6×10^{-10}	4.5×10^{-10}	1.000	4.6×10^{-10}
		M	1.000	4.2×10^{-10}	5.8×10^{-10}		
Br-77	2.33 d	F	1.000	6.7×10^{-11}	1.2×10^{-10}	1.000	9.6×10^{-11}
		M	1.000	8.7×10^{-11}	1.3×10^{-10}		
Br-80	0.290 h	F	1.000	6.3×10^{-12}	1.1×10^{-11}	1.000	3.1×10^{-11}
		M	1.000	1.0×10^{-11}	1.7×10^{-11}		
Br-80m	4.42 h	F	1.000	3.5×10^{-11}	5.8×10^{-11}	1.000	1.1×10^{-10}
		M	1.000	7.6×10^{-11}	1.0×10^{-10}		
Br-82	1.47 d	F	1.000	3.7×10^{-10}	6.4×10^{-10}	1.000	5.4×10^{-10}
		M	1.000	6.4×10^{-10}	8.8×10^{-10}		
Br-83	2.39 h	F	1.000	1.7×10^{-11}	2.9×10^{-11}	1.000	4.3×10^{-11}
		M	1.000	4.8×10^{-11}	6.7×10^{-11}		
Br-84	0.530 h	F	1.000	2.3×10^{-11}	4.0×10^{-11}	1.000	8.8×10^{-11}
		M	1.000	3.9×10^{-11}	6.2×10^{-11}		
Rubidium							
Rb-79	0.382 h	F	1.000	1.7×10^{-11}	3.0×10^{-11}	1.000	5.0×10^{-11}
Rb-81	4.58 h	F	1.000	3.7×10^{-11}	6.8×10^{-11}	1.000	5.4×10^{-11}

Rb-81m	0.533 h	F	1.000	7.3×10^{-12}	1.3×10^{-11}	1.000	9.7×10^{-12}
Rb-82m	6.20 h	F	1.000	1.2×10^{-10}	2.2×10^{-10}	1.000	1.3×10^{-10}
Rb-83	86.2 d	F	1.000	7.1×10^{-10}	1.0×10^{-9}	1.000	1.9×10^{-9}
Rb-84	32.8 d	F	1.000	1.1×10^{-9}	1.5×10^{-9}	1.000	2.8×10^{-9}
Rb-86	18.6 d	F	1.000	9.6×10^{-10}	1.3×10^{-9}	1.000	2.8×10^{-9}
Rb-87	4.70×10^{10} a	F	1.000	5.1×10^{-10}	7.6×10^{-10}	1.000	1.5×10^{-9}
Rb-88	0.297 h	F	1.000	1.7×10^{-11}	2.8×10^{-11}	1.000	9.0×10^{-11}
Rb-89	0.253 h	F	1.000	1.4×10^{-11}	2.5×10^{-11}	1.000	4.7×10^{-11}
Strontium							
Sr-80	1.67 h	F	0.300	7.6×10^{-11}	1.3×10^{-10}	0.300	3.4×10^{-10}
		S	0.010	1.4×10^{-10}	2.1×10^{-10}	0.010	3.5×10^{-10}
Sr-81	0.425 h	F	0.300	2.2×10^{-11}	3.9×10^{-11}	0.300	7.7×10^{-11}
		S	0.010	3.8×10^{-11}	6.1×10^{-11}	0.010	7.8×10^{-11}
Sr-82	25.0 d	F	0.300	2.2×10^{-9}	3.3×10^{-9}	0.300	6.1×10^{-9}
		S	0.010	1.0×10^{-8}	7.7×10^{-9}	0.010	6.0×10^{-9}
Sr-83	1.35 d	F	0.300	1.7×10^{-10}	3.0×10^{-10}	0.300	4.9×10^{-10}
		S	0.010	3.4×10^{-10}	4.9×10^{-10}	0.010	5.8×10^{-10}
Sr-85	64.8 d	F	0.300	3.9×10^{-10}	5.6×10^{-10}	0.300	5.6×10^{-10}
		S	0.010	7.7×10^{-10}	6.4×10^{-10}	0.010	3.3×10^{-10}
Sr-85m	1.16 h	F	0.300	3.1×10^{-12}	5.6×10^{-12}	0.300	6.1×10^{-12}
		S	0.010	4.5×10^{-12}	7.4×10^{-12}	0.010	6.1×10^{-12}
Sr-87m	2.80 h	F	0.300	1.2×10^{-11}	2.2×10^{-11}	0.300	3.0×10^{-11}
		S	0.010	2.2×10^{-11}	3.5×10^{-11}	0.010	3.3×10^{-11}
Sr-89	50.5 d	F	0.300	1.0×10^{-9}	1.4×10^{-9}	0.300	2.6×10^{-9}
		S	0.010	7.5×10^{-9}	5.6×10^{-9}	0.010	2.3×10^{-9}
Sr-90	29.1 a	F	0.300	2.4×10^{-8}	3.0×10^{-8}	0.300	2.8×10^{-8}
		S	0.010	1.5×10^{-7}	7.7×10^{-8}	0.010	2.7×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Sr-91	9.50 h	F	0.300	1.7×10^{-10}	2.9×10^{-10}	0.300	6.5×10^{-10}
		S	0.010	4.1×10^{-10}	5.7×10^{-10}	0.010	7.6×10^{-10}
Sr-92	2.71 h	F	0.300	1.1×10^{-10}	1.8×10^{-10}	0.300	4.3×10^{-10}
		S	0.010	2.3×10^{-10}	3.4×10^{-10}	0.010	4.9×10^{-10}
Yttrium							
Y-86	14.7 h	M	1.0×10^{-4}	4.8×10^{-10}	8.0×10^{-10}	1.0×10^{-4}	9.6×10^{-10}
		S	1.0×10^{-4}	4.9×10^{-10}	8.1×10^{-10}		
Y-86m	0.800 h	M	1.0×10^{-4}	2.9×10^{-11}	4.8×10^{-11}	1.0×10^{-4}	5.6×10^{-11}
		S	1.0×10^{-4}	3.0×10^{-11}	4.9×10^{-11}		
Y-87	3.35 d	M	1.0×10^{-4}	3.8×10^{-10}	5.2×10^{-10}	1.0×10^{-4}	5.5×10^{-10}
		S	1.0×10^{-4}	4.0×10^{-10}	5.3×10^{-10}		
Y-88	107 d	M	1.0×10^{-4}	3.9×10^{-9}	3.3×10^{-9}	1.0×10^{-4}	1.3×10^{-9}
		S	1.0×10^{-4}	4.1×10^{-9}	3.0×10^{-9}		
Y-90	2.67 d	M	1.0×10^{-4}	1.4×10^{-9}	1.6×10^{-9}	1.0×10^{-4}	2.7×10^{-9}
		S	1.0×10^{-4}	1.5×10^{-9}	1.7×10^{-9}		
Y-90m	3.19 h	M	1.0×10^{-4}	9.6×10^{-11}	1.3×10^{-10}	1.0×10^{-4}	1.7×10^{-10}
		S	1.0×10^{-4}	1.0×10^{-10}	1.3×10^{-10}		
Y-91	58.5 d	M	1.0×10^{-4}	6.7×10^{-9}	5.2×10^{-9}	1.0×10^{-4}	2.4×10^{-9}
		S	1.0×10^{-4}	8.4×10^{-9}	6.1×10^{-9}		
Y-91m	0.828 h	M	1.0×10^{-4}	1.0×10^{-11}	1.4×10^{-11}	1.0×10^{-4}	1.1×10^{-11}
		S	1.0×10^{-4}	1.1×10^{-11}	1.5×10^{-11}		
Y-92	3.54 h	M	1.0×10^{-4}	1.9×10^{-10}	2.7×10^{-10}	1.0×10^{-4}	4.9×10^{-10}
		S	1.0×10^{-4}	2.0×10^{-10}	2.8×10^{-10}		
Y-93	10.1 h	M	1.0×10^{-4}	4.1×10^{-10}	5.7×10^{-10}	1.0×10^{-4}	1.2×10^{-9}
		S	1.0×10^{-4}	4.3×10^{-10}	6.0×10^{-10}		

Y-94	0.318 h	M	1.0×10^{-4}	2.8×10^{-11}	4.4×10^{-11}	1.0×10^{-4}	8.1×10^{-11}
		S	1.0×10^{-4}	2.9×10^{-11}	4.6×10^{-11}		
Y-95	0.178 h	M	1.0×10^{-4}	1.6×10^{-11}	2.5×10^{-11}	1.0×10^{-4}	4.6×10^{-11}
		S	1.0×10^{-4}	1.7×10^{-11}	2.6×10^{-11}		
Zirconium							
Zr-86	16.5 h	F	0.002	3.0×10^{-10}	5.2×10^{-10}	0.002	8.6×10^{-10}
		M	0.002	4.3×10^{-10}	6.8×10^{-10}		
		S	0.002	4.5×10^{-10}	7.0×10^{-10}		
Zr-88	83.4 d	F	0.002	3.5×10^{-9}	4.1×10^{-9}	0.002	3.3×10^{-10}
		M	0.002	2.5×10^{-9}	1.7×10^{-9}		
		S	0.002	3.3×10^{-9}	1.8×10^{-9}		
Zr-89	3.27 d	F	0.002	3.1×10^{-10}	5.2×10^{-10}	0.002	7.9×10^{-10}
		M	0.002	5.3×10^{-10}	7.2×10^{-10}		
		S	0.002	5.5×10^{-10}	7.5×10^{-10}		
Zr-93	1.53×10^{6} a	F	0.002	2.5×10^{-8}	2.9×10^{-8}	0.002	2.8×10^{-10}
		M	0.002	9.6×10^{-9}	6.6×10^{-9}		
		S	0.002	3.1×10^{-9}	1.7×10^{-9}		
Zr-95	64.0 d	F	0.002	2.5×10^{-9}	3.0×10^{-9}	0.002	8.8×10^{-10}
		M	0.002	4.5×10^{-9}	3.6×10^{-9}		
		S	0.002	5.5×10^{-9}	4.2×10^{-9}		
Zr-97	16.9 h	F	0.002	4.2×10^{-10}	7.4×10^{-10}	0.002	2.1×10^{-9}
		M	0.002	9.4×10^{-10}	1.3×10^{-9}		
		S	0.002	1.0×10^{-9}	1.4×10^{-9}		
Niobium							
Nb-88	0.238 h	M	0.010	2.9×10^{-11}	4.8×10^{-11}	0.010	6.3×10^{-11}
		S	0.010	3.0×10^{-11}	5.0×10^{-11}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Nb-89	2.03 h	M	0.010	1.2×10^{-10}	1.8×10^{-10}	0.010	3.0×10^{-10}
		S	0.010	1.3×10^{-10}	1.9×10^{-10}		
Nb-89	1.10 h	M	0.010	7.1×10^{-11}	1.1×10^{-10}	0.010	1.4×10^{-10}
		S	0.010	7.4×10^{-11}	1.2×10^{-10}		
Nb-90	14.6 h	M	0.010	6.6×10^{-10}	1.0×10^{-9}	0.010	1.2×10^{-9}
		S	0.010	6.9×10^{-10}	1.1×10^{-9}		
Nb-93m	13.6 a	M	0.010	4.6×10^{-10}	2.9×10^{-10}	0.010	1.2×10^{-10}
		S	0.010	1.6×10^{-9}	8.6×10^{-10}		
Nb-94	2.03×10^{4} a	M	0.010	1.0×10^{-8}	7.2×10^{-9}	0.010	1.7×10^{-9}
		S	0.010	4.5×10^{-8}	2.5×10^{-8}		
Nb-95	35.1 d	M	0.010	1.4×10^{-9}	1.3×10^{-9}	0.010	5.8×10^{-10}
		S	0.010	1.6×10^{-9}	1.3×10^{-9}		
Nb-95m	3.61 d	M	0.010	7.6×10^{-10}	7.7×10^{-10}	0.010	5.6×10^{-10}
		S	0.010	8.5×10^{-10}	8.5×10^{-10}		
Nb-96	23.3 h	M	0.010	6.5×10^{-10}	9.7×10^{-10}	0.010	1.1×10^{-9}
		S	0.010	6.8×10^{-10}	1.0×10^{-9}		
Nb-97	1.20 h	M	0.010	4.4×10^{-11}	6.9×10^{-11}	0.010	6.8×10^{-11}
		S	0.010	4.7×10^{-11}	7.2×10^{-11}		
Nb-98	0.858 h	M	0.010	5.9×10^{-11}	9.6×10^{-11}	0.010	1.1×10^{-10}
		S	0.010	6.1×10^{-11}	9.9×10^{-11}		
Molybdenum							
Mo-90	5.67 h	F	0.800	1.7×10^{-10}	2.9×10^{-10}	0.800	3.1×10^{-10}
		S	0.050	3.7×10^{-10}	5.6×10^{-10}	0.050	6.2×10^{-10}
Mo-93	3.50×10^{3} a	F	0.800	1.0×10^{-9}	1.4×10^{-9}	0.800	2.6×10^{-9}
		S	0.050	2.2×10^{-9}	1.2×10^{-9}	0.050	2.0×10^{-10}

Mo-93m	6.85 h	F	0.800	1.0×10^{-10}	1.9×10^{-10}	0.800	1.6×10^{-10}
		S	0.050	1.8×10^{-10}	3.0×10^{-10}	0.050	2.8×10^{-10}
Mo-99	2.75 d	F	0.800	2.3×10^{-10}	3.6×10^{-10}	0.800	7.4×10^{-10}
		S	0.050	9.7×10^{-10}	1.1×10^{-9}	0.050	1.2×10^{-9}
Mo-101	0.244 h	F	0.800	1.5×10^{-11}	2.7×10^{-11}	0.800	4.2×10^{-11}
		S	0.050	2.7×10^{-11}	4.5×10^{-11}	0.050	4.2×10^{-11}
Technetium							
Tc-93	2.75 h	F	0.800	3.4×10^{-11}	6.2×10^{-11}	0.800	4.9×10^{-11}
		M	0.800	3.6×10^{-11}	6.5×10^{-11}		
Tc-93m	0.725 h	F	0.800	1.5×10^{-11}	2.6×10^{-11}	0.800	2.4×10^{-11}
		M	0.800	1.7×10^{-11}	3.1×10^{-11}		
Tc-94	4.88 h	F	0.800	1.2×10^{-10}	2.1×10^{-10}	0.800	1.8×10^{-10}
		M	0.800	1.3×10^{-10}	2.2×10^{-10}		
Tc-94m	0.867 h	F	0.800	4.3×10^{-11}	6.9×10^{-11}	0.800	1.1×10^{-10}
		M	0.800	4.9×10^{-11}	8.0×10^{-11}		
Tc-95	20.0 h	F	0.800	1.0×10^{-10}	1.8×10^{-10}	0.800	1.6×10^{-10}
		M	0.800	1.0×10^{-10}	1.8×10^{-10}		
Tc-95m	61.0 d	F	0.800	3.1×10^{-10}	4.8×10^{-10}	0.800	6.2×10^{-10}
		M	0.800	8.7×10^{-10}	8.6×10^{-10}		
Tc-96	4.28 d	F	0.800	6.0×10^{-10}	9.8×10^{-10}	0.800	1.1×10^{-9}
		M	0.800	7.1×10^{-10}	1.0×10^{-9}		
Tc-96m	0.858 h	F	0.800	6.5×10^{-12}	1.1×10^{-11}	0.800	1.3×10^{-11}
		M	0.800	7.7×10^{-12}	1.1×10^{-11}		
Tc-97	2.60×10^{6} a	F	0.800	4.5×10^{-11}	7.2×10^{-11}	0.800	8.3×10^{-11}
		M	0.800	2.1×10^{-10}	1.6×10^{-10}		
Tc-97m	87.0 d	F	0.800	2.8×10^{-10}	4.0×10^{-10}	0.800	6.6×10^{-10}
		M	0.800	3.1×10^{-9}	2.7×10^{-9}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Tc-98	4.20×10^{6} a	F	0.800	1.0×10^{-9}	1.5×10^{-9}	0.800	2.3×10^{-9}
		M	0.800	8.1×10^{-9}	6.1×10^{-9}		
Tc-99	2.13×10^{5} a	F	0.800	2.9×10^{-10}	4.0×10^{-10}	0.800	7.8×10^{-10}
		M	0.800	3.9×10^{-9}	3.2×10^{-9}		
Tc-99m	6.02 h	F	0.800	1.2×10^{-11}	2.0×10^{-11}	0.800	2.2×10^{-11}
		M	0.800	1.9×10^{-11}	2.9×10^{-11}		
Tc-101	0.237 h	F	0.800	8.7×10^{-12}	1.5×10^{-11}	0.800	1.9×10^{-11}
		M	0.800	1.3×10^{-11}	2.1×10^{-11}		
Tc-104	0.303 h	F	0.800	2.4×10^{-11}	3.9×10^{-11}	0.800	8.1×10^{-11}
		M	0.800	3.0×10^{-11}	4.8×10^{-11}		
Ruthenium							
Ru-94	0.863 h	F	0.050	2.7×10^{-11}	4.9×10^{-11}	0.050	9.4×10^{-11}
		M	0.050	4.4×10^{-11}	7.2×10^{-11}		
		S	0.050	4.6×10^{-11}	7.4×10^{-11}		
Ru-97	2.90 d	F	0.050	6.7×10^{-11}	1.2×10^{-10}	0.050	1.5×10^{-10}
		M	0.050	1.1×10^{-10}	1.6×10^{-10}		
		S	0.050	1.1×10^{-10}	1.6×10^{-10}		
Ru-103	39.3 d	F	0.050	4.9×10^{-10}	6.8×10^{-10}	0.050	7.3×10^{-10}
		M	0.050	2.3×10^{-9}	1.9×10^{-9}		
		S	0.050	2.8×10^{-9}	2.2×10^{-9}		
Ru-105	4.44 h	F	0.050	7.1×10^{-11}	1.3×10^{-10}	0.050	2.6×10^{-10}
		M	0.050	1.7×10^{-10}	2.4×10^{-10}		
		S	0.050	1.8×10^{-10}	2.5×10^{-10}		
Ru-106	1.01 a	F	0.050	8.0×10^{-9}	9.8×10^{-9}	0.050	7.0×10^{-9}
		M	0.050	2.6×10^{-8}	1.7×10^{-8}		
		S	0.050	6.2×10^{-8}	3.5×10^{-8}		

Rhodium							
Rh-99	16.0 d	F	0.050	3.3×10^{-10}	4.9×10^{-10}	0.050	5.1×10^{-10}
		M	0.050	7.3×10^{-10}	8.2×10^{-10}		
		S	0.050	8.3×10^{-10}	8.9×10^{-10}		
Rh-99m	4.70 h	F	0.050	3.0×10^{-11}	5.7×10^{-11}	0.050	6.6×10^{-11}
		M	0.050	4.1×10^{-11}	7.2×10^{-11}		
		S	0.050	4.3×10^{-11}	7.3×10^{-11}		
Rh-100	20.8 h	F	0.050	2.8×10^{-10}	5.1×10^{-10}	0.050	7.1×10^{-10}
		M	0.050	3.6×10^{-10}	6.2×10^{-10}		
		S	0.050	3.7×10^{-10}	6.3×10^{-10}		
Rh-101	3.20 a	F	0.050	1.4×10^{-9}	1.7×10^{-9}	0.050	5.5×10^{-10}
		M	0.050	2.2×10^{-9}	1.7×10^{-9}		
		S	0.050	5.0×10^{-9}	3.1×10^{-9}		
Rh-101m	4.34 d	F	0.050	1.0×10^{-10}	1.7×10^{-10}	0.050	2.2×10^{-10}
		M	0.050	2.0×10^{-10}	2.5×10^{-10}		
		S	0.050	2.1×10^{-10}	2.7×10^{-10}		
Rh-102	2.90 a	F	0.050	7.3×10^{-9}	8.9×10^{-9}	0.050	2.6×10^{-9}
		M	0.050	6.5×10^{-9}	5.0×10^{-9}		
		S	0.050	1.6×10^{-8}	9.0×10^{-9}		
Rh-102m	207 d	F	0.050	1.5×10^{-9}	1.9×10^{-9}	0.050	1.2×10^{-9}
		M	0.050	3.8×10^{-9}	2.7×10^{-9}		
		S	0.050	6.7×10^{-9}	4.2×10^{-9}		
Rh-103m	0.935 h	F	0.050	8.6×10^{-13}	1.2×10^{-12}	0.050	3.8×10^{-12}
		M	0.050	2.3×10^{-12}	2.4×10^{-12}		
		S	0.050	2.5×10^{-12}	2.5×10^{-12}		
Rh-105	1.47 d	F	0.050	8.7×10^{-11}	1.5×10^{-10}	0.050	3.7×10^{-10}
		M	0.050	3.1×10^{-10}	4.1×10^{-10}		
		S	0.050	3.4×10^{-10}	4.4×10^{-10}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Rh-106m	2.20 h	F	0.050	7.0×10^{-11}	1.3×10^{-10}	0.050	1.6×10^{-10}
		M	0.050	1.1×10^{-10}	1.8×10^{-10}		
		S	0.050	1.2×10^{-10}	1.9×10^{-10}		
Rh-107	0.362 h	F	0.050	9.6×10^{-12}	1.6×10^{-11}	0.050	2.4×10^{-11}
		M	0.050	1.7×10^{-11}	2.7×10^{-11}		
		S	0.050	1.7×10^{-11}	2.8×10^{-11}		
Palladium							
Pd-100	3.63 d	F	0.005	4.9×10^{-10}	7.6×10^{-10}	0.005	9.4×10^{-10}
		M	0.005	7.9×10^{-10}	9.5×10^{-10}		
		S	0.005	8.3×10^{-10}	9.7×10^{-10}		
Pd-101	8.27 h	F	0.005	4.2×10^{-11}	7.5×10^{-11}	0.005	9.4×10^{-11}
		M	0.005	6.2×10^{-11}	9.8×10^{-11}		
		S	0.005	6.4×10^{-11}	1.0×10^{-10}		
Pd-103	17.0 d	F	0.005	9.0×10^{-11}	1.2×10^{-10}	0.005	1.9×10^{-10}
		M	0.005	3.5×10^{-10}	3.0×10^{-10}		
		S	0.005	4.0×10^{-10}	2.9×10^{-10}		
Pd-107	6.50×10^{6} a	F	0.005	2.6×10^{-11}	3.3×10^{-11}	0.005	3.7×10^{-11}
		M	0.005	8.0×10^{-11}	5.2×10^{-11}		
		S	0.005	5.5×10^{-10}	2.9×10^{-10}		
Pd-109	13.4 h	F	0.005	1.2×10^{-10}	2.1×10^{-10}	0.005	5.5×10^{-10}
		M	0.005	3.4×10^{-10}	4.7×10^{-10}		
		S	0.005	3.6×10^{-10}	5.0×10^{-10}		
Silver							
Ag-102	0.215 h	F	0.050	1.4×10^{-11}	2.4×10^{-11}	0.050	4.0×10^{-11}
		M	0.050	1.8×10^{-11}	3.2×10^{-11}		
		S	0.050	1.9×10^{-11}	3.2×10^{-11}		

Ag-103	1.09 h	F	0.050	1.6×10^{-11}	2.8×10^{-11}	0.050	4.3×10^{-11}
		M	0.050	2.7×10^{-11}	4.3×10^{-11}		
		S	0.050	2.8×10^{-11}	4.5×10^{-11}		
Ag-104	1.15 h	F	0.050	3.0×10^{-11}	5.7×10^{-11}	0.050	6.0×10^{-11}
		M	0.050	3.9×10^{-11}	6.9×10^{-11}		
		S	0.050	4.0×10^{-11}	7.1×10^{-11}		
Ag-104m	0.558 h	F	0.050	1.7×10^{-11}	3.1×10^{-11}	0.050	5.4×10^{-11}
		M	0.050	2.6×10^{-11}	4.4×10^{-11}		
		S	0.050	2.7×10^{-11}	4.5×10^{-11}		
Ag-105	41.0 d	F	0.050	5.4×10^{-10}	8.0×10^{-10}	0.050	4.7×10^{-10}
		M	0.050	6.9×10^{-10}	7.0×10^{-10}		
		S	0.050	7.8×10^{-10}	7.3×10^{-10}		
Ag-106	0.399 h	F	0.050	9.8×10^{-12}	1.7×10^{-11}	0.050	3.2×10^{-11}
		M	0.050	1.6×10^{-11}	2.6×10^{-11}		
		S	0.050	1.6×10^{-11}	2.7×10^{-11}		
Ag-106m	8.41 d	F	0.050	1.1×10^{-9}	1.6×10^{-9}	0.050	1.5×10^{-9}
		M	0.050	1.1×10^{-9}	1.5×10^{-9}		
		S	0.050	1.1×10^{-9}	1.4×10^{-9}		
Ag-108m	1.27×10^{2} a	F	0.050	6.1×10^{-9}	7.3×10^{-9}	0.050	2.3×10^{-9}
		M	0.050	7.0×10^{-9}	5.2×10^{-9}		
		S	0.050	3.5×10^{-8}	1.9×10^{-8}		
Ag-110m	250 d	F	0.050	5.5×10^{-9}	6.7×10^{-9}	0.050	2.8×10^{-9}
		M	0.050	7.2×10^{-9}	5.9×10^{-9}		
		S	0.050	1.2×10^{-8}	7.3×10^{-9}		
Ag-111	7.45 d	F	0.050	4.1×10^{-10}	5.7×10^{-10}	0.050	1.3×10^{-9}
		M	0.050	1.5×10^{-9}	1.5×10^{-9}		
		S	0.050	1.7×10^{-9}	1.6×10^{-9}		
Ag-112	3.12 h	F	0.050	8.2×10^{-11}	1.4×10^{-10}	0.050	4.3×10^{-10}
		M	0.050	1.7×10^{-10}	2.5×10^{-10}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
		S	0.050	1.8×10^{-10}	2.6×10^{-10}		
Ag-115	0.333 h	F	0.050	1.6×10^{-11}	2.6×10^{-11}	0.050	6.0×10^{-11}
		M	0.050	2.8×10^{-11}	4.3×10^{-11}		
		S	0.050	3.0×10^{-11}	4.4×10^{-11}		
Cadmium							
Cd-104	0.961 h	F	0.050	2.7×10^{-11}	5.0×10^{-11}	0.050	5.8×10^{-11}
		M	0.050	3.6×10^{-11}	6.2×10^{-11}		
		S	0.050	3.7×10^{-11}	6.3×10^{-11}		
Cd-107	6.49 h	F	0.050	2.3×10^{-11}	4.2×10^{-11}	0.050	6.2×10^{-11}
		M	0.050	8.1×10^{-11}	1.0×10^{-10}		
		S	0.050	8.7×10^{-11}	1.1×10^{-10}		
Cd-109	1.27 a	F	0.050	8.1×10^{-9}	9.6×10^{-9}	0.050	2.0×10^{-9}
		M	0.050	6.2×10^{-9}	5.1×10^{-9}		
		S	0.050	5.8×10^{-9}	4.4×10^{-9}		
Cd-113	9.30×10^{15} a	F	0.050	1.2×10^{-7}	1.4×10^{-7}	0.050	2.5×10^{-8}
		M	0.050	5.3×10^{-8}	4.3×10^{-8}		
		S	0.050	2.5×10^{-8}	2.1×10^{-8}		
Cd-113m	13.6 a	F	0.050	1.1×10^{-7}	1.3×10^{-7}	0.050	2.3×10^{-8}
		M	0.050	5.0×10^{-8}	4.0×10^{-8}		
		S	0.050	3.0×10^{-8}	2.4×10^{-8}		
Cd-115	2.23 d	F	0.050	3.7×10^{-10}	5.4×10^{-10}	0.050	1.4×10^{-9}
		M	0.050	9.7×10^{-10}	1.2×10^{-9}		
		S	0.050	1.1×10^{-9}	1.3×10^{-9}		
Cd-115m	44.6 d	F	0.050	5.3×10^{-9}	6.4×10^{-9}	0.050	3.3×10^{-9}
		M	0.050	5.9×10^{-9}	5.5×10^{-9}		

		S	0.050	7.3×10^{-9}	5.5×10^{-9}		
Cd-117	2.49 h	F	0.050	7.3×10^{-11}	1.3×10^{-10}	0.050	2.8×10^{-10}
		M	0.050	1.6×10^{-10}	2.4×10^{-10}		
		S	0.050	1.7×10^{-10}	2.5×10^{-10}		
Cd-117m	3.36 h	F	0.050	1.0×10^{-10}	1.9×10^{-10}		
		M	0.050	2.0×10^{-10}	3.1×10^{-10}	0.050	2.8×10^{-10}
		S	0.050	2.1×10^{-10}	3.2×10^{-10}		
Indium							
In-109	4.20 h	F	0.020	3.2×10^{-11}	5.7×10^{-11}	0.020	6.6×10^{-11}
		M	0.020	4.4×10^{-11}	7.3×10^{-11}		
In-110	4.90 h	F	0.020	1.2×10^{-10}	2.2×10^{-10}	0.020	2.4×10^{-10}
		M	0.020	1.4×10^{-10}	2.5×10^{-10}		
In-110	1.15 h	F	0.020	3.1×10^{-11}	5.5×10^{-11}	0.020	1.0×10^{-10}
		M	0.020	5.0×10^{-11}	8.1×10^{-11}		
In-111	2.83 d	F	0.020	1.3×10^{-10}	2.2×10^{-10}	0.020	2.9×10^{-10}
		M	0.020	2.3×10^{-10}	3.1×10^{-10}		
In-112	0.240 h	F	0.020	5.0×10^{-12}	8.6×10^{-12}	0.020	1.0×10^{-11}
		M	0.020	7.8×10^{-12}	1.3×10^{-11}		
In-113m	1.66 h	F	0.020	1.0×10^{-11}	1.9×10^{-11}	0.020	2.8×10^{-11}
		M	0.020	2.0×10^{-11}	3.2×10^{-11}		
In-114m	49.5 d	F	0.020	9.3×10^{-9}	1.1×10^{-8}	0.020	4.1×10^{-9}
		M	0.020	5.9×10^{-9}	5.9×10^{-9}		
In-115	5.10×10^{15} a	F	0.020	3.9×10^{-7}	4.5×10^{-7}	0.020	3.2×10^{-8}
		M	0.020	1.5×10^{-7}	1.1×10^{-7}		
In-115m	4.49 h	F	0.020	2.5×10^{-11}	4.5×10^{-11}	0.020	8.6×10^{-11}
		M	0.020	6.0×10^{-11}	8.7×10^{-11}		
In-116m	0.902 h	F	0.020	3.0×10^{-11}	5.5×10^{-11}	0.020	6.4×10^{-11}
		M	0.020	4.8×10^{-11}	8.0×10^{-11}		
In-117	0.730 h	F	0.020	1.6×10^{-11}	2.8×10^{-11}	0.020	3.1×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
		M	0.020	3.0×10^{-11}	4.8×10^{-11}		
In-117m	1.94 h	F	0.020	3.1×10^{-11}	5.5×10^{-11}	0.020	1.2×10^{-10}
		M	0.020	7.3×10^{-11}	1.1×10^{-10}		
In-119m	0.300 h	F	0.020	1.1×10^{-11}	1.8×10^{-11}	0.020	4.7×10^{-11}
		M	0.020	1.8×10^{-11}	2.9×10^{-11}		
Tin							
Sn-110	4.00 h	F	0.020	1.1×10^{-10}	1.9×10^{-10}	0.020	3.5×10^{-10}
		M	0.020	1.6×10^{-10}	2.6×10^{-10}		
Sn-111	0.588 h	F	0.020	8.3×10^{-12}	1.5×10^{-11}	0.020	2.3×10^{-11}
		M	0.020	1.4×10^{-11}	2.2×10^{-11}		
Sn-113	115 d	F	0.020	5.4×10^{-10}	7.9×10^{-10}	0.020	7.3×10^{-10}
		M	0.020	2.5×10^{-9}	1.9×10^{-9}		
Sn-117m	13.6 d	F	0.020	2.9×10^{-10}	3.9×10^{-10}	0.020	7.1×10^{-10}
		M	0.020	2.3×10^{-9}	2.2×10^{-9}		
Sn-119m	293 d	F	0.020	2.9×10^{-10}	3.6×10^{-10}	0.020	3.4×10^{-10}
		M	0.020	2.0×10^{-9}	1.5×10^{-9}		
Sn-121	1.13 d	F	0.020	6.4×10^{-11}	1.0×10^{-10}	0.020	2.3×10^{-11}
		M	0.020	2.2×10^{-10}	2.8×10^{-10}		
Sn-121m	55.0 a	F	0.020	8.0×10^{-10}	9.7×10^{-10}	0.020	3.8×10^{-10}
		M	0.020	4.2×10^{-9}	3.3×10^{-9}		
Sn-123	129 d	F	0.020	1.2×10^{-9}	1.6×10^{-9}	0.020	2.1×10^{-9}
		M	0.020	7.7×10^{-9}	5.6×10^{-9}		
Sn-123m	0.668 h	F	0.020	1.4×10^{-11}	2.4×10^{-11}	0.020	3.8×10^{-11}
		M	0.020	2.8×10^{-11}	4.4×10^{-11}		
Sn-125	9.64 f	F	0.020	9.2×10^{-10}	1.3×10^{-9}	0.020	3.1×10^{-9}

		M	0.020	3.0×10^{-9}	2.8×10^{-9}		
Sn-126	1.00×10^{5} a	F	0.020	1.1×10^{-8}	1.4×10^{-8}	0.020	4.7×10^{-9}
		M	0.020	2.7×10^{-8}	1.8×10^{-8}		
Sn-127	2.10 h	F	0.020	6.9×10^{-11}	1.2×10^{-10}	0.020	2.0×10^{-10}
		M	0.020	1.3×10^{-10}	2.0×10^{-10}		
Sn-128	0.985 h	F	0.020	5.4×10^{-11}	9.5×10^{-11}	0.020	1.5×10^{-10}
		M	0.020	9.6×10^{-11}	1.5×10^{-10}		
Antimony							
Sb-115	0.530 h	F	0.100	9.2×10^{-12}	1.7×10^{-11}	0.100	2.4×10^{-11}
		M	0.010	1.4×10^{-11}	2.3×10^{-11}		
Sb-116	0.263 h	F	0.100	9.9×10^{-12}	1.8×10^{-11}	0.100	2.6×10^{-11}
		M	0.010	1.4×10^{-11}	2.3×10^{-11}		
Sb-116m	1.00 h	F	0.100	3.5×10^{-11}	6.4×10^{-11}	0.100	6.7×10^{-11}
		M	0.010	5.0×10^{-11}	8.5×10^{-11}		
Sb-117	2.80 h	F	0.100	9.3×10^{-12}	1.7×10^{-11}	0.100	1.8×10^{-11}
		M	0.010	1.7×10^{-11}	2.7×10^{-11}		
Sb-118m	5.00 h	F	0.100	1.0×10^{-10}	1.9×10^{-10}	0.100	2.1×10^{-10}
		M	0.010	1.3×10^{-10}	2.3×10^{-10}		
Sb-119	1.59 d	F	0.100	2.5×10^{-11}	4.5×10^{-11}	0.100	8.1×10^{-11}
		M	0.010	3.7×10^{-11}	5.9×10^{-11}		
Sb-120	5.76 d	F	0.100	5.9×10^{-10}	9.8×10^{-10}	0.100	1.2×10^{-9}
		M	0.010	1.0×10^{-9}	1.3×10^{-9}		
Sb-120	0.265 h	F	0.100	4.9×10^{-12}	8.5×10^{-12}	0.100	1.4×10^{-11}
		M	0.010	7.4×10^{-12}	1.2×10^{-11}		
Sb-122	2.70 d	F	0.100	3.9×10^{-10}	6.3×10^{-10}	0.100	1.7×10^{-9}
		M	0.010	1.0×10^{-9}	1.2×10^{-9}		
Sb-124	60.2 d	F	0.100	1.3×10^{-9}	1.9×10^{-9}	0.100	2.5×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
		M	0.010	6.1×10^{-9}	4.7×10^{-9}		
Sb-124m	0.337 h	F	0.100	3.0×10^{-12}	5.3×10^{-12}	0.100	8.0×10^{-12}
		M	0.010	5.5×10^{-12}	8.3×10^{-12}		
Sb-125	2.77 a	F	0.100	1.4×10^{-9}	1.7×10^{-9}	0.100	1.1×10^{-9}
		M	0.010	4.5×10^{-9}	3.3×10^{-9}		
Sb-126	12.4 d	F	0.100	1.1×10^{-9}	1.7×10^{-9}	0.100	2.4×10^{-9}
		M	0.010	2.7×10^{-9}	3.2×10^{-9}		
Sb-126m	0.317 h	F	0.100	1.3×10^{-11}	2.3×10^{-11}	0.100	3.6×10^{-11}
		M	0.010	2.0×10^{-11}	3.3×10^{-11}		
Sb-127	3.85 d	F	0.100	4.6×10^{-10}	7.4×10^{-10}	0.100	1.7×10^{-9}
		M	0.010	1.6×10^{-9}	1.7×10^{-9}		
Sb-128	9.01 h	F	0.100	2.5×10^{-10}	4.6×10^{-10}	0.100	7.6×10^{-10}
		M	0.010	4.2×10^{-10}	6.7×10^{-10}		
Sb-128	0.173 h	F	0.100	1.1×10^{-11}	1.9×10^{-11}	0.100	3.3×10^{-11}
		M	0.010	1.5×10^{-11}	2.6×10^{-11}		
Sb-129	4.32 h	F	0.100	1.1×10^{-10}	2.0×10^{-10}	0.100	4.2×10^{-10}
		M	0.010	2.4×10^{-10}	3.5×10^{-10}		
Sb-130	0.667 h	F	0.100	3.5×10^{-11}	6.3×10^{-11}	0.100	9.1×10^{-11}
		M	0.010	5.4×10^{-11}	9.1×10^{-11}		
Sb-131	0.383 h	F	0.100	3.7×10^{-11}	5.9×10^{-11}	0.100	1.0×10^{-10}
		M	0.010	5.2×10^{-11}	8.3×10^{-11}		
Tellurium							
Te-116	2.49 h	F	0.300	6.3×10^{-11}	1.2×10^{-10}	0.300	1.7×10^{-10}
		M	0.300	1.1×10^{-10}	1.7×10^{-10}		
Te-121	17.0 d	F	0.300	2.5×10^{-10}	3.9×10^{-10}	0.300	4.3×10^{-10}
		M	0.300	3.9×10^{-10}	4.4×10^{-10}		

Te-121m	154 d	F	0.300	1.8×10^{-9}	2.3×10^{-9}	0.300	2.3×10^{-9}
		M	0.300	4.2×10^{-9}	3.6×10^{-9}		
Te-123	1.00×10^{13} a	F	0.300	4.0×10^{-9}	5.0×10^{-9}	0.300	4.4×10^{-9}
		M	0.300	2.6×10^{-9}	2.8×10^{-9}		
Te-123m	120 d	F	0.300	9.7×10^{-10}	1.2×10^{-9}	0.300	1.4×10^{-9}
		M	0.300	3.9×10^{-9}	3.4×10^{-9}		
Te-125m	58.0 d	F	0.300	5.1×10^{-10}	6.7×10^{-10}	0.300	8.7×10^{-10}
		M	0.300	3.3×10^{-9}	2.9×10^{-9}		
Te-127	9.35 h	F	0.300	4.2×10^{-11}	7.2×10^{-11}	0.300	1.7×10^{-10}
		M	0.300	1.2×10^{-10}	1.8×10^{-10}		
Te-127m	109 d	F	0.300	1.6×10^{-9}	2.0×10^{-9}	0.300	2.3×10^{-9}
		M	0.300	7.2×10^{-9}	6.2×10^{-9}		
Te-129	1.16 h	F	0.300	1.7×10^{-11}	2.9×10^{-11}	0.300	6.3×10^{-11}
		M	0.300	3.8×10^{-11}	5.7×10^{-11}		
Te-129m	33.6 d	F	0.300	1.3×10^{-9}	1.8×10^{-9}	0.300	3.0×10^{-9}
		M	0.300	6.3×10^{-9}	5.4×10^{-9}		
Te-131	0.417 h	F	0.300	2.3×10^{-11}	4.6×10^{-11}	0.300	8.7×10^{-11}
		M	0.300	3.8×10^{-11}	6.1×10^{-11}		
Te-131m	1.25 d	F	0.300	8.7×10^{-10}	1.2×10^{-9}	0.300	1.9×10^{-9}
		M	0.300	1.1×10^{-9}	1.6×10^{-9}		
Te-132	3.26 d	F	0.300	1.8×10^{-9}	2.4×10^{-9}	0.300	3.7×10^{-9}
		M	0.300	2.2×10^{-9}	3.0×10^{-9}		
Te-133	0.207 h	F	0.300	2.0×10^{-11}	3.8×10^{-11}	0.300	7.2×10^{-11}
		M	0.300	2.7×10^{-11}	4.4×10^{-11}		
Te-133m	0.923 h	F	0.300	8.4×10^{-11}	1.2×10^{-10}	0.300	2.8×10^{-10}
		M	0.300	1.2×10^{-10}	1.9×10^{-10}		
Te-134	0.696 h	F	0.300	5.0×10^{-11}	8.3×10^{-11}	0.300	1.1×10^{-10}
		M	0.300	7.1×10^{-11}	1.1×10^{-10}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Iodine							
I-120	1.35 h	F	1.000	1.0×10^{-10}	1.9×10^{-10}	1.000	3.4×10^{-10}
I-120m	0.883 h	F	1.000	8.7×10^{-11}	1.4×10^{-10}	1.000	2.1×10^{-10}
I-121	2.12 h	F	1.000	2.8×10^{-11}	3.9×10^{-11}	1.000	8.2×10^{-11}
I-123	13.2 h	F	1.000	7.6×10^{-11}	1.1×10^{-10}	1.000	2.1×10^{-10}
I-124	4.18 d	F	1.000	4.5×10^{-9}	6.3×10^{-9}	1.000	1.3×10^{-8}
I-125	60.1 d	F	1.000	5.3×10^{-9}	7.3×10^{-9}	1.000	1.5×10^{-8}
I-126	13.0 d	F	1.000	1.0×10^{-8}	1.4×10^{-8}	1.000	2.9×10^{-8}
I-128	0.416 h	F	1.000	1.4×10^{-11}	2.2×10^{-11}	1.000	4.6×10^{-11}
I-129	1.57×10^{7} a	F	1.000	3.7×10^{-8}	5.1×10^{-8}	1.000	1.1×10^{-7}
I-130	12.4 h	F	1.000	6.9×10^{-10}	9.6×10^{-10}	1.000	2.0×10^{-9}
I-131	8.04 d	F	1.000	7.6×10^{-9}	1.1×10^{-8}	1.000	2.2×10^{-8}
I-132	2.30 h	F	1.000	9.6×10^{-11}	2.0×10^{-10}	1.000	2.9×10^{-10}
I-132m	1.39 h	F	1.000	8.1×10^{-11}	1.1×10^{-10}	1.000	2.2×10^{-10}
I-133	20.8 h	F	1.000	1.5×10^{-9}	2.1×10^{-9}	1.000	4.3×10^{-9}
I-134	0.876 h	F	1.000	4.8×10^{-11}	7.9×10^{-11}	1.000	1.1×10^{-10}
I-135	6.61 h	F	1.000	3.3×10^{-10}	4.6×10^{-10}	1.000	9.3×10^{-10}
Caesium							
Cs-125	0.750 h	F	1.000	1.3×10^{-11}	2.3×10^{-11}	1.000	3.5×10^{-11}
Cs-127	6.25 h	F	1.000	2.2×10^{-11}	4.0×10^{-11}	1.000	2.4×10^{-11}
Cs-129	1.34 d	F	1.000	4.5×10^{-11}	8.1×10^{-11}	1.000	6.0×10^{-11}
Cs-130	0.498 h	F	1.000	8.4×10^{-12}	1.5×10^{-11}	1.000	2.8×10^{-11}
Cs-131	9.69 d	F	1.000	2.8×10^{-11}	4.5×10^{-11}	1.000	5.8×10^{-11}
Cs-132	6.48 d	F	1.000	2.4×10^{-10}	3.8×10^{-10}	1.000	5.0×10^{-10}
Cs-134	2.06 a	F	1.000	6.8×10^{-9}	9.6×10^{-9}	1.000	1.9×10^{-8}
Cs-134m	2.90 h	F	1.000	1.5×10^{-11}	2.6×10^{-11}	1.000	2.0×10^{-11}

Cs-135	2.30 x 10^{6} a	F	1.000	7.1 x 10^{-10}	9.9 x 10^{-10}	1.000	2.0 x 10^{-9}
Cs-135m	0.883 h	F	1.000	1.3 x 10^{-11}	2.4 x 10^{-11}	1.000	1.9 x 10^{-11}
Cs-136	13.1 d	F	1.000	1.3 x 10^{-9}	1.9 x 10^{-9}	1.000	3.0 x 10^{-9}
Cs-137	30.0 a	F	1.000	4.8 x 10^{-9}	6.7 x 10^{-9}	1.000	1.3 x 10^{-8}
Cs-138	0.536 h	F	1.000	2.6 x 10^{-11}	4.6 x 10^{-11}	1.000	9.2 x 10^{-11}
Barium							
Ba-126	1.61 h	F	0.100	7.8 x 10^{-11}	1.2 x 10^{-10}	0.100	2.6 x 10^{-10}
Ba-128	2.43 d	F	0.100	8.0 x 10^{-10}	1.3 x 10^{-9}	0.100	2.7 x 10^{-9}
Ba-131	11.8 d	F	0.100	2.3 x 10^{-10}	3.5 x 10^{-10}	0.100	4.5 x 10^{-10}
Ba-131m	0.243 h	F	0.100	4.1 x 10^{-12}	6.4 x 10^{-12}	0.100	4.9 x 10^{-12}
Ba-133	10.7 a	F	0.100	1.5 x 10^{-9}	1.8 x 10^{-9}	0.100	1.0 x 10^{-9}
Ba-133m	1.62 d	F	0.100	1.9 x 10^{-10}	2.8 x 10^{-10}	0.100	5.5 x 10^{-10}
Ba-135m	1.20 d	F	0.100	1.5 x 10^{-10}	2.3 x 10^{-10}	0.100	4.5 x 10^{-10}
Ba-139	1.38 h	F	0.100	3.5 x 10^{-11}	5.5 x 10^{-11}	0.100	1.2 x 10^{-10}
Ba-140	12.7 d	F	0.100	1.0 x 10^{-9}	1.6 x 10^{-9}	0.100	2.5 x 10^{-9}
Ba-141	0.305 h	F	0.100	2.2 x 10^{-11}	3.5 x 10^{-11}	0.100	7.0 x 10^{-11}
Ba-142	0.177 h	F	0.100	1.6 x 10^{-11}	2.7 x 10^{-11}	0.100	3.5 x 10^{-11}
Lanthanum							
La-131	0.983 h	F	5.0 x 10^{-4}	1.4 x 10^{-11}	2.4 x 10^{-11}	5.0 x 10^{-4}	3.5 x 10^{-11}
		M	5.0 x 10^{-4}	2.3 x 10^{-11}	3.6 x 10^{-11}		
La-132	4.80 h	F	5.0 x 10^{-4}	1.1 x 10^{-10}	2.0 x 10^{-10}	5.0 x 10^{-4}	3.9 x 10^{-10}
		M	5.0 x 10^{-4}	1.7 x 10^{-10}	2.8 x 10^{-10}		
La-135	19.5 h	F	5.0 x 10^{-4}	1.1 x 10^{-11}	2.0 x 10^{-11}	5.0 x 10^{-4}	3.0 x 10^{-11}
		M	5.0 x 10^{-4}	1.5 x 10^{-11}	2.5 x 10^{-11}		
La-137	6.00 x 10^{4} a	F	5.0 x 10^{-4}	8.6 x 10^{-9}	1.0 x 10^{-8}	5.0 x 10^{-4}	8.1 x 10^{-11}
		M	5.0 x 10^{-4}	3.4 x 10^{-9}	2.3 x 10^{-9}		
La-138	1.35 x 10^{11} a	F	5.0 x 10^{-4}	1.5 x 10^{-7}	1.8 x 10^{-7}	5.0 x 10^{-4}	1.1 x 10^{-9}
		M	5.0 x 10^{-4}	6.1 x 10^{-8}	4.2 x 10^{-8}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
La-140	1.68 d	F	5.0×10^{-4}	6.0×10^{-10}	1.0×10^{-9}	5.0×10^{-4}	2.0×10^{-9}
		M	5.0×10^{-4}	1.1×10^{-9}	1.5×10^{-9}		
La-141	3.93 h	F	5.0×10^{-4}	6.7×10^{-11}	1.1×10^{-10}	5.0×10^{-4}	3.6×10^{-10}
		M	5.0×10^{-4}	1.5×10^{-10}	2.2×10^{-10}		
La-142	1.54 h	F	5.0×10^{-4}	5.6×10^{-11}	1.0×10^{-10}	5.0×10^{-4}	1.8×10^{-10}
		M	5.0×10^{-4}	9.3×10^{-11}	1.5×10^{-10}		
La-143	0.237 h	F	5.0×10^{-4}	1.2×10^{-11}	2.0×10^{-11}	5.0×10^{-4}	5.6×10^{-11}
		M	5.0×10^{-4}	2.2×10^{-11}	3.3×10^{-11}		
Cerium							
Ce-134	3.00 d	M	5.0×10^{-4}	1.3×10^{-9}	1.5×10^{-9}	5.0×10^{-4}	2.5×10^{-9}
		S	5.0×10^{-4}	1.3×10^{-9}	1.6×10^{-9}		
Ce-135	17.6 h	M	5.0×10^{-4}	4.9×10^{-10}	7.3×10^{-10}	5.0×10^{-4}	7.9×10^{-10}
		S	5.0×10^{-4}	5.1×10^{-10}	7.6×10^{-10}		
Ce-137	9.00 h	M	5.0×10^{-4}	1.0×10^{-11}	1.8×10^{-11}	5.0×10^{-4}	2.5×10^{-11}
		S	5.0×10^{-4}	1.1×10^{-11}	1.9×10^{-11}		
Ce-137m	1.43 d	M	5.0×10^{-4}	4.0×10^{-10}	5.5×10^{-10}	5.0×10^{-4}	5.4×10^{-10}
		S	5.0×10^{-4}	4.3×10^{-10}	5.9×10^{-10}		
Ce-139	138 d	M	5.0×10^{-4}	1.6×10^{-9}	1.3×10^{-9}	5.0×10^{-4}	2.6×10^{-10}
		S	5.0×10^{-4}	1.8×10^{-9}	1.4×10^{-9}		
Ce-141	32.5 d	M	5.0×10^{-4}	3.1×10^{-9}	2.7×10^{-9}	5.0×10^{-4}	7.1×10^{-10}
		S	5.0×10^{-4}	3.6×10^{-9}	3.1×10^{-9}		
Ce-143	1.38 d	M	5.0×10^{-4}	7.4×10^{-10}	9.5×10^{-10}	5.0×10^{-4}	1.1×10^{-9}
		S	5.0×10^{-4}	8.1×10^{-10}	1.0×10^{-9}		

Ce-144	284 d	M	5.0×10^{-4}	3.4×10^{-8}	2.3×10^{-8}	5.0×10^{-4}	5.2×10^{-9}
		S	5.0×10^{-4}	4.9×10^{-8}	2.9×10^{-8}		
Praseodymium							
Pr-136	0.218 h	M	5.0×10^{-4}	1.4×10^{-11}	2.4×10^{-11}	5.0×10^{-4}	3.3×10^{-11}
		S	5.0×10^{-4}	1.5×10^{-11}	2.5×10^{-11}		
Pr-137	1.28 h	M	5.0×10^{-4}	2.1×10^{-11}	3.4×10^{-11}	5.0×10^{-4}	4.0×10^{-11}
		S	5.0×10^{-4}	2.2×10^{-11}	3.5×10^{-11}		
Pr-138m	2.10 h	M	5.0×10^{-4}	7.6×10^{-11}	1.3×10^{-10}	5.0×10^{-4}	1.3×10^{-10}
		S	5.0×10^{-4}	7.9×10^{-11}	1.3×10^{-10}		
Pr-139	4.51 h	M	5.0×10^{-4}	1.9×10^{-11}	2.9×10^{-11}	5.0×10^{-4}	3.1×10^{-11}
		S	5.0×10^{-4}	2.0×10^{-11}	3.0×10^{-11}		
Pr-142	19.1 h	M	5.0×10^{-4}	5.3×10^{-10}	7.0×10^{-10}	5.0×10^{-4}	1.3×10^{-9}
		S	5.0×10^{-4}	5.6×10^{-10}	7.4×10^{-10}		
Pr-142m	0.234 h	M	5.0×10^{-4}	6.7×10^{-12}	8.9×10^{-12}	5.0×10^{-4}	1.7×10^{-11}
		S	5.0×10^{-4}	7.1×10^{-12}	9.4×10^{-12}		
Pr-143	13.6 d	M	5.0×10^{-4}	2.1×10^{-9}	1.9×10^{-9}	5.0×10^{-4}	1.2×10^{-9}
		S	5.0×10^{-4}	2.3×10^{-9}	2.2×10^{-9}		
Pr-144	0.288 h	M	5.0×10^{-4}	1.8×10^{-11}	2.9×10^{-11}	5.0×10^{-4}	5.0×10^{-11}
		S	5.0×10^{-4}	1.9×10^{-11}	3.0×10^{-11}		
Pr-145	5.98 h	M	5.0×10^{-4}	1.6×10^{-10}	2.5×10^{-10}	5.0×10^{-4}	3.9×10^{-10}
		S	5.0×10^{-4}	1.7×10^{-10}	2.6×10^{-10}		
Pr-147	0.227 h	M	5.0×10^{-4}	1.8×10^{-11}	2.9×10^{-11}	5.0×10^{-4}	3.3×10^{-11}
		S	5.0×10^{-4}	1.9×10^{-11}	3.0×10^{-11}		
Neodymium							
Nd-136	0.844 h	M	5.0×10^{-4}	5.3×10^{-11}	8.5×10^{-11}	5.0×10^{-4}	9.9×10^{-11}
		S	5.0×10^{-4}	5.6×10^{-11}	8.9×10^{-11}		
Nd-138	5.04 h	M	5.0×10^{-4}	2.4×10^{-10}	3.7×10^{-10}	5.0×10^{-4}	6.4×10^{-10}
		S	5.0×10^{-4}	2.6×10^{-10}	3.8×10^{-10}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Nd-139	0.495 h	M	5.0×10^{-4}	1.0×10^{-11}	1.7×10^{-11}	5.0×10^{-4}	2.0×10^{-11}
		S	5.0×10^{-4}	1.1×10^{-11}	1.7×10^{-11}		
Nd-139m	5.50 h	M	5.0×10^{-4}	1.5×10^{-10}	2.5×10^{-10}	5.0×10^{-4}	2.5×10^{-10}
		S	5.0×10^{-4}	1.6×10^{-10}	2.5×10^{-10}		
Nd-141	2.49 h	M	5.0×10^{-4}	5.1×10^{-12}	8.5×10^{-12}	5.0×10^{-4}	8.3×10^{-12}
		S	5.0×10^{-4}	5.3×10^{-12}	8.8×10^{-12}		
Nd-147	11.0 d	M	5.0×10^{-4}	2.0×10^{-9}	1.9×10^{-9}	5.0×10^{-4}	1.1×10^{-9}
		S	5.0×10^{-4}	2.3×10^{-9}	2.1×10^{-9}		
Nd-149	1.73 h	M	5.0×10^{-4}	8.5×10^{-11}	1.2×10^{-10}	5.0×10^{-4}	1.2×10^{-10}
		S	5.0×10^{-4}	9.0×10^{-11}	1.3×10^{-10}		
Nd-151	0.207 h	M	5.0×10^{-4}	1.7×10^{-11}	2.8×10^{-11}	5.0×10^{-4}	3.0×10^{-11}
		S	5.0×10^{-4}	1.8×10^{-11}	2.9×10^{-11}		
Promethium							
Pm-141	0.348 h	M	5.0×10^{-4}	1.5×10^{-11}	2.4×10^{-11}	5.0×10^{-4}	3.6×10^{-11}
		S	5.0×10^{-4}	1.6×10^{-11}	2.5×10^{-11}		
Pm-143	265 d	M	5.0×10^{-4}	1.4×10^{-9}	9.6×10^{-10}	5.0×10^{-4}	2.3×10^{-10}
		S	5.0×10^{-4}	1.3×10^{-9}	8.3×10^{-10}		
Pm-144	363 d	M	5.0×10^{-4}	7.8×10^{-9}	5.4×10^{-9}	5.0×10^{-4}	9.7×10^{-10}
		S	5.0×10^{-4}	7.0×10^{-9}	3.9×10^{-9}		
Pm-145	17.7 a	M	5.0×10^{-4}	3.4×10^{-9}	2.4×10^{-9}	5.0×10^{-4}	1.1×10^{-10}
		S	5.0×10^{-4}	2.1×10^{-9}	1.2×10^{-9}		
Pm-146	5.53 a	M	5.0×10^{-4}	1.9×10^{-8}	1.3×10^{-8}	5.0×10^{-4}	9.0×10^{-10}
		S	5.0×10^{-4}	1.6×10^{-8}	9.0×10^{-9}		
Pm-147	2.62 a	M	5.0×10^{-4}	4.7×10^{-9}	3.5×10^{-9}	5.0×10^{-4}	2.6×10^{-10}
		S	5.0×10^{-4}	4.6×10^{-9}	3.2×10^{-9}		

Pm-148	5.37 d	M	5.0×10^{-4}	2.0×10^{-9}	2.1×10^{-9}	5.0×10^{-4}	2.7×10^{-9}
		S	5.0×10^{-4}	2.1×10^{-9}	2.2×10^{-9}		
Pm-148m	41.3 d	M	5.0×10^{-4}	4.9×10^{-9}	4.1×10^{-9}	5.0×10^{-4}	1.8×10^{-9}
		S	5.0×10^{-4}	5.4×10^{-9}	4.3×10^{-9}		
Pm-149	2.21 d	M	5.0×10^{-4}	6.6×10^{-10}	7.6×10^{-10}	5.0×10^{-4}	9.9×10^{-10}
		S	5.0×10^{-4}	7.2×10^{-10}	8.2×10^{-10}		
Pm-150	2.68 h	M	5.0×10^{-4}	1.3×10^{-10}	2.0×10^{-10}	5.0×10^{-4}	2.6×10^{-10}
		S	5.0×10^{-4}	1.4×10^{-10}	2.1×10^{-10}		
Pm-151	1.18 d	M	5.0×10^{-4}	4.2×10^{-10}	6.1×10^{-10}	5.0×10^{-4}	7.3×10^{-10}
		S	5.0×10^{-4}	4.5×10^{-10}	6.4×10^{-10}		
Samarium							
Sm-141	0.170 h	M	5.0×10^{-4}	1.6×10^{-11}	2.7×10^{-11}	5.0×10^{-4}	3.9×10^{-11}
Sm-141m	0.377 h	M	5.0×10^{-4}	3.4×10^{-11}	5.6×10^{-11}	5.0×10^{-4}	6.5×10^{-11}
Sm-142	1.21 h	M	5.0×10^{-4}	7.4×10^{-11}	1.1×10^{-10}	5.0×10^{-4}	1.9×10^{-10}
Sm-145	340 d	M	5.0×10^{-4}	1.5×10^{-9}	1.1×10^{-9}	5.0×10^{-4}	2.1×10^{-10}
Sm-146	1.03×10^{8} a	M	5.0×10^{-4}	9.9×10^{-6}	6.7×10^{-6}	5.0×10^{-4}	5.4×10^{-8}
Sm-147	1.06×10^{11} a	M	5.0×10^{-4}	8.9×10^{-6}	6.1×10^{-6}	5.0×10^{-4}	4.9×10^{-8}
Sm-151	90.0 a	M	5.0×10^{-4}	3.7×10^{-9}	2.6×10^{-9}	5.0×10^{-4}	9.8×10^{-11}
Sm-153	1.95 d	M	5.0×10^{-4}	6.1×10^{-10}	6.8×10^{-10}	5.0×10^{-4}	7.4×10^{-10}
Sm-155	0.368 h	M	5.0×10^{-4}	1.7×10^{-11}	2.8×10^{-11}	5.0×10^{-4}	2.9×10^{-11}
Sm-156	9.40 h	M	5.0×10^{-4}	2.1×10^{-10}	2.8×10^{-10}	5.0×10^{-4}	2.5×10^{-10}
Europium							
Eu-145	5.94 d	M	5.0×10^{-4}	5.6×10^{-10}	7.3×10^{-10}	5.0×10^{-4}	7.5×10^{-10}
Eu-146	4.61 d	M	5.0×10^{-4}	8.2×10^{-10}	1.2×10^{-9}	5.0×10^{-4}	1.3×10^{-9}
Eu-147	24.0 d	M	5.0×10^{-4}	1.0×10^{-9}	1.0×10^{-9}	5.0×10^{-4}	4.4×10^{-10}
Eu-148	54.5 d	M	5.0×10^{-4}	2.7×10^{-9}	2.3×10^{-9}	5.0×10^{-4}	1.3×10^{-9}
Eu-149	93.1 d	M	5.0×10^{-4}	2.7×10^{-10}	2.3×10^{-10}	5.0×10^{-4}	1.0×10^{-10}
Eu-150	34.2 a	M	5.0×10^{-4}	5.0×10^{-8}	3.4×10^{-8}	5.0×10^{-4}	1.3×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Eu-150	12.6 h	M	5.0×10^{-4}	1.9×10^{-10}	2.8×10^{-10}	5.0×10^{-4}	3.8×10^{-10}
Eu-152	13.3 a	M	5.0×10^{-4}	3.9×10^{-8}	2.7×10^{-8}	5.0×10^{-4}	1.4×10^{-9}
Eu-152m	9.32 h	M	5.0×10^{-4}	2.2×10^{-10}	3.2×10^{-10}	5.0×10^{-4}	5.0×10^{-10}
Eu-154	8.80 a	M	5.0×10^{-4}	5.0×10^{-8}	3.5×10^{-8}	5.0×10^{-4}	2.0×10^{-9}
Eu-155	4.96 a	M	5.0×10^{-4}	6.5×10^{-9}	4.7×10^{-9}	5.0×10^{-4}	3.2×10^{-10}
Eu-156	15.2 d	M	5.0×10^{-4}	3.3×10^{-9}	3.0×10^{-9}	5.0×10^{-4}	2.2×10^{-9}
Eu-157	15.1 h	M	5.0×10^{-4}	3.2×10^{-10}	4.4×10^{-10}	5.0×10^{-4}	6.0×10^{-10}
Eu-158	0.765 h	M	5.0×10^{-4}	4.8×10^{-11}	7.5×10^{-11}	5.0×10^{-4}	9.4×10^{-11}
Gadolinium							
Gd-145	0.382 h	F	5.0×10^{-4}	1.5×10^{-11}	2.6×10^{-11}	5.0×10^{-4}	4.4×10^{-11}
		M	5.0×10^{-4}	2.1×10^{-11}	3.5×10^{-11}		
Gd-146	48.3 d	F	5.0×10^{-4}	4.4×10^{-9}	5.2×10^{-9}	5.0×10^{-4}	9.6×10^{-10}
		M	5.0×10^{-4}	6.0×10^{-9}	4.6×10^{-9}		
Gd-147	1.59 d	F	5.0×10^{-4}	2.7×10^{-10}	4.5×10^{-10}	5.0×10^{-4}	6.1×10^{-10}
		M	5.0×10^{-4}	4.1×10^{-10}	5.9×10^{-10}		
Gd-148	93.0 a	F	5.0×10^{-4}	2.5×10^{-5}	3.0×10^{-5}	5.0×10^{-4}	5.5×10^{-8}
		M	5.0×10^{-4}	1.1×10^{-5}	7.2×10^{-6}		
Gd-149	9.40 d	F	5.0×10^{-4}	2.6×10^{-10}	4.5×10^{-10}	5.0×10^{-4}	4.5×10^{-10}
		M	5.0×10^{-4}	7.0×10^{-10}	7.9×10^{-10}		
Gd-151	120 d	F	5.0×10^{-4}	7.8×10^{-10}	9.3×10^{-10}	5.0×10^{-4}	2.0×10^{-10}
		M	5.0×10^{-4}	8.1×10^{-10}	6.5×10^{-10}		
Gd-152	1.08×10^{14} a	F	5.0×10^{-4}	1.9×10^{-5}	2.2×10^{-5}	5.0×10^{-4}	4.1×10^{-8}
		M	5.0×10^{-4}	7.4×10^{-6}	5.0×10^{-6}		
Gd-153	242 d	F	5.0×10^{-4}	2.1×10^{-9}	2.5×10^{-9}	5.0×10^{-4}	2.7×10^{-10}
		M	5.0×10^{-4}	1.9×10^{-9}	1.4×10^{-9}		

Gd-159	18.6 h	F	5.0×10^{-4}	1.1×10^{-10}	1.8×10^{-10}	5.0×10^{-4}	4.9×10^{-10}
		M	5.0×10^{-4}	2.7×10^{-10}	3.9×10^{-10}		
Terbium							
Tb-147	1.65 h	M	5.0×10^{-4}	7.9×10^{-11}	1.2×10^{-10}	5.0×10^{-4}	1.6×10^{-10}
Tb-149	4.15 h	M	5.0×10^{-4}	4.3×10^{-9}	3.1×10^{-9}	5.0×10^{-4}	2.5×10^{-10}
Tb-150	3.27 h	M	5.0×10^{-4}	1.1×10^{-10}	1.8×10^{-10}	5.0×10^{-4}	2.5×10^{-10}
Tb-151	17.6 h	M	5.0×10^{-4}	2.3×10^{-10}	3.3×10^{-10}	5.0×10^{-4}	3.4×10^{-10}
Tb-153	2.34 d	M	5.0×10^{-4}	2.0×10^{-10}	2.4×10^{-10}	5.0×10^{-4}	2.5×10^{-10}
Tb-154	21.4 h	M	5.0×10^{-4}	3.8×10^{-10}	6.0×10^{-10}	5.0×10^{-4}	6.5×10^{-10}
Tb-155	5.32 d	M	5.0×10^{-4}	2.1×10^{-10}	2.5×10^{-10}	5.0×10^{-4}	2.1×10^{-10}
Tb-156	5.34 d	M	5.0×10^{-4}	1.2×10^{-9}	1.4×10^{-9}	5.0×10^{-4}	1.2×10^{-9}
Tb-156m	1.02 d	M	5.0×10^{-4}	2.0×10^{-10}	2.3×10^{-10}	5.0×10^{-4}	1.7×10^{-10}
Tb-156m	5.00 h	M	5.0×10^{-4}	9.2×10^{-11}	1.3×10^{-10}	5.0×10^{-4}	8.1×10^{-11}
Tb-157	1.50×10^{2} a	M	5.0×10^{-4}	1.1×10^{-9}	7.9×10^{-10}	5.0×10^{-4}	3.4×10^{-11}
Tb-158	1.50×10^{2} a	M	5.0×10^{-4}	4.3×10^{-8}	3.0×10^{-8}	5.0×10^{-4}	1.1×10^{-9}
Tb-160	72.3 d	M	5.0×10^{-4}	6.6×10^{-9}	5.4×10^{-9}	5.0×10^{-4}	1.6×10^{-9}
Tb-161	6.91 d	M	5.0×10^{-4}	1.2×10^{-9}	1.2×10^{-9}	5.0×10^{-4}	7.2×10^{-10}
Dysprosium							
Dy-155	10.0 h	M	5.0×10^{-4}	8.0×10^{-11}	1.2×10^{-10}	5.0×10^{-4}	1.3×10^{-10}
Dy-157	8.10 h	M	5.0×10^{-4}	3.2×10^{-11}	5.5×10^{-11}	5.0×10^{-4}	6.1×10^{-11}
Dy-159	144 d	M	5.0×10^{-4}	3.5×10^{-10}	2.5×10^{-10}	5.0×10^{-4}	1.0×10^{-10}
Dy-165	2.33 h	M	5.0×10^{-4}	6.1×10^{-11}	8.7×10^{-11}	5.0×10^{-4}	1.1×10^{-10}
Dy-166	3.40 d	M	5.0×10^{-4}	1.8×10^{-9}	1.8×10^{-9}	5.0×10^{-4}	1.6×10^{-9}
Holmium							
Ho-155	0.800 h	M	5.0×10^{-4}	2.0×10^{-11}	3.2×10^{-11}	5.0×10^{-4}	3.7×10^{-11}
Ho-157	0.210 h	M	5.0×10^{-4}	4.5×10^{-12}	7.6×10^{-12}	5.0×10^{-4}	6.5×10^{-12}
Ho-159	0.550 h	M	5.0×10^{-4}	6.3×10^{-12}	1.0×10^{-11}	5.0×10^{-4}	7.9×10^{-12}
Ho-161	2.50 h	M	5.0×10^{-4}	6.3×10^{-12}	1.0×10^{-11}	5.0×10^{-4}	1.3×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Ho-162	0.250 h	M	5.0×10^{-4}	2.9×10^{-12}	4.5×10^{-12}	5.0×10^{-4}	3.3×10^{-12}
Ho-162m	1.13 h	M	5.0×10^{-4}	2.2×10^{-11}	3.3×10^{-11}	5.0×10^{-4}	2.6×10^{-11}
Ho-164	0.483 h	M	5.0×10^{-4}	8.6×10^{-12}	1.3×10^{-11}	5.0×10^{-4}	9.5×10^{-12}
Ho-164m	0.625 h	M	5.0×10^{-4}	1.2×10^{-11}	1.6×10^{-11}	5.0×10^{-4}	1.6×10^{-11}
Ho-166	1.12 d	M	5.0×10^{-4}	6.6×10^{-10}	8.3×10^{-10}	5.0×10^{-4}	1.4×10^{-9}
Ho-166m	1.20×10^{3} a	M	5.0×10^{-4}	1.1×10^{-7}	7.8×10^{-8}	5.0×10^{-4}	2.0×10^{-9}
Ho-167	3.10 h	M	5.0×10^{-4}	7.1×10^{-11}	1.0×10^{-10}	5.0×10^{-4}	8.3×10^{-11}
Erbium							
Er-161	3.24 h	M	5.0×10^{-4}	5.1×10^{-11}	8.5×10^{-11}	5.0×10^{-4}	8.0×10^{-11}
Er-165	10.4 h	M	5.0×10^{-4}	8.3×10^{-12}	1.4×10^{-11}	5.0×10^{-4}	1.9×10^{-11}
Er-169	9.30 d	M	5.0×10^{-4}	9.8×10^{-10}	9.2×10^{-10}	5.0×10^{-4}	3.7×10^{-10}
Er-171	7.52 h	M	5.0×10^{-4}	2.2×10^{-10}	3.0×10^{-10}	5.0×10^{-4}	3.6×10^{-10}
Er-172	2.05 d	M	5.0×10^{-4}	1.1×10^{-9}	1.2×10^{-9}	5.0×10^{-4}	1.0×10^{-9}
Thulium							
Tm-162	0.362 h	M	5.0×10^{-4}	1.6×10^{-11}	2.7×10^{-11}	5.0×10^{-4}	2.9×10^{-11}
Tm-166	7.70 h	M	5.0×10^{-4}	1.8×10^{-10}	2.8×10^{-10}	5.0×10^{-4}	2.8×10^{-10}
Tm-167	9.24 d	M	5.0×10^{-4}	1.1×10^{-9}	1.0×10^{-9}	5.0×10^{-4}	5.6×10^{-10}
Tm-170	129 d	M	5.0×10^{-4}	6.6×10^{-9}	5.2×10^{-9}	5.0×10^{-4}	1.3×10^{-9}
Tm-171	1.92 a	M	5.0×10^{-4}	1.3×10^{-9}	9.1×10^{-10}	5.0×10^{-4}	1.1×10^{-10}
Tm-172	2.65 d	M	5.0×10^{-4}	1.1×10^{-9}	1.4×10^{-9}	5.0×10^{-4}	1.7×10^{-9}
Tm-173	8.24 h	M	5.0×10^{-4}	1.8×10^{-10}	2.6×10^{-10}	5.0×10^{-4}	3.1×10^{-10}
Tm-175	0.253 h	M	5.0×10^{-4}	1.9×10^{-11}	3.1×10^{-11}	5.0×10^{-4}	2.7×10^{-11}
Ytterbium							
Yb-162	0.315 h	M	5.0×10^{-4}	1.4×10^{-11}	2.2×10^{-11}	5.0×10^{-4}	2.3×10^{-11}
		S	5.0×10^{-4}	1.4×10^{-11}	2.3×10^{-11}		

Yb-166	2.36 d	M	5.0×10^{-4}	7.2×10^{-10}	9.1×10^{-10}	5.0×10^{-4}	9.5×10^{-10}
		S	5.0×10^{-4}	7.6×10^{-10}	9.5×10^{-10}		
Yb-167	0.292 h	M	5.0×10^{-4}	6.5×10^{-12}	9.0×10^{-12}	5.0×10^{-4}	6.7×10^{-12}
		S	5.0×10^{-4}	6.9×10^{-12}	9.5×10^{-12}		
Yb-169	32.0 d	M	5.0×10^{-4}	2.4×10^{-9}	2.1×10^{-9}	5.0×10^{-4}	7.1×10^{-10}
		S	5.0×10^{-4}	2.8×10^{-9}	2.4×10^{-9}		
Yb-175	4.19 d	M	5.0×10^{-4}	6.3×10^{-10}	6.4×10^{-10}	5.0×10^{-4}	4.4×10^{-10}
		S	5.0×10^{-4}	7.0×10^{-10}	7.0×10^{-10}		
Yb-177	1.90 h	M	5.0×10^{-4}	6.4×10^{-11}	8.8×10^{-11}	5.0×10^{-4}	9.7×10^{-11}
		S	5.0×10^{-4}	6.9×10^{-11}	9.4×10^{-11}		
Yb-178	1.23 h	M	5.0×10^{-4}	7.1×10^{-11}	1.0×10^{-10}	5.0×10^{-4}	1.2×10^{-10}
		S	5.0×10^{-4}	7.6×10^{-11}	1.1×10^{-10}		
Lutetium							
Lu-169	1.42 d	M	5.0×10^{-4}	3.5×10^{-10}	4.7×10^{-10}	5.0×10^{-4}	4.6×10^{-10}
		S	5.0×10^{-4}	3.8×10^{-10}	4.9×10^{-10}		
Lu-170	2.00 d	M	5.0×10^{-4}	6.4×10^{-10}	9.3×10^{-10}	5.0×10^{-4}	9.9×10^{-10}
		S	5.0×10^{-4}	6.7×10^{-10}	9.5×10^{-10}		
Lu-171	8.22 d	M	5.0×10^{-4}	7.6×10^{-10}	8.8×10^{-10}	5.0×10^{-4}	6.7×10^{-10}
		S	5.0×10^{-4}	8.3×10^{-10}	9.3×10^{-10}		
Lu-172	6.70 d	M	5.0×10^{-4}	1.4×10^{-9}	1.7×10^{-9}	5.0×10^{-4}	1.3×10^{-9}
		S	5.0×10^{-4}	1.5×10^{-9}	1.8×10^{-9}		
Lu-173	1.37 a	M	5.0×10^{-4}	2.0×10^{-9}	1.5×10^{-9}	5.0×10^{-4}	2.6×10^{-10}
		S	5.0×10^{-4}	2.3×10^{-9}	1.4×10^{-9}		
Lu-174	3.31 a	M	5.0×10^{-4}	4.0×10^{-9}	2.9×10^{-9}	5.0×10^{-4}	2.7×10^{-10}
		S	5.0×10^{-4}	3.9×10^{-9}	2.5×10^{-9}		
Lu-174m	142 d	M	5.0×10^{-4}	3.4×10^{-9}	2.4×10^{-9}	5.0×10^{-4}	5.3×10^{-10}
		S	5.0×10^{-4}	3.8×10^{-9}	2.6×10^{-9}		
Lu-176	3.60×10^{10} a	M	5.0×10^{-4}	6.6×10^{-8}	4.6×10^{-8}	5.0×10^{-4}	1.8×10^{-9}
		S	5.0×10^{-4}	5.2×10^{-8}	3.0×10^{-8}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Lu-176m	3.68 h	M	5.0×10^{-4}	1.1×10^{-10}	1.5×10^{-10}	5.0×10^{-4}	1.7×10^{-10}
		S	5.0×10^{-4}	1.2×10^{-10}	1.6×10^{-10}		
Lu-177	6.71 d	M	5.0×10^{-4}	1.0×10^{-9}	1.0×10^{-9}	5.0×10^{-4}	5.3×10^{-10}
		S	5.0×10^{-4}	1.1×10^{-9}	1.1×10^{-9}		
Lu-177m	161 d	M	5.0×10^{-4}	1.2×10^{-8}	1.0×10^{-8}	5.0×10^{-4}	1.7×10^{-9}
		S	5.0×10^{-4}	1.5×10^{-8}	1.2×10^{-8}		
Lu-178	0.473 h	M	5.0×10^{-4}	2.5×10^{-11}	3.9×10^{-11}	5.0×10^{-4}	4.7×10^{-11}
		S	5.0×10^{-4}	2.6×10^{-11}	4.1×10^{-11}		
Lu-178m	0.378 h	M	5.0×10^{-4}	3.3×10^{-11}	5.4×10^{-11}	5.0×10^{-4}	3.8×10^{-11}
		S	5.0×10^{-4}	3.5×10^{-11}	5.6×10^{-11}		
Lu-179	4.59 h	M	5.0×10^{-4}	1.1×10^{-10}	1.6×10^{-10}	5.0×10^{-4}	2.1×10^{-10}
		S	5.0×10^{-4}	1.2×10^{-10}	1.6×10^{-10}		
Hafnium							
Hf-170	16.0 h	F	0.002	1.7×10^{-10}	2.9×10^{-10}	0.002	4.8×10^{-10}
		M	0.002	3.2×10^{-10}	4.3×10^{-10}		
Hf-172	1.87 a	F	0.002	3.2×10^{-8}	3.7×10^{-8}	0.002	1.0×10^{-9}
		M	0.002	1.9×10^{-8}	1.3×10^{-8}		
Hf-173	24.0 h	F	0.002	7.9×10^{-11}	1.3×10^{-10}	0.002	2.3×10^{-10}
		M	0.002	1.6×10^{-10}	2.2×10^{-10}		
Hf-175	70.0 d	F	0.002	7.2×10^{-10}	8.7×10^{-10}	0.002	4.1×10^{-10}
		M	0.002	1.1×10^{-9}	8.8×10^{-10}		
Hf-177m	0.856 h	F	0.002	4.7×10^{-11}	8.4×10^{-11}	0.002	8.1×10^{-11}
		M	0.002	9.2×10^{-11}	1.5×10^{-10}		
Hf-178m	31.0 a	F	0.002	2.6×10^{-7}	3.1×10^{-7}	0.002	4.7×10^{-9}
		M	0.002	1.1×10^{-7}	7.8×10^{-8}		
Hf-179m	25.1 d	F	0.002	1.1×10^{-9}	1.4×10^{-9}	0.002	1.2×10^{-9}
		M	0.002	3.6×10^{-9}	3.2×10^{-9}		

Hf-180m	5.50 h	F	0.002	6.4×10^{-11}	1.2×10^{-10}	0.002	1.7×10^{-10}
		M	0.002	1.4×10^{-10}	2.0×10^{-10}		
Hf-181	42.4 d	F	0.002	1.4×10^{-9}	1.8×10^{-9}	0.002	1.1×10^{-9}
		M	0.002	4.7×10^{-9}	4.1×10^{-9}		
Hf-182	9.00×10^{6} a	F	0.002	3.0×10^{-7}	3.6×10^{-7}	0.002	3.0×10^{-9}
		M	0.002	1.2×10^{-7}	8.3×10^{-8}		
Hf-182m	1.02 h	F	0.002	2.3×10^{-11}	4.0×10^{-11}	0.002	4.2×10^{-11}
		M	0.002	4.7×10^{-11}	7.1×10^{-11}		
Hf-183	1.07 h	F	0.002	2.6×10^{-11}	4.4×10^{-11}	0.002	7.3×10^{-11}
		M	0.002	5.8×10^{-11}	8.3×10^{-11}		
Hf-184	4.12 h	F	0.002	1.3×10^{-10}	2.3×10^{-10}	0.002	5.2×10^{-10}
		M	0.002	3.3×10^{-10}	4.5×10^{-10}		
Tantalum							
Ta-172	0.613 h	M	0.001	3.4×10^{-11}	5.5×10^{-11}	0.001	5.3×10^{-11}
		S	0.001	3.6×10^{-11}	5.7×10^{-11}		
Ta-173	3.65 h	M	0.001	1.1×10^{-10}	1.6×10^{-10}	0.001	1.9×10^{-10}
		S	0.001	1.2×10^{-10}	1.6×10^{-10}		
Ta-174	1.20 h	M	0.001	4.2×10^{-11}	6.3×10^{-11}	0.001	5.7×10^{-11}
		S	0.001	4.4×10^{-11}	6.6×10^{-11}		
Ta-175	10.5 h	M	0.001	1.3×10^{-10}	2.0×10^{-10}	0.001	2.1×10^{-10}
		S	0.001	1.4×10^{-10}	2.0×10^{-10}		
Ta-176	8.08 h	M	0.001	2.0×10^{-10}	3.2×10^{-10}	0.001	3.1×10^{-10}
		S	0.001	2.1×10^{-10}	3.3×10^{-10}		
Ta-177	2.36 h	M	0.001	9.3×10^{-11}	1.2×10^{-10}	0.001	1.1×10^{-10}
		S	0.001	1.0×10^{-10}	1.3×10^{-10}		
Ta-178	2.20 h	M	0.001	6.6×10^{-11}	1.0×10^{-10}	0.001	7.8×10^{-11}
		S	0.001	6.9×10^{-11}	1.1×10^{-10}		
Ta-179	1.82 a	M	0.001	2.0×10^{-10}	1.3×10^{-10}	0.001	6.5×10^{-11}
		S	0.001	5.2×10^{-10}	2.9×10^{-10}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Ta-180	1.00 x 10^{13} a	M	0.001	6.0 x 10^{-9}	4.6 x 10^{-9}	0.001	8.4 x 10^{-10}
		S	0.001	2.4 x 10^{-8}	1.4 x 10^{-8}		
Ta-180m	8.10 h	M	0.001	4.4 x 10^{-11}	5.8 x 10^{-11}	0.001	5.4 x 10^{-11}
		S	0.001	4.7 x 10^{-11}	6.2 x 10^{-11}		
Ta-182	115 d	M	0.001	7.2 x 10^{-9}	5.8 x 10^{-9}	0.001	1.5 x 10^{-9}
		S	0.001	9.7 x 10^{-9}	7.4 x 10^{-9}		
Ta-182m	0.264 h	M	0.001	2.1 x 10^{-11}	3.4 x 10^{-11}	0.001	1.2 x 10^{-11}
		S	0.001	2.2 x 10^{-11}	3.6 x 10^{-11}		
Ta-183	5.10 d	M	0.001	1.8 x 10^{-9}	1.8 x 10^{-9}	0.001	1.3 x 10^{-9}
		S	0.001	2.0 x 10^{-9}	2.0 x 10^{-9}		
Ta-184	8.70 h	M	0.001	4.1 x 10^{-10}	6.0 x 10^{-10}	0.001	6.8 x 10^{-10}
		S	0.001	4.4 x 10^{-10}	6.3 x 10^{-10}		
Ta-185	0.816 h	M	0.001	4.6 x 10^{-11}	6.8 x 10^{-11}	0.001	6.8 x 10^{-11}
		S	0.001	4.9 x 10^{-11}	7.2 x 10^{-11}		
Ta-186	0.175 h	M	0.001	1.8 x 10^{-11}	3.0 x 10^{-11}	0.001	3.3 x 10^{-11}
		S	0.001	1.9 x 10^{-11}	3.1 x 10^{-11}		
Tungsten							
W-176	2.30 h	F	0.300	4.4 x 10^{-11}	7.6 x 10^{-11}	0.300	1.0 x 10^{-10}
						0.010	1.1 x 10^{-10}
W-177	2.25 h	F	0.300	2.6 x 10^{-11}	4.6 x 10^{-11}	0.300	5.8 x 10^{-11}
						0.010	6.1 x 10^{-11}
W-178	21.7 d	F	0.300	7.6 x 10^{-11}	1.2 x 10^{-10}	0.300	2.2 x 10^{-10}
						0.010	2.5 x 10^{-10}
W-179	0.625 h	F	0.300	9.9 x 10^{-13}	1.8 x 10^{-12}	0.300	3.3 x 10^{-12}
						0.010	3.3 x 10^{-12}

W-181	121 d	F	0.300	2.8×10^{-11}	4.3×10^{-11}	0.300	7.6×10^{-11}
						0.010	8.2×10^{-11}
W-185	75.1 d	F	0.300	1.4×10^{-10}	2.2×10^{-10}	0.300	4.4×10^{-10}
						0.010	5.0×10^{-10}
W-187	23.9 h	F	0.300	2.0×10^{-10}	3.3×10^{-10}	0.300	6.3×10^{-10}
						0.010	7.1×10^{-10}
W-188	69.4 d	F	0.300	5.9×10^{-10}	8.4×10^{-10}	0.300	2.1×10^{-9}
						0.010	2.3×10^{-9}
Rhenium							
Re-177	0.233h	F	0.800	1.0×10^{-11}	1.7×10^{-11}	0.800	2.2×10^{-11}
		M	0.800	1.4×10^{-11}	2.2×10^{-11}		
Re-178	0.220 h	F	0.800	1.1×10^{-11}	1.8×10^{-11}	0.800	2.5×10^{-11}
		M	0.800	1.5×10^{-11}	2.4×10^{-11}		
Re-181	20.0 h	F	0.800	1.9×10^{-10}	3.0×10^{-10}	0.800	4.2×10^{-10}
		M	0.800	2.5×10^{-10}	3.7×10^{-10}		
Re-182	2.67 d	F	0.800	6.8×10^{-10}	1.1×10^{-9}	0.800	1.4×10^{-9}
		M	0.800	1.3×10^{-9}	1.7×10^{-9}		
Re-182	12. 7 h	F	0.800	1.5×10^{-10}	2.4×10^{-10}	0.800	2.7×10^{-10}
		M	0.800	2.0×10^{-10}	3.0×10^{-10}		
Re-184	38.0 d	F	0.800	4.6×10^{-10}	7.0×10^{-10}	0.800	1.0×10^{-9}
		M	0.800	1.8×10^{-9}	1.8×10^{-9}		
Re-184m	165 d	F	0.800	6.1×10^{-10}	8.8×10^{-10}	0.800	1.5×10^{-9}
		M	0.800	6.1×10^{-9}	4.8×10^{-9}		
Re-186	3.78 d	F	0.800	5.3×10^{-10}	7.3×10^{-10}	0.800	1.5×10^{-9}
		M	0.800	1.1×10^{-9}	1.2×10^{-9}		
Re-186m	2.00×10^{5} a	F	0.800	8.5×10^{-10}	1.2×10^{-9}	0.800	2.2×10^{-9}
		M	0.800	1.1×10^{-8}	7.9×10^{-9}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Re-187	5.00×10^{10} a	F	0.800	1.9×10^{-12}	2.6×10^{-12}	0.800	5.1×10^{-12}
		M	0.800	6.0×10^{-12}	4.6×10^{-12}		
Re-188	17.0 h	F	0.800	4.7×10^{-10}	6.6×10^{-10}	0.800	1.4×10^{-9}
		M	0.800	5.5×10^{-10}	7.4×10^{-10}		
Re-188m	0.3 x 10 h	F	0.800	1.0×10^{-11}	1.6×10^{-11}	0.800	3.0×10^{-11}
		M	0.800	1.4×10^{-11}	2.0×10^{-11}		
Re-189	1.01 d	F	0.800	2.7×10^{-10}	4.3×10^{-10}	0.800	7.8×10^{-10}
		M	0.800	4.3×10^{-10}	6.0×10^{-10}		
Osmium							
Os-180	0.366 h	F	0.010	8.8×10^{-12}	1.6×10^{-11}	0.010	1.7×10^{-11}
		M	0.010	1.4×10^{-11}	2.4×10^{-11}		
		S	0.010	1.5×10^{-11}	2.5×10^{-11}		
Os-181	1.75 h	F	0.010	3.6×10^{-11}	6.4×10^{-11}	0.010	8.9×10^{-11}
		M	0.010	6.3×10^{-11}	9.6×10^{-11}		
		S	0.010	6.6×10^{-11}	1.0×10^{-10}		
Os-182	22.0 h	F	0.010	1.9×10^{-10}	3.2×10^{-10}	0.010	5.6×10^{-10}
		M	0.010	3.7×10^{-10}	5.0×10^{-10}		
		S	0.010	3.9×10^{-10}	5.2×10^{-10}		
Os-185	94.0 d	F	0.010	1.1×10^{-9}	1.4×10^{-9}	0.010	5.1×10^{-10}
		M	0.010	1.2×10^{-9}	1.0×10^{-9}		
		S	0.010	1.5×10^{-9}	1.1×10^{-9}		
Os-189m	6.00 h	F	0.010	2.7×10^{-12}	5.2×10^{-12}	0.010	1.8×10^{-11}
		M	0.010	5.1×10^{-12}	7.6×10^{-12}		
		S	0.010	5.4×10^{-12}	7.9×10^{-12}		

Os-191	15.4 d	F	0.010	2.5×10^{-10}	3.5×10^{-10}	0.010	5.7×10^{-10}
		M	0.010	1.5×10^{-9}	1.3×10^{-9}		
		S	0.010	1.8×10^{-9}	1.5×10^{-9}		
Os-191m	13.0 h	F	0.010	2.6×10^{-11}	4.1×10^{-11}	0.010	9.6×10^{-11}
		M	0.010	1.3×10^{-10}	1.3×10^{-10}		
		S	0.010	1.5×10^{-10}	1.4×10^{-10}		
Os-193	1.25 d	F	0.010	1.7×10^{-10}	2.8×10^{-10}	0.010	8.1×10^{-10}
		M	0.010	4.7×10^{-10}	6.4×10^{-10}		
		S	0.010	5.1×10^{-10}	6.8×10^{-10}		
Os-194	6.00 a	F	0.010	1.1×10^{-8}	1.3×10^{-8}	0.010	2.4×10^{-9}
		M	0.010	2.0×10^{-8}	1.3×10^{-8}		
		S	0.010	7.9×10^{-8}	4.2×10^{-8}		
Iridium							
Ir-182	0.250 h	F	0.010	1.5×10^{-11}	2.6×10^{-11}	0.010	4.8×10^{-11}
		M	0.010	2.4×10^{-11}	3.9×10^{-11}		
		S	0.010	2.5×10^{-11}	4.0×10^{-11}		
Ir-184	3.02 h	F	0.010	6.7×10^{-11}	1.2×10^{-10}	0.010	1.7×10^{-10}
		M	0.010	1.1×10^{-10}	1.8×10^{-10}		
		S	0.010	1.2×10^{-10}	1.9×10^{-10}		
Ir-185	14.0 h	F	0.010	8.8×10^{-11}	1.5×10^{-10}	0.010	2.6×10^{-10}
		M	0.010	1.8×10^{-10}	2.5×10^{-10}		
		S	0.010	1.9×10^{-10}	2.6×10^{-10}		
Ir-186	15.8 h	F	0.010	1.8×10^{-10}	3.3×10^{-10}	0.010	4.9×10^{-10}
		M	0.010	3.2×10^{-10}	4.8×10^{-10}		
		S	0.010	3.3×10^{-10}	5.0×10^{-10}		
Ir-186	1.75 h	F	0.010	2.5×10^{-11}	4.5×10^{-11}	0.010	6.1×10^{-11}
		M	0.010	4.3×10^{-11}	6.9×10^{-11}		
		S	0.010	4.5×10^{-11}	7.1×10^{-11}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Ir-187	10.5 h	F	0.010	4.0×10^{-11}	7.2×10^{-11}	0.010	1.2×10^{-10}
		M	0.010	7.5×10^{-11}	1.1×10^{-10}		
		S	0.010	7.9×10^{-11}	1.2×10^{-10}		
Ir-188	1.73 d	F	0.010	2.6×10^{-10}	4.4×10^{-10}	0.010	6.3×10^{-10}
		M	0.010	4.1×10^{-10}	6.0×10^{-10}		
		S	0.010	4.3×10^{-10}	6.2×10^{-10}		
Ir-189	13.3 d	F	0.010	1.1×10^{-10}	1.7×10^{-10}	0.010	2.4×10^{-10}
		M	0.010	4.8×10^{-10}	4.1×10^{-10}		
		S	0.010	5.5×10^{-10}	4.6×10^{-10}		
Ir-190	12.1 d	F	0.010	7.9×10^{-10}	1.2×10^{-9}	0.010	1.2×10^{-9}
		M	0.010	2.0×10^{-9}	2.3×10^{-9}		
		S	0.010	2.3×10^{-9}	2.5×10^{-9}		
Ir-190m	3.10 h	F	0.010	5.3×10^{-11}	9.7×10^{-11}	0.010	1.2×10^{-10}
		M	0.010	8.3×10^{-11}	1.4×10^{-10}		
		S	0.010	8.6×10^{-11}	1.4×10^{-10}		
Ir-190m	1.20 h	F	0.010	3.7×10^{-12}	5.6×10^{-12}	0.010	8.0×10^{-12}
		M	0.010	9.0×10^{-12}	1.0×10^{-11}		
		S	0.010	1.0×10^{-11}	1.1×10^{-11}		
Ir-192	74.0 d	F	0.010	1.8×10^{-9}	2.2×10^{-9}	0.010	1.4×10^{-9}
		M	0.010	4.9×10^{-9}	4.1×10^{-9}		
		S	0.010	6.2×10^{-9}	4.9×10^{-9}		
Ir-192m	2.41×10^{2} a	F	0.010	4.8×10^{-9}	5.6×10^{-9}	0.010	3.1×10^{-10}
		M	0.010	5.4×10^{-9}	3.4×10^{-9}		
		S	0.010	3.6×10^{-8}	1.9×10^{-8}		

Ir-193m	11.9 d	F	0.010	1.0×10^{-10}	1.6×10^{-10}	0.010	2.7×10^{-10}
		M	0.010	1.0×10^{-9}	9.1×10^{-10}		
		S	0.010	1.2×10^{-9}	1.0×10^{-9}		
Ir-194	19.1 h	F	0.010	2.2×10^{-10}	3.6×10^{-10}	0.010	1.3×10^{-9}
		M	0.010	5.3×10^{-10}	7.1×10^{-10}		
		S	0.010	5.6×10^{-10}	7.5×10^{-10}		
Ir-194m	171d	F	0.010	5.4×10^{-9}	6.5×10^{-9}	0.010	2.1×10^{-9}
		M	0.010	8.5×10^{-9}	6.5×10^{-9}		
		S	0.010	1.2×10^{-8}	8.2×10^{-9}		
Ir-195	2.50 h	F	0.010	2.6×10^{-11}	4.5×10^{-11}	0.010	1.0×10^{-10}
		M	0.010	6.7×10^{-11}	9.6×10^{-11}		
		S	0.010	7.2×10^{-11}	1.0×10^{-10}		
Ir-195m	3.80 h	F	0.010	6.5×10^{-11}	1.1×10^{-10}	0.010	2.1×10^{-10}
		M	0.010	1.6×10^{-10}	2.3×10^{-10}		
		S	0.010	1.7×10^{-10}	2.4×10^{-10}		
Platinum							
Pt-186	2.00 h	F	0.010	3.6×10^{-11}	6.6×10^{-11}	0.010	9.3×10^{-11}
Pt-188	10.2 d	F	0.010	4.3×10^{-10}	6.3×10^{-10}	0.010	7.6×10^{-10}
Pt-189	10.9 h	F	0.010	4.1×10^{-11}	7.3×10^{-11}	0.010	1.2×10^{-10}
Pt-191	2.80 d	F	0.010	1.1×10^{-10}	1.9×10^{-10}	0.010	3.4×10^{-10}
Pt-193	50.0 a	F	0.010	2.1×10^{-11}	2.7×10^{-11}	0.010	3.1×10^{-11}
Pt-193m	4.33 d	F	0.010	1.3×10^{-10}	2.1×10^{-10}	0.010	4.5×10^{-10}
Pt-195m	4.02 d	F	0.010	1.9×10^{-10}	3.1×10^{-10}	0.010	6.3×10^{-10}
Pt-197	18.3 h	F	0.010	9.1×10^{-11}	1.6×10^{-10}	0.010	4.0×10^{-10}
Pt-197m	1.57 h	F	0.010	2.5×10^{-11}	4.3×10^{-11}	0.010	8.4×10^{-11}
Pt-199	0.513 h	F	0.010	1.3×10^{-11}	2.2×10^{-11}	0.010	3.9×10^{-11}
Pt-200	12.5 h	F	0.010	2.4×10^{-10}	4.0×10^{-10}	0.010	1.2×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Gold							
Au-193	17.6 h	F	0.010	3.9×10^{-11}	7.1×10^{-11}	0.100	1.3×10^{-10}
		M	0.010	1.1×10^{-10}	1.5×10^{-10}		
		S	0.010	1.2×10^{-10}	1.6×10^{-10}		
Au-194	1.64 d	F	0.010	1.5×10^{-10}	2.8×10^{-10}	0.100	4.2×10^{-10}
		M	0.010	2.4×10^{-10}	3.7×10^{-10}		
		S	0.010	2.5×10^{-10}	3.8×10^{-10}		
Au-195	183 d	F	0.010	7.1×10^{-11}	1.2×10^{-10}	0.100	2.5×10^{-10}
		M	0.010	1.0×10^{-9}	8.0×10^{-10}		
		S	0.010	1.6×10^{-9}	1.2×10^{-9}		
Au-198	2.69 d	F	0.010	2.3×10^{-10}	3.9×10^{-10}	0.100	1.0×10^{-9}
		M	0.010	7.6×10^{-10}	9.8×10^{-10}		
		S	0.010	8.4×10^{-10}	1.1×10^{-9}		
Au-198m	2.30 d	F	0.010	3.4×10^{-10}	5.9×10^{-10}	0.100	1.3×10^{-9}
		M	0.010	1.7×10^{-9}	2.0×10^{-9}		
		S	0.010	1.9×10^{-9}	1.9×10^{-9}		
Au-199	3.14 d	F	0.010	1.1×10^{-10}	1.9×10^{-10}	0.100	4.4×10^{-10}
		M	0.010	6.8×10^{-10}	6.8×10^{-10}		
		S	0.010	7.5×10^{-10}	7.6×10^{-10}		
Au-200	0.807 h	F	0.010	1.7×10^{-11}	3.0×10^{-11}	0.100	6.8×10^{-11}
		M	0.010	3.5×10^{-11}	5.3×10^{-11}		
		S	0.010	3.6×10^{-11}	5.6×10^{-11}		
Au-200m	18.7 h	F	0.010	3.2×10^{-10}	5.7×10^{-10}	0.100	1.1×10^{-9}
		M	0.010	6.9×10^{-10}	9.8×10^{-10}		
		S	0.010	7.3×10^{-10}	1.0×10^{-9}		

Au-201	0.440 h	F	0.010	9.2×10^{-12}	1.6×10^{-11}	0.100	2.4×10^{-11}
		M	0.010	1.7×10^{-11}	2.8×10^{-11}		
		S	0.010	1.8×10^{-11}	2.9×10^{-11}		
Mercury							
Hg-193	3.50 h	F	0.400	2.6×10^{-11}	4.7×10^{-11}	1.000	3.1×10^{-11}
(organic)						0.400	6.6×10^{-11}
Hg-193	3.50 h	F	0.020	2.8×10^{-11}	5.0×10^{-11}	0.020	8.2×10^{-11}
(inorganic)		M	0.020	7.5×10^{-11}	1.0×10^{-10}		
Hg-193m	11.1 h	F	0.400	1.1×10^{-10}	2.0×10^{-10}	1.000	1.3×10^{-10}
(organic)						0.400	3.0×10^{-10}
Hg-193m	11.1 h	F	0.020	1.2×10^{-10}	2.3×10^{-10}	0.020	4.0×10^{-10}
(inorganic)		M	0.020	2.6×10^{-10}	3.8×10^{-10}		
Hg-194	2.60×10^{2} a	F	0.400	1.5×10^{-8}	1.9×10^{-8}	1.000	5.1×10^{-8}
(organic)						0.400	2.1×10^{-8}
Hg-194	2.60×10^{2} a	F	0.020	1.3×10^{-8}	1.5×10^{-8}	0.020	1.4×10^{-9}
(inorganic)		M	0.020	7.8×10^{-9}	5.3×10^{-9}		
Hg-195	9.90 h	F	0.400	2.4×10^{-11}	4.4×10^{-11}	1.000	3.4×10^{-11}
(organic)						0.400	7.5×10^{-11}
Hg-195	9.90 h	F	0.020	2.7×10^{-11}	4.8×10^{-11}	0.020	9.7×10^{-11}
(inorganic)		M	0.020	7.2×10^{-11}	9.2×10^{-11}		
Hg-195m	1.73 d	F	0.400	1.3×10^{-10}	2.2×10^{-10}	1.000	2.2×10^{-10}
(organic)						0.400	4.1×10^{-10}
Hg-195m	1.73 d	F	0.020	1.5×10^{-10}	2.6×10^{-10}	0.020	5.6×10^{-10}
(inorganic)		M	0.020	5.1×10^{-10}	6.5×10^{-10}		
Hg-197	2.67 d	F	0.400	5.0×10^{-11}	8.5×10^{-11}	1.000	9.9×10^{-11}
(organic)						0.400	1.7×10^{-10}
Hg-197	2.67 d	F	0.020	6.0×10^{-11}	1.0×10^{-10}	0.020	2.3×10^{-10}
(inorganic)		M	0.020	2.9×10^{-10}	2.8×10^{-10}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Hg-197m	23.8 h	F	0.400	1.0×10^{-10}	1.8×10^{-10}	1.000	1.5×10^{-10}
(organic)						0.400	3.4×10^{-10}
Hg-197m	23.8 h	F	0.020	1.2×10^{-10}	2.1×10^{-10}	0.020	4.7×10^{-10}
(inorganic)		M	0.020	5.1×10^{-10}	6.6×10^{-10}		
Hg-199m	0.7 x 10 h	F	0.400	1.6×10^{-11}	2.7×10^{-11}	1.000	2.8×10^{-11}
(organic)						0.400	3.1×10^{-11}
Hg-199m	0.7 x 10 h	F	0.020	1.6×10^{-11}	2.7×10^{-11}	0.020	3.1×10^{-11}
(inorganic)		M	0.020	3.3×10^{-11}	5.2×10^{-11}		
Hg-203	46.6 d	F	0.400	5.7×10^{-10}	7.5×10^{-10}	1.000	1.9×10^{-9}
(organic)						0.400	1.1×10^{-9}
Hg-203	46.6 d	F	0.020	4.7×10^{-10}	5.9×10^{-10}	0.020	5.4×10^{-10}
(inorganic)		M	0.020	2.3×10^{-9}	1.9×10^{-9}		
Thallium							
Tl-194	0.550 h	F	1.000	4.8×10^{-12}	8.9×10^{-12}	1.000	8.1×10^{-12}
Tl-194m	0.546 h	F	1.000	2.0×10^{-11}	3.6×10^{-11}	1.000	4.0×10^{-11}
Tl-195	1.16 h	F	1.000	1.6×10^{-11}	3.0×10^{-11}	1.000	2.7×10^{-11}
Tl-197	2.84 h	F	1.000	1.5×10^{-11}	2.7×10^{-11}	1.000	2.3×10^{-11}
Tl-198	5.30 h	F	1.000	6.6×10^{-11}	1.2×10^{-10}	1.000	7.3×10^{-11}
Tl-198m	1.87 h	F	1.000	4.0×10^{-11}	7.3×10^{-11}	1.000	5.4×10^{-11}
Tl-199	7.42 h	F	1.000	2.0×10^{-11}	3.7×10^{-11}	1.000	2.6×10^{-11}
Tl-200	1.09 d	F	1.000	1.4×10^{-10}	2.5×10^{-10}	1.000	2.0×10^{-10}
Tl-201	3.04 d	F	1.000	4.7×10^{-11}	7.6×10^{-11}	1.000	9.5×10^{-11}
Tl-202	12.2 d	F	1.000	2.0×10^{-10}	3.1×10^{-10}	1.000	4.5×10^{-10}
Tl-204	3.78 a	F	1.000	4.4×10^{-10}	6.2×10^{-10}	1.000	1.3×10^{-9}

Lead							
Pb-195m	0.263 h	F	0.200	1.7×10^{-11}	3.0×10^{-11}	0.200	2.9×10^{-11}
Pb-198	2.40 h	F	0.200	4.7×10^{-11}	8.7×10^{-11}	0.200	1.0×10^{-10}
Pb-199	1.50 h	F	0.200	2.6×10^{-11}	4.8×10^{-11}	0.200	5.4×10^{-11}
Pb-200	21.5 h	F	0.200	1.5×10^{-10}	2.6×10^{-10}	0.200	4.0×10^{-10}
Pb-201	9.40 h	F	0.200	6.5×10^{-11}	1.2×10^{-10}	0.200	1.6×10^{-10}
Pb-202	3.00×10^{5} a	F	0.200	1.1×10^{-8}	1.4×10^{-8}	0.200	8.7×10^{-9}
Pb-202m	3.62 h	F	0.200	6.7×10^{-11}	1.2×10^{-10}	0.200	1.3×10^{-10}
Pb-203	2.17 d	F	0.200	9.1×10^{-11}	1.6×10^{-10}	0.200	2.4×10^{-10}
Pb-205	1.43×10^{7} a	F	0.200	3.4×10^{-10}	4.1×10^{-10}	0.200	2.8×10^{-10}
Pb-209	3.25 h	F	0.200	1.8×10^{-11}	3.2×10^{-11}	0.200	5.7×10^{-11}
Pb-210	22.3 a	F	0.200	8.9×10^{-7}	1.1×10^{-6}	0.200	6.8×10^{-7}
Pb-211	0.601 h	F	0.200	3.9×10^{-9}	5.6×10^{-9}	0.200	1.8×10^{-10}
Pb-212	10.6 h	F	0.200	1.9×10^{-8}	3.3×10^{-8}	0.200	5.9×10^{-9}
Pb-214	0.447 h	F	0.200	2.9×10^{-9}	4.8×10^{-9}	0.200	1.4×10^{-10}
Bismuth							
Bi-200	0.606 h	F	0.050	2.4×10^{-11}	4.2×10^{-11}	0.050	5.1×10^{-11}
		M	0.050	3.4×10^{-11}	5.6×10^{-11}		
Bi-201	1.80 h	F	0.050	4.7×10^{-11}	8.3×10^{-11}	0.050	1.2×10^{-10}
		M	0.050	7.0×10^{-11}	1.1×10^{-10}		
Bi-202	1.67 h	F	0.050	4.6×10^{-11}	8.4×10^{-11}	0.050	8.9×10^{-11}
		M	0.050	5.8×10^{-11}	1.0×10^{-10}		
Bi-203	11.8 h	F	0.050	2.0×10^{-10}	3.6×10^{-10}	0.050	4.8×10^{-10}
		M	0.050	2.8×10^{-10}	4.5×10^{-10}		
Bi-205	15.3 d	F	0.050	4.0×10^{-10}	6.8×10^{-10}	0.050	9.0×10^{-10}
		M	0.050	9.2×10^{-10}	1.0×10^{-9}		
Bi-206	6.24 d	F	0.050	7.9×10^{-10}	1.3×10^{-9}	0.050	1.9×10^{-9}
		M	0.050	1.7×10^{-9}	2.1×10^{-9}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Bi-207	38.0 a	F	0.050	5.2×10^{-10}	8.4×10^{-10}	0.050	1.3×10^{-9}
		M	0.050	5.2×10^{-9}	3.2×10^{-9}		
Bi-210	5.01 d	F	0.050	1.1×10^{-9}	1.4×10^{-9}	0.050	1.3×10^{-9}
		M	0.050	8.4×10^{-8}	6.0×10^{-8}		
Bi-210m	3.00×10^{6} a	F	0.050	4.5×10^{-8}	5.3×10^{-8}	0.050	1.5×10^{-8}
		M	0.050	3.1×10^{-6}	2.1×10^{-6}		
Bi-212	1.01 h	F	0.050	9.3×10^{-9}	1.5×10^{-8}	0.050	2.6×10^{-10}
		M	0.050	3.0×10^{-8}	3.9×10^{-8}		
Bi-213	0.761 h	F	0.050	1.1×10^{-8}	1.8×10^{-8}	0.050	2.0×10^{-10}
		M	0.050	2.9×10^{-8}	4.1×10^{-8}		
Bi-214	0.332 h	F	0.050	7.2×10^{-9}	1.2×10^{-8}	0.050	1.1×10^{-10}
		M	0.050	1.4×10^{-8}	2.1×10^{-8}		
Polonium							
Po-203	0.612 h	F	0.100	2.5×10^{-11}	4.5×10^{-11}	0.100	5.2×10^{-11}
		M	0.100	3.6×10^{-11}	6.1×10^{-11}		
Po-205	1.80 h	F	0.100	3.5×10^{-11}	6.0×10^{-11}	0.100	5.9×10^{-11}
		M	0.100	6.4×10^{-11}	8.9×10^{-11}		
Po-207	5.83 h	F	0.100	6.3×10^{-11}	1.2×10^{-10}	0.100	1.4×10^{-10}
		M	0.100	8.4×10^{-11}	1.5×10^{-10}		
Po-210	138 d	F	0.100	6.0×10^{-7}	7.1×10^{-7}	0.100	2.4×10^{-7}
		M	0.100	3.0×10^{-6}	2.2×10^{-6}		
Astatine							
At-207	1.80 h	F	0.100	3.5×10^{-10}	4.4×10^{-10}	1.000	2.3×10^{-10}
		M	0.100	2.1×10^{-9}	1.9×10^{-9}		

At-211	7.21 h	F	1.000	1.6×10^{-8}	2.7×10^{-8}	1.000	1.1×10^{-8}
		M	1.000	9.8×10^{-8}	1.1×10^{-7}		
Francium							
Fr-222	0.240 h	F	1.000	1.4×10^{-8}	2.1×10^{-8}	1.000	7.1×10^{-10}
Fr-223	0.363 h	F	1.000	9.1×10^{-10}	1.3×10^{-9}	1.000	2.3×10^{-9}
Radium							
Ra-223	11.4 d	M	0.200	6.9×10^{-6}	5.7×10^{-6}	0.200	1.0×10^{-7}
Ra-224	3.66 d	M	0.200	2.9×10^{-6}	2.4×10^{-6}	0.200	6.5×10^{-8}
Ra-225	14.8 d	M	0.200	5.8×10^{-6}	4.8×10^{-6}	0.200	9.5×10^{-8}
Ra-226	1.60×10^{3} a	M	0.200	3.2×10^{-6}	2.2×10^{-6}	0.200	2.8×10^{-7}
Ra-227	0.703 h	M	0.200	2.8×10^{-10}	2.1×10^{-10}	0.200	8.4×10^{-11}
Ra-228	5.75 a	M	0.200	2.6×10^{-6}	1.7×10^{-6}	0.200	6.7×10^{-7}
Actinium							
Ac-224	2.90 h	F	5.0×10^{-4}	1.1×10^{-8}	1.3×10^{-8}	5.0×10^{-4}	7.0×10^{-10}
		M	5.0×10^{-4}	1.0×10^{-7}	8.9×10^{-8}		
		S	5.0×10^{-4}	1.2×10^{-7}	9.9×10^{-8}		
Ac-225	10.0 d	F	5.0×10^{-4}	8.7×10^{-7}	1.0×10^{-6}	5.0×10^{-4}	2.4×10^{-8}
		M	5.0×10^{-4}	6.9×10^{-6}	5.7×10^{-6}		
		S	5.0×10^{-4}	7.9×10^{-6}	6.5×10^{-6}		
Ac-226	1.21 d	F	5.0×10^{-4}	9.5×10^{-8}	2.2×10^{-7}	5.0×10^{-4}	1.0×10^{-8}
		M	5.0×10^{-4}	1.1×10^{-6}	9.2×10^{-7}		
		S	5.0×10^{-4}	1.2×10^{-6}	1.0×10^{-6}		
Ac-227	21.8 a	F	5.0×10^{-4}	5.4×10^{-4}	6.3×10^{-4}	5.0×10^{-4}	1.1×10^{-6}
		M	5.0×10^{-4}	2.1×10^{-4}	1.5×10^{-4}		
		S	5.0×10^{-4}	6.6×10^{-5}	4.7×10^{-5}		
Ac-228	6.13 h	F	5.0×10^{-4}	2.5×10^{-8}	2.9×10^{-8}	5.0×10^{-4}	4.3×10^{-10}
		M	5.0×10^{-4}	1.6×10^{-8}	1.2×10^{-8}		
		S	5.0×10^{-4}	1.4×10^{-8}	1.2×10^{-8}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Thorium							
Th-226	0.515 h	M	5.0×10^{-4}	5.5×10^{-8}	7.4×10^{-8}	5.0×10^{-4}	3.5×10^{-10}
		S	2.0×10^{-4}	5.9×10^{-8}	7.8×10^{-8}	2.0×10^{-4}	3.6×10^{-10}
Th-227	18.7 d	M	5.0×10^{-4}	7.8×10^{-6}	6.2×10^{-6}	5.0×10^{-4}	8.9×10^{-9}
		S	2.0×10^{-4}	9.6×10^{-6}	7.6×10^{-6}	2.0×10^{-4}	8.4×10^{-9}
Th-228	1.91 a	M	5.0×10^{-4}	3.1×10^{-5}	2.3×10^{-5}	5.0×10^{-4}	7.0×10^{-8}
		S	2.0×10^{-4}	3.9×10^{-5}	3.2×10^{-5}	2.0×10^{-4}	3.5×10^{-8}
Th-229	7.34×10^{3} a	M	5.0×10^{-4}	9.9×10^{-5}	6.9×10^{-5}	5.0×10^{-4}	4.8×10^{-7}
		S	2.0×10^{-4}	6.5×10^{-5}	4.8×10^{-5}	2.0×10^{-4}	2.0×10^{-7}
Th-230	7.70×10^{4} a	M	5.0×10^{-4}	4.0×10^{-5}	2.8×10^{-5}	5.0×10^{-4}	2.1×10^{-7}
		S	2.0×10^{-4}	1.3×10^{-5}	7.2×10^{-6}	2.0×10^{-4}	8.7×10^{-8}
Th-231	1.06 d	M	5.0×10^{-4}	2.9×10^{-10}	3.7×10^{-10}	5.0×10^{-4}	3.4×10^{-10}
		S	2.0×10^{-4}	3.2×10^{-10}	4.0×10^{-10}	2.0×10^{-4}	3.4×10^{-10}
Th-232	1.40×10^{10} a	M	5.0×10^{-4}	4.2×10^{-5}	2.9×10^{-5}	5.0×10^{-4}	2.2×10^{-7}
		S	2.0×10^{-4}	2.3×10^{-5}	1.2×10^{-5}	2.0×10^{-4}	9.2×10^{-8}
Th-234	24.1 d	M	5.0×10^{-4}	6.3×10^{-9}	5.3×10^{-9}	5.0×10^{-4}	3.4×10^{-9}
		S	2.0×10^{-4}	7.3×10^{-9}	5.8×10^{-9}	2.0×10^{-4}	3.4×10^{-9}
Protactinium							
Pa-227	0.638 h	M	5.0×10^{-4}	7.0×10^{-8}	9.0×10^{-8}	5.0×10^{-4}	4.5×10^{-10}
		S	5.0×10^{-4}	7.6×10^{-8}	9.7×10^{-8}		
Pa-228	22.0 h	M	5.0×10^{-4}	5.9×10^{-8}	4.6×10^{-8}	5.0×10^{-4}	7.8×10^{-10}
		S	5.0×10^{-4}	6.9×10^{-8}	5.1×10^{-8}		
Pa-230	17.4 d	M	5.0×10^{-4}	5.6×10^{-7}	4.6×10^{-7}	5.0×10^{-4}	9.2×10^{-10}
		S	5.0×10^{-4}	7.1×10^{-7}	5.7×10^{-7}		

Pa-231	3.27×10^{4} a	M	5.0×10^{-4}	1.3×10^{-4}	8.9×10^{-5}	5.0×10^{-4}	7.1×10^{-7}
		S	5.0×10^{-4}	3.2×10^{-5}	1.7×10^{-5}		
Pa-232	1.31 d	M	5.0×10^{-4}	9.5×10^{-9}	6.8×10^{-9}	5.0×10^{-4}	7.2×10^{-10}
		S	5.0×10^{-4}	3.2×10^{-9}	2.0×10^{-9}		
Pa-233	27.0 d	M	5.0×10^{-4}	3.1×10^{-9}	2.8×10^{-9}	5.0×10^{-4}	8.7×10^{-10}
		S	5.0×10^{-4}	3.7×10^{-9}	3.2×10^{-9}		
Pa-234	6.70 h	M	5.0×10^{-4}	3.8×10^{-10}	5.5×10^{-10}	5.0×10^{-4}	5.1×10^{-10}
		S	5.0×10^{-4}	4.0×10^{-10}	5.8×10^{-10}		
Uranium							
U-230	20.8 d	F	0.020	3.6×10^{-7}	4.2×10^{-7}	0.020	5.5×10^{-8}
		M	0.020	1.2×10^{-5}	1.0×10^{-5}	0.002	2.8×10^{-8}
		S	0.002	1.5×10^{-5}	1.2×10^{-5}		
U-231	4.20 d	F	0.020	8.3×10^{-11}	1.4×10^{-10}	0.020	2.8×10^{-10}
		M	0.020	3.4×10^{-10}	3.7×10^{-10}	0.002	2.8×10^{-10}
		S	0.002	3.7×10^{-10}	4.0×10^{-10}		
U-232	72.0 a	F	0.020	4.0×10^{-6}	4.7×10^{-6}	0.020	3.3×10^{-7}
		M	0.020	7.2×10^{-6}	4.8×10^{-6}	0.002	3.7×10^{-8}
		S	0.002	3.5×10^{-5}	2.6×10^{-5}		
U-233	1.58×10^{5} a	F	0.020	5.7×10^{-7}	6.6×10^{-7}	0.020	5.0×10^{-8}
		M	0.020	3.2×10^{-6}	2.2×10^{-6}	0.002	8.5×10^{-9}
		S	0.002	8.7×10^{-6}	6.9×10^{-6}		
U-234	2.44×10^{5} a	F	0.020	5.5×10^{-7}	6.4×10^{-7}	0.020	4.9×10^{-8}
		M	0.020	3.1×10^{-6}	2.1×10^{-6}	0.002	8.3×10^{-9}
		S	0.002	8.5×10^{-6}	6.8×10^{-6}		
U-235	7.04×10^{8} a	F	0.020	5.1×10^{-7}	6.0×10^{-7}	0.020	4.6×10^{-8}
		M	0.020	2.8×10^{-6}	1.8×10^{-6}	0.002	8.3×10^{-9}
		S	0.002	7.7×10^{-6}	6.1×10^{-6}		

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
U-236	2.34 x 10^7 a	F	0.020	5.2 x 10^{-7}	6.1 x 10^{-7}	0.020	4.6 x 10^{-8}
		M	0.020	2.9 x 10^{-6}	1.9 x 10^{-6}	0.002	7.9 x 10^{-9}
		S	0.002	7.9 x 10^{-6}	6.3 x 10^{-6}		
U-237	6.75 d	F	0.020	1.9 x 10^{-10}	3.3 x 10^{-10}	0.020	7.6 x 10^{-10}
		M	0.020	1.6 x 10^{-9}	1.5 x 10^{-9}	0.002	7.7 x 10^{-10}
		S	0.002	1.8 x 10^{-9}	1.7 x 10^{-9}		
U-238	4.47 x 10^9 a	F	0.020	4.9 x 10^{-7}	5.8 x 10^{-7}	0.020	4.4 x 10^{-8}
		M	0.020	2.6 x 10^{-6}	1.6 x 10^{-6}	0.002	7.6 x 10^{-9}
		S	0.002	7.3 x 10^{-6}	5.7 x 10^{-6}		
U-239	0.392 h	F	0.020	1.1 x 10^{-11}	1.8 x 10^{-11}	0.020	2.7 x 10^{-11}
		M	0.020	2.3 x 10^{-11}	3.3 x 10^{-11}	0.002	2.8 x 10^{-11}
		S	0.002	2.4 x 10^{-11}	3.5 x 10^{-11}		
U-240	14.1 h	F	0.020	2.1 x 10^{-10}	3.7 x 10^{-10}	0.020	1.1 x 10^{-9}
		M	0.020	5.3 x 10^{-10}	7.9 x 10^{-10}	0.002	1.1 x 10^{-9}
		S	0.002	5.7 x 10^{-10}	8.4 x 10^{-10}		
Neptunium							
Np-232	0.245 h	M	5.0 x 10^{-4}	4.7 x 10^{-11}	3.5 x 10^{-11}	5.0 x 10^{-4}	9.7 x 10^{-12}
Np-233	0.603 h	M	5.0 x 10^{-4}	1.7 x 10^{-12}	3.0 x 10^{-12}	5.0 x 10^{-4}	2.2 x 10^{-12}
Np-234	4.40 d	M	5.0 x 10^{-4}	5.4 x 10^{-10}	7.3 x 10^{-10}	5.0 x 10^{-4}	8.1 x 10^{-10}
Np-235	1.08 a	M	5.0 x 10^{-4}	4.0 x 10^{-10}	2.7 x 10^{-10}	5.0 x 10^{-4}	5.3 x 10^{-11}
Np-236	1.15 x 10^5 a	M	5.0 x 10^{-4}	3.0 x 10^{-6}	2.0 x 10^{-6}	5.0 x 10^{-6}	1.7 x 10^{-8}
Np-236	22.5 h	M	5.0 x 10^{-4}	5.0 x 10^{-9}	3.6 x 10^{-9}	5.0 x 10^{-4}	1.9 x 10^{-10}
Np-237	2.14 x 10^6 a	M	5.0 x 10^{-4}	2.1 x 10^{-5}	1.5 x 10^{-5}	5.0 x 10^{-4}	1.1 x 10^{-7}
Np-238	2.12 d	M	5.0 x 10^{-4}	2.0 x 10^{-9}	1.7 x 10^{-9}	5.0 x 10^{-4}	9.1 x 10^{-10}
Np-239	2.36 d	M	5.0 x 10^{-4}	9.0 x 10^{-10}	1.1 x 10^{-9}	5.0 x 10^{-4}	8.0 x 10^{-10}
Np-240	1.08 h	M	5.0 x 10^{-4}	8.7 x 10^{-11}	1.3 x 10^{-10}	5.0 x 10^{-4}	8.2 x 10^{-11}

Plutonium							
Pu-234	8.80 h	M	5.0×10^{-4}	1.9×10^{-8}	1.6×10^{-8}	5.0×10^{-4}	1.6×10^{-10}
		S	1.0×10^{-5}	2.2×10^{-8}	1.8×10^{-8}	1.0×10^{-5}	1.5×10^{-10}
						1.0×10^{-4}	1.6×10^{-10}
Pu-235	0.422 h	M	5.0×10^{-4}	1.5×10^{-12}	2.5×10^{-12}	5.0×10^{-4}	2.1×10^{-12}
		S	1.0×10^{-5}	1.6×10^{-12}	2.6×10^{-12}	1.0×10^{-5}	2.1×10^{-12}
						1.0×10^{-4}	2.1×10^{-12}
Pu-236	2.85 a	M	5.0×10^{-4}	1.8×10^{-5}	1.3×10^{-5}	5.0×10^{-4}	8.6×10^{-8}
		S	1.0×10^{-5}	9.6×10^{-6}	7.4×10^{-6}	1.0×10^{-5}	6.3×10^{-9}
						1.0×10^{-4}	2.1×10^{-8}
Pu-237	45.3 d	M	5.0×10^{-4}	3.3×10^{-10}	2.9×10^{-10}	5.0×10^{-4}	1.0×10^{-10}
		S	1.0×10^{-5}	3.6×10^{-10}	3.0×10^{-10}	1.0×10^{-5}	1.0×10^{-10}
						1.0×10^{-4}	1.0×10^{-10}
Pu-238	87.7 a	M	5.0×10^{-4}	4.3×10^{-5}	3.0×10^{-5}	5.0×10^{-4}	2.3×10^{-7}
		S	1.0×10^{-5}	1.5×10^{-5}	1.1×10^{-5}	1.0×10^{-5}	8.8×10^{-9}
						1.0×10^{-4}	4.9×10^{-8}
Pu-239	2.41×10^{4} a	M	5.0×10^{-4}	4.7×10^{-5}	3.2×10^{-5}	5.0×10^{-4}	2.5×10^{-7}
		S	1.0×10^{-5}	1.5×10^{-5}	8.3×10^{-6}	1.0×10^{-5}	9.0×10^{-9}
						1.0×10^{-4}	5.3×10^{-8}
Pu-240	6.54×10^{3} a	M	5.0×10^{-4}	4.7×10^{-5}	3.2×10^{-5}	5.0×10^{-4}	2.5×10^{-7}
		S	1.0×10^{-5}	1.5×10^{-5}	8.3×10^{-6}	1.0×10^{-5}	9.0×10^{-9}
						1.0×10^{-4}	5.3×10^{-8}
Pu-241	14.4 a	M	5.0×10^{-4}	8.5×10^{-7}	5.8×10^{-7}	5.0×10^{-4}	4.7×10^{-9}
		S	1.0×10^{-5}	1.6×10^{-7}	8.4×10^{-8}	1.0×10^{-5}	1.1×10^{-10}
						1.0×10^{-4}	9.6×10^{-10}
Pu-242	3.76×10^{5} a	M	5.0×10^{-4}	4.4×10^{-5}	3.1×10^{-5}	5.0×10^{-4}	2.4×10^{-7}
		S	1.0×10^{-5}	1.4×10^{-5}	7.7×10^{-6}	1.0×10^{-5}	8.6×10^{-9}
						1.0×10^{-4}	5.0×10^{-8}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Pu-243	4.95 h	M	5.0×10^{-4}	8.2×10^{-11}	1.1×10^{-10}	5.0×10^{-4}	8.5×10^{-11}
		S	1.0×10^{-5}	8.5×10^{-11}	1.1×10^{-10}	1.0×10^{-5}	8.5×10^{-11}
						1.0×10^{-4}	8.5×10^{-11}
Pu-244	8.26×10^{7} a	M	5.0×10^{-4}	4.4×10^{-5}	3.0×10^{-5}	5.0×10^{-4}	2.4×10^{-7}
		S	1.0×10^{-5}	1.3×10^{-5}	7.4×10^{-6}	1.0×10^{-5}	1.1×10^{-8}
						1.0×10^{-4}	5.2×10^{-8}
Pu-245	10.5 h	M	5.0×10^{-4}	4.5×10^{-10}	6.1×10^{-10}	5.0×10^{-4}	7.2×10^{-10}
		S	1.0×10^{-5}	4.8×10^{-10}	6.5×10^{-10}	1.0×10^{-5}	7.2×10^{-10}
						1.0×10^{-4}	7.2×10^{-10}
Pu-246	10.9 d	M	5.0×10^{-4}	7.0×10^{-9}	6.5×10^{-9}	5.0×10^{-4}	3.3×10^{-9}
		S	1.0×10^{-5}	7.6×10^{-9}	7.0×10^{-9}	1.0×10^{-5}	3.3×10^{-9}
						1.0×10^{-4}	3.3×10^{-9}
Americium							
Am-237	1.22 h	M	5.0×10^{-4}	2.5×10^{-11}	3.6×10^{-11}	5.0×10^{-4}	1.8×10^{-11}
Am-238	1.63 h	M	5.0×10^{-4}	8.5×10^{-11}	6.6×10^{-11}	5.0×10^{-4}	3.2×10^{-11}
Am-239	11.9 h	M	5.0×10^{-4}	2.2×10^{-10}	2.9×10^{-10}	5.0×10^{-4}	2.4×10^{-10}
Am-240	2.12 d	M	5.0×10^{-4}	4.4×10^{-10}	5.9×10^{-10}	5.0×10^{-4}	5.8×10^{-10}
Am-241	4.32×10^{2} a	M	5.0×10^{-4}	3.9×10^{-5}	2.7×10^{-5}	5.0×10^{-4}	2.0×10^{-7}
Am-242	16.0 h	M	5.0×10^{-4}	1.6×10^{-8}	1.2×10^{-8}	5.0×10^{-4}	3.0×10^{-10}
Am-242m	1.52×10^{2} a	M	5.0×10^{-4}	3.5×10^{-5}	2.4×10^{-5}	5.0×10^{-4}	1.9×10^{-7}
Am-243	7.38×10^{3} a	M	5.0×10^{-4}	3.9×10^{-5}	2.7×10^{-5}	5.0×10^{-4}	2.0×10^{-7}
Am-244	10.1 h	M	5.0×10^{-4}	1.9×10^{-9}	1.5×10^{-9}	5.0×10^{-4}	4.6×10^{-10}
Am-244m	0.433 h	M	5.0×10^{-4}	7.9×10^{-11}	6.2×10^{-11}	5.0×10^{-4}	2.9×10^{-11}
Am-245	2.05 h	M	5.0×10^{-4}	5.3×10^{-11}	7.6×10^{-11}	5.0×10^{-4}	6.2×10^{-11}

Am-246	0.650 h	M	5.0×10^{-4}	6.8×10^{-11}	1.1×10^{-10}	5.0×10^{-4}	5.8×10^{-11}
Am246m	0.417 h	M	5.0×10^{-4}	2.3×10^{-11}	3.8×10^{-11}	5.0×10^{-4}	3.4×10^{-11}
Curium							
Cm-238	2.40 h	M	5.0×10^{-4}	4.1×10^{-9}	4.8×10^{-9}	5.0×10^{-4}	8.0×10^{-11}
Cm-240	27.0 d	M	5.0×10^{-4}	2.9×10^{-6}	2.3×10^{-6}	5.0×10^{-4}	7.6×10^{-9}
Cm-241	32.8 d	M	5.0×10^{-4}	3.4×10^{-8}	2.6×10^{-8}	5.0×10^{-4}	9.1×10^{-10}
Cm-242	163 d	M	5.0×10^{-4}	4.8×10^{-6}	3.7×10^{-6}	5.0×10^{-4}	1.2×10^{-8}
Cm-243	28.5 a	M	5.0×10^{-4}	2.9×10^{-5}	2.0×10^{-5}	5.0×10^{-4}	1.5×10^{-7}
Cm-244	18.1 a	M	5.0×10^{-4}	2.5×10^{-5}	1.7×10^{-5}	5.0×10^{-4}	1.2×10^{-7}
Cm-245	8.50×10^{3} a	M	5.0×10^{-4}	4.0×10^{-5}	2.7×10^{-5}	5.0×10^{-4}	2.1×10^{-7}
Cm-246	4.73×10^{3} a	M	5.0×10^{-4}	4.0×10^{-5}	2.7×10^{-5}	5.0×10^{-4}	2.1×10^{-7}
Cm-247	1.56×10^{7} a	M	5.0×10^{-4}	3.6×10^{-5}	2.5×10^{-5}	5.0×10^{-4}	1.9×10^{-7}
Cm-248	3.39×10^{5} a	M	5.0×10^{-4}	1.4×10^{-4}	9.5×10^{-5}	5.0×10^{-4}	7.7×10^{-7}
Cm-249	1.07 h	M	5.0×10^{-4}	3.2×10^{-11}	5.1×10^{-11}	5.0×10^{-4}	3.1×10^{-11}
Cm-250	6.90×10^{3} a	M	5.0×10^{-4}	7.9×10^{-4}	5.4×10^{-4}	5.0×10^{-4}	4.4×10^{-6}
Berkelium							
Bk-245	4.94 d	M	5.0×10^{-4}	2.0×10^{-9}	1.8×10^{-9}	5.0×10^{-4}	5.7×10^{-10}
Bk-246	1.83 d	M	5.0×10^{-4}	3.4×10^{-10}	4.6×10^{-10}	5.0×10^{-4}	4.8×10^{-10}
Bk-247	1.38×10^{3} a	M	5.0×10^{-4}	6.5×10^{-5}	4.5×10^{-5}	5.0×10^{-4}	3.5×10^{-7}
Bk-249	320 d	M	5.0×10^{-4}	1.5×10^{-7}	1.0×10^{-7}	5.0×10^{-4}	9.7×10^{-10}
Bk-250	3.22 h	M	5.0×10^{-4}	9.6×10^{-10}	7.1×10^{-10}	5.0×10^{-4}	1.4×10^{-10}
Californium							
Cf-244	0.323 h	M	5.0×10^{-4}	1.3×10^{-8}	1.8×10^{-8}	5.0×10^{-4}	7.0×10^{-11}
Cf-246	1.49 d	M	5.0×10^{-4}	4.2×10^{-7}	3.5×10^{-7}	5.0×10^{-4}	3.3×10^{-9}
Cf-248	334 d	M	5.0×10^{-4}	8.2×10^{-6}	6.1×10^{-6}	5.0×10^{-4}	2.8×10^{-8}
Cf-249	3.50×10^{2} a	M	5.0×10^{-4}	6.6×10^{-5}	4.5×10^{-5}	5.0×10^{-4}	3.5×10^{-7}
Cf-250	13.1 a	M	5.0×10^{-4}	3.2×10^{-5}	2.2×10^{-5}	5.0×10^{-4}	1.6×10^{-7}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Inhalation*				*Ingestion*	
		Type	f_1	$e(g)_{1\ \mu m}$	$e(g)_{5\ \mu m}$	f_1	$e(g)$
Cf-251	8.98×10^2 a	M	5.0×10^{-4}	6.7×10^{-5}	4.6×10^{-5}	5.0×10^{-4}	3.6×10^{-7}
Cf-252	2.64 a	M	5.0×10^{-4}	1.8×10^{-5}	1.3×10^{-5}	5.0×10^{-4}	9.0×10^{-8}
Cf-253	17.8 d	M	5.0×10^{-4}	1.2×10^{-6}	1.0×10^{-6}	5.0×10^{-4}	1.4×10^{-9}
Cf-254	60.5 d	M	5.0×10^{-4}	3.7×10^{-5}	2.2×10^{-5}	5.0×10^{-4}	4.0×10^{-7}
Einsteinium							
Es-250	2.10 h	M	5.0×10^{-4}	5.9×10^{-10}	4.2×10^{-10}	5.0×10^{-4}	2.1×10^{-11}
Es-251	1.38 d	M	5.0×10^{-4}	2.0×10^{-9}	1.7×10^{-9}	5.0×10^{-4}	1.7×10^{-10}
Es-253	20.5 d	M	5.0×10^{-4}	2.5×10^{-6}	2.1×10^{-6}	5.0×10^{-4}	6.1×10^{-9}
Es-254	276 d	M	5.0×10^{-4}	8.0×10^{-6}	6.0×10^{-6}	5.0×10^{-4}	2.8×10^{-8}
Es-254m	1.64 d	M	5.0×10^{-4}	4.4×10^{-7}	3.7×10^{-7}	5.0×10^{-4}	4.2×10^{-9}
Fermium							
Fm-252	22.7 h	M	5.0×10^{-4}	3.0×10^{-7}	2.6×10^{-7}	5.0×10^{-4}	2.7×10^{-9}
Fm-253	3.00 d	M	5.0×10^{-4}	3.7×10^{-7}	3.0×10^{-7}	5.0×10^{-4}	9.1×10^{-10}
Fm-254	3.24 h	M	5.0×10^{-4}	5.6×10^{-8}	7.7×10^{-8}	5.0×10^{-4}	4.4×10^{-10}
Fm-255	20.1 h	M	5.0×10^{-4}	2.5×10^{-7}	2.6×10^{-7}	5.0×10^{-4}	2.5×10^{-9}
Fm-257	101 d	M	5.0×10^{-4}	6.6×10^{-6}	5.2×10^{-6}	5.0×10^{-4}	1.5×10^{-8}
Mendelevium							
Md-257	5.20 h	M	5.0×10^{-4}	2.3×10^{-8}	2.0×10^{-8}	5.0×10^{-4}	1.2×10^{-10}
Md-258	55.0 d	M	5.0×10^{-4}	5.5×10^{-6}	4.4×10^{-6}	5.0×10^{-4}	1.3×10^{-8}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Table IV

COMPOUNDS AND VALUES OF GUT TRANSFER FACTOR (f_1) USED TO CALCULATE COMMITTED EFFECTIVE DOSE PER UNIT INTAKE THROUGH INGESTION—FOR WORKERS

Element	*Gut transfer factor* (f_1)	*Compound*
Hydrogen	1.000	Tritiated water (ingested)
	1.000	Organically bound tritium
Beryllium	0.005	All compounds
Carbon	1.000	Labelled organic compounds
Fluorine	1.000	All compounds
Sodium	1.000	All compounds
Magnesium	0.500	All compounds
Aluminium	0.010	All compounds
Silicon	0.010	All compounds
Phosphorus	0.800	All compounds
Sulphur	0.800	Inorganic compounds
	0.100	Elemental sulphur
	1.000	Organic sulphur
Chlorine	1.000	All compounds
Potassium	1.000	All compounds
Calcium	0.300	All compounds
Scandium	1.0×10^{-4}	All compounds
Titanium	0.010	All compounds
Vanadium	0.010	All compounds
Chromium	0.100	Hexavalent compounds
	0.010	Trivalent compound
Manganese	0.100	All compounds
Iron	0.100	All compounds
Cobalt	0.100	All unspecified compounds
	0.050	Oxides, hydroxides and inorganic compounds
Nickel	0.050	All compounds
Copper	0.500	All compounds
Zinc	0.500	All compounds
Gallium	0.001	All compounds
Germanium	1.000	All compounds
Arsenic	0.500	All compounds
Selenium	0.800	All unspecified compounds
	0.050	Elemental selenium and selenides
Bromine	1.000	All compounds
Rubidium	1.000	All compounds
Strontium	0.300	All unspecified compounds
	0.010	Strontium titanate ($SrTio_3$)
Yttrium	1.0×10^{-4}	All compounds
Zirconium	0.002	All compounds
Niobium	0.010	All compounds

Element	*Gut transfer factor* (f_1)	*Compound*
Molybdenum	0.800	All unspecified compounds
	0.050	Molybdenum sulphide
Technetium	0.800	All compounds
Ruthenium	0.050	All compounds
Rhodium	0.050	All compounds
Palladium	0.005	All compounds
Silver	0.050	All compounds
Cadmium	0.050	All inorganic compounds
Indium	0.020	All compounds
Tin	0.020	All compounds
Antimony	0.100	All compounds
Tellurium	0.300	All compounds
Iodine	1.000	All compounds
Caesium	1.000	All compounds
Barium	0.100	All compounds
Lanthanum	5.0×10^{-4}	All compounds
Cerium	5.0×10^{-4}	All compounds
Praseodymium	5.0×10^{-4}	All compounds
Neodymium	5.0×10^{-4}	All compounds
Promethium	5.0×10^{-4}	All compounds
Samarium	5.0×10^{-4}	All compounds
Europium	5.0×10^{-4}	All compounds
Gadolinium	5.0×10^{-4}	All compounds
Terbium	5.0×10^{-4}	All compounds
Dysprosium	5.0×10^{-4}	All compounds
Holmium	5.0×10^{-4}	All compounds
Erbium	5.0×10^{-4}	All compounds
Thulium	5.0×10^{-4}	All compounds
Ytterbium	5.0×10^{-4}	All compounds
Lutetium	5.0×10^{-4}	All compounds
Hafnium	0.002	All compounds
Tantalum	0.001	All compounds
Tungsten	0.300	All unspecified compounds
	0.010	Tungstic acid
Rhenium	0.800	All compounds
Osmium	0.010	All compounds
Iridium	0.010	All compounds
Platinum	0.010	All compounds
Gold	0.100	All compounds
Mercury	0.020	All inorganic compound
Mercury	1.000	Methyl mercury
	0.400	All unspecified organic compounds
Thallium	1.000	All compounds
Lead	0.200	All compounds
Bismuth	0.050	All compounds

Element	*Gut transfer factor (f_1)*	*Compound*
Polonium	0.100	All compounds
Astatine	1.000	All compounds
Francium	1.000	All compounds
Radium	0.200	All compounds
Actinium	5.0×10^{-4}	All compound
Thorium	5.0×10^{-4}	All unspecified compound
	2.0×10^{-4}	Oxides and hydroxides
Protactinium	5.0×10^{-4}	All compound
Uranium	0.020	All unspecified compound
	0.002	Most tetravalent compounds, e.g. UO_2, U_3O_8, UF_4
Neptunium	5.0×10^{-4}	All compound
Plutonium	5.0×10^{-4}	All unspecified compound
	1.0×10^{-4}	Nitrates
	1.0×10^{-5}	Insoluble oxides
Americium	5.0×10^{-4}	All compound
Curium	5.0×10^{-4}	All compound
Berkelium	5.0×10^{-4}	All compound
Californium	5.0×10^{-4}	All compound
Einsteinium	5.0×10^{-4}	All compound
Fermium	5.0×10^{-4}	All compound
Mendelevium	5.0×10^{-4}	All compound

Table V

COMPOUNDS FOR LUNG ABSORPTION TYPES AND VALUES OF GUT TRANSFER FACTOR (f_1) USED TO CALCULATE COMMITTED EFFECTIVE DOSE PER UNIT INTAKE VIA INGESTION FOR WORKERS

Element	*Absorption type(s)*	*Gut transfer factor (f_1)*	*Compound*
Beryllium	M	0.005	All unspecified compound
	S	0.005	Oxides, halides and nitrates
Fluorine	F	1.000	Determined by combining cation
	M	1.000	Determined by combining cation
	S	1.000	Determined by combining cation
Sodium	F	1.000	All compounds
Magnesium	F	0.500	All unspecified compound
	M	0.500	Oxides, hydroxide, carbides, halides and nitrates
Aluminium	F	0.010	All unspecified compounds
	M	0.010	Oxides, hydroxide, carbides, halides, nitrates and metallic aluminium
Silicon	F	0.010	All unspecified compounds
	M	0.010	Oxides, hydroxides, carbides and nitrates
	S	0.010	Aluminosilicate glass aerosol

Note: Types F, M and S denote fast, moderate and slow absorption from the lung, respectively.

Element	*Absorption type(s)*	*Gut transfer factor (f_1)*	*Compound*
Phosphorus	F	0.800	All unspecified compounds
	M	0.800	Some phosphates: determined by combining cation
Sulphur	F	0.800	Sulphides and sulphates: determined by combing cation
	M	0.800	Elemental sulphur, Sulphides and sulphates: determined by combining cation
Chlorine	F	1.000	Determined by combining cation
	M	1.000	Determined by combining cation
Potassium	F	1.000	All compounds
Calcium	M	0.300	All compounds
Scandium	S	1.0×10^{-4}	All compounds
Titanium	F	0.010	All unspecified compounds
	M	0.010	Oxides, hydroxides, carbides, halides and nitrates
	S	0.010	Strontium titanate ($SrTiO_3$)
Vanadium	F	0.010	All unspecified compounds
	M	0.010	Oxides, hydroxides, carbides and halides
Chromium	F	0.100	All unspecified compounds
	M	0.100	Halides and nitrates
	S	0.100	Oxides and hydroxides
Manganese	F	0.100	All unspecified compounds
	M	0.100	Oxides, hydroxides, halides and nitrates
Iron	F	0.100	All unspecified compounds
	M	0.100	Oxides, hydroxides and halides
Cobalt	M	0.100	All unspecified compounds
	S	0.050	Oxides, hydroxides, halides and nitrates
Nickel	F	0.050	All unspecified compounds
	M	0.050	Oxides, hydroxides, halides and nitrates
Copper	F	0.500	All unspecified compounds
	M	0.500	Sulphides, halides and nitrates
	S	0.500	Oxides and hydroxides
Zinc	S	0.500	All compounds
Gallium	F	0.001	All unspecified compounds
	M	0.001	Oxides, hydroxides, carbides, halides and nitrates
Germanium	F	1.000	All unspecified compounds
	M	1.000	Oxides, sulphides and halides
Arsenic	M	0.500	All compounds
Selenium	F	0.800	All unspecified inorganic compounds
	M	0.800	Elemental selenium, oxides, hydroxides and carbides
Bromine	F	1.000	Determined by combining cation
	M	1.000	Determined by combining cation
Rubidium	F	1.000	All Compound
Strontium	F	0.300	All unspecified compound
	S	0.010	Strontium titanate ($SrTio_3$)

Note: Types F, M and S denote fast, moderate and slow absorption from the lung, respectively.

Element	*Absorption type(s)*	*Gut transfer factor (f_1)*	*Compound*
Yttrium	M	1.0×10^{-4}	All unspecified compound
	S	1.0×10^{-4}	Oxides and hydroxides
Zirconium	F	0.002	All unspecified compound
	M	0.002	Oxides, hydroxides, halides and nitrates
	S	0.002	Zirconium carbide
Niobium	M	0.010	All unspecified compounds
	S	0.010	Molybdenum sulphide, oxides and hydroxides
Molybdenum	F	0.800	All unspecified compounds
	S	0.050	Molybdenum sulphide, oxides and hydroxides
Technetium	F	0.800	All unspecified compounds
	M	0.800	Oxides, hydroxides, halides and nitrates
Ruthenium	F	0.050	All unspecified compounds
	M	0.050	Halides
	S	0.050	Oxides and hydroxides
Rhodium	F	0.050	All unspecified compounds
	M	0.050	Nitrates and halides
	S	0.050	Oxides and hydroxides
Palladium	F	0.005	All unspecified compounds
	M	0.005	Nitrates and halides
	S	0.005	Oxides and hydroxides
Silver	F	0.050	All unspecified compounds and metallic silver
	M	0.050	Nitrates and sulphides
	S	0.050	Oxides, hydroxides and carbides
Cadmium	F	0.050	All unspecified compounds
	M	0.050	Sulphides, halides and nitrates
	S	0.050	Oxides and hydroxides
Indium	F	0.020	All unspecified compounds
	M	0.020	Oxides, hydroxides, halides and nitrate
Tin	F	0.020	All unspecified compounds
	M	0.020	Stannic phosphate, sulphides, oxides, hydroxides, halides and nitrates
Antimony	F	0.100	All unspecified compounds
	M	0.010	Oxides, hydroxide, halides, sulphides, sulphates and nitrates
Tellurium	F	0.300	All unspecified compounds
	M	0.300	Oxides, hydroxide and nitrates
Iodine	F	1.000	All compounds
Caesium	F	1.000	All compound
Barium	F	0.100	All compound
Lanthanum	F	5.0×10^{-4}	All unspecified compounds
	M	5.0×10^{-4}	Oxides and hydroxides
Cerium	M	5.0×10^{-4}	All unspecified compounds
	S	5.0×10^{-4}	Oxides hydroxides and fluorides
Praseodymium	M	5.0×10^{-4}	All unspecified compounds

Note: Types F, M and S denote fast, moderate and slow absorption from the lung, respectively.

Element	*Absorption type(s)*	*Gut transfer factor (f_1)*	*Compound*
	S	5.0×10^{-4}	Oxides hydroxides, carbides and fluorides
Neodymium	M	5.0×10^{-4}	All unspecified compounds
	S	5.0×10^{-4}	Oxides hydroxides, carbides and fluorides
Promethium	M	5.0×10^{-4}	All unspecified compounds
	S	5.0×10^{-4}	Oxides hydroxides, carbides and fluorides
Samarium	M	5.0×10^{-4}	All compounds
Europium	M	5.0×10^{-4}	All compounds
Gadolinium	F	5.0×10^{-4}	All unspecified compounds
	M	5.0×10^{-4}	Oxides hydroxides, and fluorides
Terbium	M	5.0×10^{-4}	All compounds
Dysprosium	M	5.0×10^{-4}	All compounds
Holmium	M	5.0×10^{-4}	All unspecified compounds
Erbium	M	5.0×10^{-4}	All compounds
Thulium	M	5.0×10^{-4}	All compounds
Ytterbium	M	5.0×10^{-4}	All unspecified compounds
	S	5.0×10^{-4}	Oxides hydroxides, and fluorides
Lutetium	M	5.0×10^{-4}	All unspecified compounds
	S	5.0×10^{-4}	Oxides hydroxides, and fluorides
Hafnium	F	0.002	All unspecified compounds
	M	0.002	Oxides hydroxides, halides, carbides and nitrates
Tantalum	M	0.001	All unspecified compounds
	S	0.001	Elemental tantalum, oxides, hydroxides, halides, carbides, nitrates and nitrides
Tungsten	F	0.300	All compounds
Rhenium	F	0.800	All unspecified compounds
	M	0.800	Oxides, hydroxide, halides and nitrates
Osmium	F	0.010	All unspecified compounds
	M	0.010	Halides and nitrates
	S	0.010	Oxides and hydroxides
Iridium	F	0.010	All unspecified compounds
	M	0.010	Metallic iridium, halides and nitrates
	S	0.010	Oxides and hydroxides
Platinum	F	0.010	All compounds
Gold	F	0.100	All unspecified compounds
	M	0.100	Halides and nitrates
	S	0.100	Oxides and hydroxides
Mercury	F	0.020	Sulphates
	M	0.020	Oxides, hydroxide, halides, nitrates and sulphides
Mercury	F	0.400	All organic compounds
Thallium	F	1.000	All compound
Lead	F	0.200	All compounds
Bismuth	F	0.050	Bismuth nitrates
	M	0.050	All unspecified compounds

Note: Types F, M and S denote fast, moderate and slow absorption from the lung, respectively.

Element	*Absorption type(s)*	*Gut transfer factor (f_1)*	*Compound*
Polonium	F	0.100	All unspecified compounds
	M	0.100	Oxides, hydroxides and nitrates
Astatine	F	1.000	Determined by combining cation
	M	1.000	Determined by combining cation
Francium	F	1.000	All compounds
Radium	M	0.200	All compounds
Actinium	F	5.0×10^{-4}	All unspecified compounds
	M	5.0×10^{-4}	Halides and nitrates
	S	5.0×10^{-4}	Oxides and hydroxides
Thorium	M	5.0×10^{-4}	All unspecified compounds
	S	2.0×10^{-4}	Oxides and hydroxides
Protactinium	M	5.0×10^{-4}	All unspecified compounds
	S	5.0×10^{-4}	Oxides and hydroxides
Uranium	F	0.020	Most hexavalent compounds e.g. UF_6, UO_2F_2 and $UO_2(NO_3)_2$
	M	0.020	Less soluble compounds, e.g. UO_3, UF_4, UCl_4 and most other hexavalent compounds
	S	0.020	Highly insoluble compounds, e.g. UO_2 and U_3O_8
Neptunium	M	5.0×10^{-4}	All compounds
Plutonium	M	5.0×10^{-4}	All unspecified compounds
	S	1.0×10^{-5}	Insoluble oxides
Americium	M	5.0×10^{-4}	All compounds
Curium	M	5.0×10^{-4}	All compounds
Berkelium	M	5.0×10^{-4}	All compounds
Californium	M	5.0×10^{-4}	All compounds
Einsteinium	M	5.0×10^{-4}	All compounds
Fermium	M	5.0×10^{-4}	All compounds
Mendelevium	M	5.0×10^{-4}	All compounds

Note: Types F, M and S denote fast, moderate and slow absorption from the lung, respectively.

Table VI

COMMITTED EFFECTIVE DOSE PER UNIT INTAKE, e(g)
THROUGH INGESTION ($Sv.Bq^{-1}$)—FOR MEMBERS OF THE PUBLIC

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 t e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Hydrogen									
Tritiated Water	12.3 a	1.000	6.4×10^{-11}	1.000	4.8×10^{-11}	3.1×10^{-11}	2.3×10^{-11}	1.8×10^{-11}	1.8×10^{-11}
OBT [a]	12.3 a	1.000	1.2×10^{-10}	1.000	1.2×10^{-10}	7.3×10^{-11}	5.7×10^{-11}	4.2×10^{-11}	4.2×10^{-11}
Beryllium									
Be-7	53.3 d	0.020	1.8×10^{-10}	0.005	1.3×10^{-10}	7.7×10^{-11}	5.3×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
Be-10	1.60×10^{6} a	0.020	1.4×10^{-8}	0.005	8.0×10^{-9}	4.1×10^{-9}	2.4×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Carbon									
C-11	0.340 h	1.000	2.6×10^{-10}	1.000	1.5×10^{-10}	7.3×10^{-11}	4.3×10^{-11}	3.0×10^{-11}	2.4×10^{-11}
C-14	5.73×10^{3} a	1.000	1.4×10^{-9}	1.000	1.6×10^{-9}	9.9×10^{-10}	8.0×10^{-10}	5.7×10^{-10}	5.8×10^{-10}
Fluorine									
F-18	1.83 h	1.000	5.2×10^{-10}	1.000	3.0×10^{-10}	1.5×10^{-10}	9.1×10^{-11}	6.2×10^{-11}	4.9×10^{-11}
Sodium									
Na-22	2.60 a	1.000	2.1×10^{-8}	1.000	1.5×10^{-8}	8.4×10^{-9}	5.5×10^{-9}	3.7×10^{-9}	3.2×10^{-9}
Na-24	15.0 h	1.000	3.5×10^{-9}	1.000	2.3×10^{-9}	1.2×10^{-9}	7.7×10^{-10}	5.2×10^{-10}	4.3×10^{-10}
Magnesium									
Mg-28	20.9 h	1.000	1.2×10^{-8}	0.500	1.4×10^{-8}	7.4×10^{-9}	4.5×10^{-9}	2.7×10^{-9}	2.2×10^{-9}
Aluminium									
A1-26	7.16×10^{5} a	0.020	3.4×10^{-8}	0.010	2.1×10^{-8}	1.1×10^{-8}	7.1×10^{-9}	4.3×10^{-9}	3.5×10^{-9}
Silicon									
Si-31	2.62 h	0.020	1.9×10^{-9}	0.010	1.0×10^{-9}	5.1×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	1.6×10^{-10}

Si-32	4.50 x 10^2a	0.020	7.3 x 10^{-9}	0.010	4.1 x 10^{-9}	2.0 x 10^{-9}	1.2 x 10^{-9}	7.0 x 10^{-10}	5.6 x 10^{-10}
Phosphorus									
P-32	14.3 d	1.000	3.1 x 10^{-8}	0.800	1.9 x 10^{-8}	9.4 x 10^{-9}	5.3 x 10^{-9}	3.1 x 10^{-9}	2.4 x 10^{-9}
P-33	25.4 d	1.000	2.7 x 10^{-9}	0.800	1.8 x 10^{-9}	9.1 x 10^{-10}	5.3 x 10^{-10}	3.1 x 10^{-10}	2.4 x 10^{-10}
Sulphur									
S-35 (inorganic)	87.4 d	1.000	1.3 x 10^{-9}	1.000	8.7 x 10^{-10}	4.4 x 10^{-10}	2.7 x 10^{-10}	1.6 x 10^{-10}	1.3 x 10^{-10}
S-35 (organic)	87.4 d	1.000	7.7 x 10^{-9}	1.000	5.4 x 10^{-9}	2.7 x 10^{-9}	1.6 x 10^{-9}	9.5 x 10^{-10}	7.7 x 10^{-10}
Chlorine									
Cl-36	3.01 x 10^5a	1.000	9.8 x 10^{-9}	1.000	6.3 x 10^{-9}	3.2 x 10^{-9}	1.9 x 10^{-9}	1.2 x 10^{-9}	9.3 x 10^{-10}
Cl-38	0.620 h	1.000	1.4 x 10^{-9}	1.000	7.7 x 10^{-10}	3.8 x 10^{-10}	2.2 x 10^{-10}	1.5 x 10^{-10}	1.2 x 10^{-10}
Cl-39	0.927 h	1.000	9.7 x 10^{-10}	1.000	5.5 x 10^{-10}	2.7 x 10^{-10}	1.6 x 10^{-10}	1.1 x 10^{-10}	8.5 x 10^{-11}
Potassium									
K-41	1.28 x 10^9a	1.000	6.2 x 10^{-8}	1.000	4.2 x 10^{-8}	2.1 x 10^{-8}	1.3 x 10^{-8}	7.6 x 10^{-8}	6.2 x 10^{-9}
K-42	12.4 h	1.000	5.1 x 10^{-9}	1.000	3.0 x 10^{-9}	1.5 x 10^{-9}	8.6 x 10^{-10}	5.4 x 10^{-10}	4.3 x 10^{-10}
K-43	22.6 h	1.000	2.3 x 10^{-9}	1.000	1.4 x 10^{-9}	7.6 x 10^{-10}	4.7 x 10^{-10}	3.0 x 10^{-10}	2.5 x 10^{-10}
K-44	0.369 h	1.000	1.0 x 10^{-9}	1.000	5.5 x 10^{-10}	2.7 x 10^{-10}	1.6 x 10^{-10}	1.1 x 10^{-10}	8.4 x 10^{-11}
K-45	0.333 h	1.000	6.2 x 10^{-10}	1.000	3.5 x 10^{-10}	1.7 x 10^{-10}	9.9 x 10^{-11}	6.8 x 10^{-11}	5.4 x 10^{-11}
Calcium [a]									
Ca-41	1.40 x 10^5a	0.600	1.2 x 10^{-9}	0.300	5.2 x 10^{-10}	3.9 x 10^{-10}	4.8 x 10^{-10}	5.0 x 10^{-10}	1.9 x 10^{-10}
Ca-45	163 d	0.600	1.1 x 10^{-8}	0.300	4.9 x 10^{-9}	2.6 x 10^{-9}	1.8 x 10^{-9}	1.3 x 10^{-9}	7.1 x 10^{-10}
Ca-47	4.53 d	0.600	1.3 x 10^{-8}	0.300	9.3 x 10^{-9}	4.9 x 10^{-9}	3.0 x 10^{-9}	1.8 x 10^{-9}	1.6 x 10^{-9}
Scandium									
Sc-43	3.89 h	0.001	1.8 x 10^{-9}	1.0 x 10^{-4}	1.2 x 10^{-9}	6.1 x 10^{-10}	3.7 x 10^{-10}	2.3 x 10^{-10}	1.9 x 10^{-10}
Sc-44	3.93 h	0.001	3.5 x 10^{-9}	1.0 x 10^{-4}	2.2 x 10^{-9}	1.2 x 10^{-9}	7.1 x 10^{-10}	4.4 x 10^{-10}	3.5 x 10^{-10}
Sc-44m	2.44 d	0.001	24 x 10^{-8}	1.0 x 10^{-4}	1.6 x 10^{-8}	8.3 x 10^{-9}	5.1 x 10^{-9}	3.1 x 10^{-9}	2.4 x 10^{-9}
Sc-46	83.8 d	0.001	1.1 x 10^{-8}	1.0 x 10^{-4}	7.9 x 10^{-9}	4.4 x 10^{-9}	2.9 x 10^{-9}	1.8 x 10^{-9}	1.5 x 10^{-9}

[a] OBT: originally bound tritium

[a] The f_1 value for Calcium for 1 to 15 years old is 0.4

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Sc-47	3.35 d	0.001	6.1×10^{-9}	1.0×10^{-4}	3.9×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	6.8×10^{-10}	5.4×10^{-10}
Sc-48	1.82 d	0.001	1.3×10^{-8}	1.0×10^{-4}	9.3×10^{-9}	5.1×10^{-9}	3.3×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Sc-49	0.956 h	0.001	1.0×10^{-9}	1.0×10^{-4}	5.7×10^{-10}	2.8×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	8.2×10^{-11}
Titanium									
Ti-44	47.3 a	0.020	5.5×10^{-8}	0.010	3.1×10^{-8}	1.7×10^{-8}	1.1×10^{-8}	6.9×10^{-9}	5.8×10^{-9}
Ti-45	3.08 h	0.020	1.6×10^{-9}	0.010	9.8×10^{-10}	5.0×10^{-10}	3.1×10^{-10}	1.9×10^{-10}	1.5×10^{-10}
Vanadium									
V-47	0.543 h	0.020	7.3×10^{-10}	0.010	4.1×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	8.0×10^{-11}	6.3×10^{-11}
V-48	16.2 d	0.020	1.5×10^{-8}	0.010	1.1×10^{-8}	5.9×10^{-9}	3.9×10^{-9}	2.5×10^{-9}	2.0×10^{-9}
V-49	330 d	0.020	2.2×10^{-10}	0.010	1.4×10^{-10}	6.9×10^{-11}	4.0×10^{-11}	2.3×10^{-11}	1.8×10^{-11}
Chromium									
Cr-48	23.0 h	0.020	1.4×10^{-9}	0.100	9.9×10^{-10}	5.7×10^{-10}	3.8×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
		0.020	1.4×10^{-9}	0.010	9.9×10^{-10}	5.7×10^{-10}	3.8×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
Cr-49	0.702 h	0.020	6.8×10^{-10}	0.100	3.9×10^{-10}	2.0×10^{-10}	1.1×10^{-10}	7.7×10^{-11}	6.1×10^{-11}
		0.020	6.8×10^{-10}	0.010	3.9×10^{-10}	2.0×10^{-10}	1.1×10^{-10}	7.7×10^{-11}	6.1×10^{-11}
Cr-51	27.7 d	0.020	3.5×10^{-10}	0.100	2.3×10^{-10}	1.2×10^{-10}	7.8×10^{-11}	4.8×10^{-11}	3.8×10^{-11}
		0.020	3.3×10^{-10}	0.010	2.2×10^{-10}	1.2×10^{-10}	7.5×10^{-11}	4.6×10^{-11}	3.7×10^{-11}
Manganese									
Mn-51	0.770 h	0.200	1.1×10^{-9}	0.100	6.1×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	9.3×10^{-11}
Mn-52	5.59 d	0.200	1.2×10^{-8}	0.100	8.8×10^{-9}	5.1×10^{-9}	3.4×10^{-9}	2.2×10^{-9}	1.8×10^{-9}
Mn-52m	0.352 h	0.200	7.8×10^{-10}	0.100	4.4×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	8.8×10^{-11}	6.9×10^{-11}
Mn-53	3.70×10^{6} a	0.200	4.1×10^{-10}	0.100	2.2×10^{-10}	1.1×10^{-10}	6.5×10^{-11}	3.7×10^{-11}	3.0×10^{-11}
Mn-54	312 d	0.200	5.4×10^{-9}	0.100	3.1×10^{-9}	1.9×10^{-9}	1.3×10^{-9}	8.7×10^{-10}	7.1×10^{-10}
Mn-56	2.58 h	0.200	2.7×10^{-9}	0.100	1.7×10^{-9}	8.5×10^{-10}	5.1×10^{-10}	3.2×10^{-10}	2.5×10^{-10}

Iron [a]									
Fe-52	8.28 h	0.600	1.3×10^{-8}	0.100	9.1×10^{-9}	4.6×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Fe-55	2.70 a	0.600	7.6×10^{-9}	0.100	2.4×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	7.7×10^{-10}	3.3×10^{-10}
Fe-59	44.5 d	0.600	3.9×10^{-8}	0.100	1.3×10^{-8}	7.5×10^{-9}	4.7×10^{-9}	3.1×10^{-9}	1.8×10^{-9}
Fe-60	1.00×10^{5}a	0.600	7.9×10^{-7}	0.100	2.7×10^{-7}	2.7×10^{-7}	2.5×10^{-7}	2.3×10^{-7}	1.1×10^{-7}
Cobalt [a]									
Co-55	17.5 h	0.600	6.0×10^{-9}	0.100	5.5×10^{-9}	2.9×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	1.0×10^{-9}
Co-56	78.7 d	0.600	2.5×10^{-8}	0.100	1.5×10^{-8}	8.8×10^{-9}	5.8×10^{-9}	3.8×10^{-9}	2.5×10^{-9}
Co-57	271 d	0.600	2.9×10^{-9}	0.100	1.6×10^{-9}	8.9×10^{-10}	5.8×10^{-10}	3.7×10^{-10}	2.1×10^{-10}
Co-58	70.8 d	0.600	7.3×10^{-9}	0.100	4.4×10^{-9}	2.6×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	7.4×10^{-10}
Co-58m	9.15 h	0.600	2.0×10^{-10}	0.100	1.5×10^{-10}	7.8×10^{-11}	4.7×10^{-11}	2.8×10^{-11}	2.4×10^{-11}
Co-60	5.27 a	0.600	5.4×10^{-8}	0.100	2.7×10^{-8}	1.7×10^{-8}	1.1×10^{-8}	7.9×10^{-9}	3.4×10^{-9}
Co-60m	0.174 h	0.600	2.2×10^{-11}	0.100	1.2×10^{-11}	5.7×10^{-12}	3.2×10^{-12}	2.2×10^{-12}	1.7×10^{-12}
Co-61	1.65 h	0.600	8.2×10^{-10}	0.100	5.1×10^{-10}	2.5×10^{-10}	1.4×10^{-10}	9.2×10^{-11}	7.4×10^{-11}
Co-62m	0.232 h	0.600	5.3×10^{-10}	0.100	3.0×10^{-10}	1.5×10^{-10}	8.7×10^{-11}	6.0×10^{-11}	4.7×10^{-11}
Nickel									
Ni-56	6.10 d	0.100	5.3×10^{-9}	0.050	4.0×10^{-9}	2.3×10^{-9}	1.6×10^{-9}	1.1×10^{-9}	8.6×10^{-10}
Ni-57	1.50 d	0.100	6.8×10^{-9}	0.050	4.9×10^{-9}	2.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	8.7×10^{-10}
Ni-59	7.50×10^{4} a	0.100	6.4×10^{-10}	0.050	3.4×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	7.3×10^{-11}	6.3×10^{-11}
Ni-63	96.0 a	0.100	1.6×10^{-9}	0.050	8.4×10^{-10}	4.6×10^{-10}	2.8×10^{-10}	1.8×10^{-10}	1.5×10^{-10}
Ni-65	2.52 h	0.100	2.1×10^{-9}	0.050	1.3×10^{-9}	6.3×10^{-10}	3.8×10^{-10}	2.3×10^{-10}	1.8×10^{-10}
Ni-66	2.27 d	0.100	3.3×10^{-8}	0.050	2.2×10^{-8}	1.1×10^{-8}	6.6×10^{-9}	3.7×10^{-9}	3.0×10^{-9}
Copper									
Cu-60	0.387 h	0.100	7.0×10^{-10}	0.050	4.2×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	8.9×10^{-11}	7.0×10^{-11}
Cu-61	3.41 h	0.100	7.1×10^{-10}	0.050	7.5×10^{-10}	3.9×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Cu-64	12.7 h	0.100	5.2×10^{-10}	0.050	8.3×10^{-10}	4.2×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Cu-67	2.58 d	0.100	2.1×10^{-9}	0.050	2.4×10^{-9}	1.2×10^{-9}	7.2×10^{-10}	4.2×10^{-10}	3.4×10^{-10}

[a] The f_1 value for iron for 1 to 15 years old is 0.2
[a] The f_1 value for cobalt for 1 to 15 years old is 0.3

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Zinc									
Zn-62	9.26 h	0.100	4.2×10^{-9}	0.050	6.5×10^{-9}	3.3×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	9.4×10^{-10}
Zn-63	0.635 h	0.100	8.7×10^{-10}	0.050	5.2×10^{-10}	2.6×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	7.9×10^{-11}
Zn-65	244 d	0.100	3.6×10^{-8}	0.050	1.6×10^{-8}	9.7×10^{-9}	6.4×10^{-9}	4.5×10^{-9}	3.9×10^{-9}
Zn-69	0.950 h	0.100	3.5×10^{-10}	0.050	2.2×10^{-10}	1.1×10^{-10}	6.0×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
Zn-69m	13.8 h	0.100	1.3×10^{-9}	0.050	2.3×10^{-9}	1.2×10^{-9}	7.0×10^{-10}	4.1×10^{-10}	3.3×10^{-10}
Zn-71m	3.92 h	0.100	1.4×10^{-9}	0.050	1.5×10^{-9}	7.8×10^{-10}	4.8×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
Zn-72	1.94 d	0.100	8.7×10^{-9}	0.050	8.6×10^{-9}	4.5×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Gallium									
Ga-65	0.253 h	0.010	4.3×10^{-10}	0.001	2.4×10^{-10}	1.2×10^{-10}	6.9×10^{-11}	4.7×10^{-11}	3.7×10^{-11}
Ga-66	9.40 h	0.010	1.2×10^{-8}	0.001	7.9×10^{-9}	4.0×10^{-9}	2.5×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Ga-67	3.26 d	0.010	1.8×10^{-9}	0.001	1.2×10^{-9}	6.4×10^{-10}	4.0×10^{-10}	2.4×10^{-10}	1.9×10^{-10}
Ga-68	1.13 h	0.010	1.2×10^{-9}	0.001	6.7×10^{-10}	3.4×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
Ga-70	0.353 h	0.010	3.9×10^{-10}	0.001	2.2×10^{-10}	1.0×10^{-10}	5.9×10^{-11}	4.0×10^{-11}	3.1×10^{-11}
Ga-72	14.1 h	0.010	1.0×10^{-8}	0.001	6.8×10^{-9}	3.6×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Ga-73	4.91 h	0.010	3.0×10^{-9}	0.001	1.9×10^{-9}	9.3×10^{-10}	5.5×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
Germanium									
Ge-66	2.27 h	1.000	8.3×10^{-10}	1.000	5.3×10^{-10}	2.9×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
Ge-67	0.312 h	1.000	7.7×10^{-10}	1.000	4.2×10^{-10}	2.1×10^{-10}	1.2×10^{-10}	8.2×10^{-11}	6.5×10^{-11}
Ge-68	288 d	1.000	1.2×10^{-8}	1.000	8.0×10^{-9}	4.2×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Ge-69	1.63 d	1.000	2.0×10^{-9}	1.000	1.3×10^{-9}	7.1×10^{-10}	4.6×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
Ge-71	11.8 d	1.000	1.2×10^{-10}	1.000	7.8×10^{-11}	4.0×10^{-11}	2.4×10^{-11}	1.5×10^{-11}	1.2×10^{-11}
Ge-75	1.38 h	1.000	5.5×10^{-10}	1.000	3.1×10^{-10}	1.5×10^{-10}	8.7×10^{-11}	5.9×10^{-11}	4.6×10^{-11}
Ge-77	11.3 h	1.000	3.0×10^{-9}	1.000	1.8×10^{-9}	9.9×10^{-10}	6.2×10^{-10}	4.1×10^{-10}	3.3×10^{-10}
Ge-78	1.45 h	1.000	1.2×10^{-9}	1.000	7.0×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.5×10^{-10}	1.2×10^{-10}

Arsenic									
As-69	0.253 h	1.000	6.6×10^{-10}	0.500	3.7×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	5.7×10^{-11}
As-70	0.876 h	1.000	1.2×10^{-9}	0.500	7.8×10^{-10}	4.1×10^{-10}	2.5×10^{-10}	1.7×10^{-10}	1.3×10^{-10}
As-71	2.70 d	1.000	2.8×10^{-9}	0.500	2.8×10^{-9}	1.5×10^{-9}	9.3×10^{-10}	5.7×10^{-10}	4.6×10^{-10}
As-72	1.08 d	1.000	1.1×10^{-8}	0.500	1.2×10^{-8}	6.3×10^{-9}	3.8×10^{-9}	2.3×10^{-9}	1.8×10^{-9}
As-73	80.3 d	1.000	2.6×10^{-9}	0.500	1.9×10^{-9}	9.3×10^{-10}	5.6×10^{-10}	3.2×10^{-10}	2.6×10^{-10}
As-74	17.8 d	1.000	1.0×10^{-8}	0.500	8.2×10^{-9}	4.3×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
As-76	1.10 d	1.000	1.0×10^{-8}	0.500	1.1×10^{-8}	5.8×10^{-9}	3.4×10^{-9}	2.0×10^{-9}	1.6×10^{-9}
As-77	1.62 d	1.000	2.7×10^{-9}	0.500	2.9×10^{-9}	1.5×10^{-9}	8.7×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
As-78	1.51 h	1.000	2.0×10^{-9}	0.500	1.4×10^{-9}	7.0×10^{-10}	4.1×10^{-10}	2.7×10^{-10}	2.1×10^{-10}
Selenium									
Se-70	0.683 h	1.000	1.0×10^{-9}	0.800	7.1×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Se-73	7.15 h	1.000	1.6×10^{-9}	0.800	1.4×10^{-9}	7.4×10^{-10}	4.8×10^{-10}	2.5×10^{-10}	2.1×10^{-10}
Se-73m	0.650 h	1.000	2.6×10^{-10}	0.800	1.8×10^{-10}	9.5×10^{-11}	5.9×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
Se-75	120 d	1.000	2.0×10^{-8}	0.800	1.3×10^{-8}	8.3×10^{-9}	6.0×10^{-9}	3.1×10^{-9}	2.6×10^{-9}
Se-79	6.50×10^{4} a	1.000	4.1×10^{-8}	0.800	2.8×10^{-8}	1.9×10^{-8}	1.4×10^{-8}	4.1×10^{-9}	2.9×10^{-9}
Se-81	0.308 h	1.000	3.4×10^{-10}	0.800	1.9×10^{-10}	9.0×10^{-11}	5.1×10^{-11}	3.4×10^{-11}	2.7×10^{-11}
Se-81m	0.954 h	1.000	6.0×10^{-10}	0.800	3.7×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	6.7×10^{-11}	5.3×10^{-11}
Se-83	0.375 h	1.000	4.6×10^{-10}	0.800	2.9×10^{-10}	1.5×10^{-10}	8.7×10^{-11}	5.9×10^{-11}	4.7×10^{-11}
Bromine									
Br-74	0.422 h	1.000	9.0×10^{-10}	1.000	5.2×10^{-10}	2.6×10^{-10}	1.5×10^{-10}	1.1×10^{-10}	8.4×10^{-11}
Br-74m	0.691 h	1.000	1.5×10^{-9}	1.000	8.5×10^{-10}	4.3×10^{-10}	2.5×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
Br-75	1.63 h	1.000	8.5×10^{-10}	1.000	4.9×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	9.9×10^{-11}	7.9×10^{-11}
Br-76	16.2 h	1.000	4.2×10^{-9}	1.000	2.7×10^{-9}	1.4×10^{-9}	8.7×10^{-10}	5.6×10^{-10}	4.6×10^{-10}
Br-77	2.33 d	1.000	6.3×10^{-10}	1.000	4.4×10^{-10}	2.5×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	9.6×10^{-11}
Br-80	0.290 h	1.000	3.9×10^{-10}	1.000	2.1×10^{-10}	1.0×10^{-10}	5.8×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
Br-80m	4.42 h	1.000	1.4×10^{-9}	1.000	8.0×10^{-10}	3.9×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	1.1×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Br-82	1.47 d	1.000	3.7×10^{-9}	1.000	2.6×10^{-9}	1.5×10^{-9}	9.5×10^{-10}	6.4×10^{-10}	5.4×10^{-10}
Br-83	2.39 h	1.000	5.3×10^{-10}	1.000	3.0×10^{-10}	1.4×10^{-10}	8.3×10^{-11}	5.5×10^{-11}	4.3×10^{-11}
Br-84	0.530 h	1.000	1.0×10^{-9}	1.000	5.8×10^{-10}	2.8×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.8×10^{-11}
Rubidium									
Rb-79	0.382 h	1.000	5.7×10^{-10}	1.000	3.2×10^{-10}	1.6×10^{-10}	9.2×10^{-11}	6.3×10^{-11}	5.0×10^{-11}
Rb-81	4.58 h	1.000	5.4×10^{-10}	1.000	3.2×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	6.7×10^{-11}	5.4×10^{-11}
Rb-81m	0.533 h	1.000	1.1×10^{-10}	1.000	6.2×10^{-11}	3.1×10^{-11}	1.8×10^{-11}	1.2×10^{-11}	9.7×10^{-12}
Rb-82m	6.20 h	1.000	8.7×10^{-10}	1.000	5.9×10^{-10}	3.4×10^{-10}	2.2×10^{-10}	1.5×10^{-10}	1.3×10^{-10}
Rb-83	86.2 d	1.000	1.1×10^{-8}	1.000	8.4×10^{-9}	4.9×10^{-9}	3.2×10^{-9}	2.2×10^{-9}	1.9×10^{-9}
Rb-84	32.8 d	1.000	2.0×10^{-8}	1.000	1.4×10^{-8}	7.9×10^{-9}	5.0×10^{-9}	3.3×10^{-9}	2.8×10^{-9}
Rb-86	18.7 d	1.000	3.1×10^{-8}	1.000	2.0×10^{-8}	9.9×10^{-9}	5.9×10^{-9}	3.5×10^{-9}	2.8×10^{-9}
Rb-87	4.70×10^{10} a	1.000	1.5×10^{-8}	1.000	1.0×10^{-8}	5.2×10^{-9}	3.1×10^{-9}	1.8×10^{-9}	1.5×10^{-9}
Rb-88	0.297 h	1.000	1.1×10^{-9}	1.000	6.2×10^{-10}	3.0×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	9.0×10^{-11}
Rb-89	0.253 h	1.000	5.4×10^{-10}	1.000	3.0×10^{-10}	1.5×10^{-10}	8.6×10^{-11}	5.9×10^{-11}	4.7×10^{-11}
Strontium [a]									
Sr-80	1.67 h	0.600	3.7×10^{-9}	0.300	2.3×10^{-9}	1.1×10^{-9}	6.5×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
Sr-81	0.425 h	0.600	8.4×10^{-10}	0.300	4.9×10^{-10}	2.4×10^{-10}	1.4×10^{-10}	9.6×10^{-11}	7.7×10^{-11}
Sr-82	25.0 d	0.600	7.2×10^{-8}	0.300	4.1×10^{-8}	2.1×10^{-8}	1.3×10^{-8}	8.7×10^{-9}	6.1×10^{-9}
Sr-83	1.35 d	0.600	3.4×10^{-9}	0.300	2.7×10^{-9}	1.4×10^{-9}	9.1×10^{-10}	5.7×10^{-10}	4.9×10^{-10}
Sr-85	64.8 d	0.600	7.7×10^{-9}	0.300	3.1×10^{-9}	1.7×10^{-9}	1.5×10^{-9}	1.3×10^{-9}	5.6×10^{-10}
Sr-85m	1.16 h	0.600	4.5×10^{-11}	0.300	3.0×10^{-11}	1.7×10^{-11}	1.1×10^{-11}	7.8×10^{-12}	6.1×10^{-12}
Sr-87m	2.80 h	0.600	2.4×10^{-10}	0.300	1.7×10^{-10}	9.0×10^{-11}	5.6×10^{-11}	3.6×10^{-11}	3.0×10^{-11}
Sr-89	50.5 d	0.600	3.6×10^{-8}	0.300	1.8×10^{-8}	8.9×10^{-9}	5.8×10^{-9}	4.0×10^{-9}	2.6×10^{-9}
Sr-90	29.1 a	0.600	2.3×10^{-7}	0.300	7.3×10^{-8}	4.7×10^{-8}	6.0×10^{-8}	8.0×10^{-8}	2.8×10^{-8}

Sr-91	9.50 h	0.600	5.2×10^{-9}	0.300	4.0×10^{-9}	2.1×10^{-9}	1.2×10^{-9}	7.4×10^{-10}	6.5×10^{-10}
Sr-92	2.71 h	0.600	3.4×10^{-9}	0.300	2.7×10^{-9}	1.4×10^{-9}	8.2×10^{-10}	4.8×10^{-10}	4.3×10^{-10}
Yttrium									
Y-86	14.7 h	0.001	7.6×10^{-9}	1.0×10^{-4}	5.2×10^{-9}	2.9×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.6×10^{-10}
Y-86m	0.800 h	0.001	4.5×10^{-10}	1.0×10^{-4}	3.1×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	7.1×10^{-11}	5.6×10^{-11}
Y-87	3.35 d	0.001	4.6×10^{-9}	1.0×10^{-4}	3.2×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	7.0×10^{-10}	5.5×10^{-10}
Y-88	107 d	0.001	8.1×10^{-9}	1.0×10^{-4}	6.0×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Y-90	2.67 d	0.001	3.1×10^{-8}	1.0×10^{-4}	2.0×10^{-8}	1.0×10^{-8}	5.9×10^{-9}	3.3×10^{-9}	2.7×10^{-9}
Y-90m	3.19 h	0.001	1.8×10^{-9}	1.0×10^{-4}	1.2×10^{-9}	6.1×10^{-10}	3.7×10^{-10}	2.2×10^{-10}	1.7×10^{-10}
Y-91	58.5 d	0.001	2.8×10^{-8}	1.0×10^{-4}	1.8×10^{-8}	8.8×10^{-9}	5.2×10^{-9}	2.9×10^{-9}	2.4×10^{-9}
Y-91m	0.828 h	0.001	9.2×10^{-11}	1.0×10^{-4}	6.0×10^{-11}	3.3×10^{-11}	2.1×10^{-11}	1.4×10^{-11}	1.1×10^{-11}
Y-92	3.54 h	0.001	5.9×10^{-9}	1.0×10^{-4}	3.6×10^{-9}	1.8×10^{-9}	1.0×10^{-9}	6.2×10^{-10}	4.9×10^{-10}
Y-93	10.1 h	0.001	1.4×10^{-8}	1.0×10^{-4}	8.5×10^{-9}	4.3×10^{-9}	2.5×10^{-9}	1.4×10^{-9}	1.2×10^{-9}
Y-94	0.318 h	0.001	9.9×10^{-10}	1.0×10^{-4}	5.5×10^{-10}	2.7×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	8.1×10^{-11}
Y-95	0.178 h	0.001	5.7×10^{-10}	1.0×10^{-4}	3.1×10^{-10}	1.5×10^{-10}	8.7×10^{-11}	5.9×10^{-11}	4.6×10^{-11}
Zirconium									
Zr-86	16.5 h	0.020	6.9×10^{-9}	0.010	4.8×10^{-9}	2.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	8.6×10^{-10}
Zr-88	83.4 d	0.020	2.8×10^{-9}	0.010	2.0×10^{-9}	1.2×10^{-9}	8.0×10^{-10}	5.4×10^{-10}	4.5×10^{-10}
Zr-89	3.27 d	0.020	6.5×10^{-9}	0.010	4.5×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	9.9×10^{-10}	7.9×10^{-10}
Zr-93	1.53×10^{6} a	0.020	1.2×10^{-9}	0.010	7.6×10^{-10}	5.1×10^{-10}	5.8×10^{-10}	8.6×10^{-10}	1.1×10^{-9}
Zr-95	64.0 d	0.020	8.5×10^{-9}	0.010	5.6×10^{-9}	3.0×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.5×10^{-10}
Zr-97	16.9 h	0.020	2.2×10^{-8}	0.010	1.4×10^{-8}	7.3×10^{-9}	4.4×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
Niobium									
Nb-88	0.238 h	0.020	6.7×10^{-10}	0.010	3.8×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	7.9×10^{-11}	6.3×10^{-11}
Nb-89	2.03 h	0.020	3.0×10^{-9}	0.010	2.0×10^{-9}	1.0×10^{-9}	6.0×10^{-10}	3.4×10^{-10}	2.7×10^{-10}
Nb-89	1.10 h	0.020	1.5×10^{-9}	0.010	8.7×10^{-10}	4.4×10^{-10}	2.7×10^{-10}	1.8×10^{-10}	1.4×10^{-10}
Nb-90	14.6 h	0.020	1.1×10^{-8}	0.010	7.2×10^{-9}	3.9×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.2×10^{-9}
Nb-93m	13.6 a	0.020	1.5×10^{-9}	0.010	9.1×10^{-10}	4.6×10^{-10}	2.7×10^{-10}	1.5×10^{-10}	1.2×10^{-10}

[a] The f_1 value for strontium for 1 to 15 years old is 0.4

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Nb-94	2.03 x 10^4 a	0.020	1.5 x 10^{-8}	0.010	9.7 x 10^{-9}	5.3 x 10^{-9}	3.4 x 10^{-9}	2.1 x 10^{-9}	1.7 x 10^{-9}
Nb-95	35.1 d	0.020	4.6 x 10^{-9}	0.010	3.2 x 10^{-9}	1.8 x 10^{-9}	1.1 x 10^{-9}	7.4 x 10^{-10}	5.8 x 10^{-10}
Nb-95m	3.61 d	0.020	6.4 x 10^{-9}	0.010	4.1 x 10^{-9}	2.1 x 10^{-9}	1.2 x 10^{-9}	7.1 x 10^{-10}	5.6 x 10^{-10}
Nb-96	23.3 h	0.020	9.2 x 10^{-9}	0.010	6.3 x 10^{-9}	3.4 x 10^{-9}	2.2 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Nb-97	1.20 h	0.020	7.7 x 10^{-10}	0.010	4.5 x 10^{-10}	2.3 x 10^{-10}	1.3 x 10^{-10}	8.7 x 10^{-11}	6.8 x 10^{-11}
Nb-98	0.858 h	0.020	1.2 x 10^{-9}	0.010	7.1 x 10^{-10}	3.6 x 10^{-10}	2.2 x 10^{-10}	1.4 x 10^{-10}	1.1 x 10^{-10}
Molybdenum									
Mo-90	5.67 h	1.000	1.7 x 10^{-9}	1.000	1.2 x 10^{-9}	6.3 x 10^{-10}	4.0 x 10^{-10}	2.7 x 10^{-10}	2.2 x 10^{-10}
Mo-93	3.50 x10^3 a	1.000	7.9 x 10^{-9}	1.000	6.9 x 10^{-9}	5.0 x 10^{-9}	4.0 x 10^{-9}	3.4 x 10^{-9}	3.1 x 10^{-9}
Mo-93m	6.85 h	1.000	8.0 x 10^{-10}	1.000	5.4 x 10^{-10}	3.1 x 10^{-10}	2.0 x 10^{-10}	1.4 x 10^{-10}	1.1 x 10^{-10}
Mo-99	2.75 d	1.000	5.5 x 10^{-9}	1.000	3.5 x 10^{-9}	1.8 x 10^{-9}	1.1 x 10^{-9}	7.6 x 10^{-10}	6.0 x 10^{-10}
Mo-101	0.244 h	1.000	4.8 x 10^{-10}	1.000	2.7 x 10^{-10}	1.3 x 10^{-10}	7.6 x 10^{-11}	5.2 x 10^{-11}	4.1 x 10^{-11}
Technetium									
Tc-93	2.75 h	1.000	2.7 x 10^{-10}	0.500	2.5 x 10^{-10}	1.5 x 10^{-10}	9.8 x 10^{-11}	6.8 x 10^{-11}	5.5 x 10^{-11}
Tc-93m	0.725 h	1.000	2.0 x 10^{-10}	0.500	1.3 x 10^{-10}	7.3 x 10^{-11}	4.6 x 10^{-11}	3.2 x 10^{-11}	2.5 x 10^{-11}
Tc-94	4.88 h	1.000	1.2 x 10^{-9}	0.500	1.0 x 10^{-9}	5.8 x 10^{-10}	3.7 x 10^{-10}	2.5 x 10^{-10}	2.0 x 10^{-10}
Tc-94m	0.867 h	1.000	1.3 x 10^{-9}	0.500	6.5 x 10^{-10}	3.3 x 10^{-10}	1.9 x 10^{-10}	1.3 x 10^{-10}	1.0 x 10^{-10}
Tc-95	20.0 h	1.000	9.9 x 10^{-10}	0.500	8.7 x 10^{-10}	5.0 x 10^{-10}	3.3 x 10^{-10}	2.3 x 10^{-10}	1.8 x 10^{-10}
Tc-95m	61.0 d	1.000	4.7 x 10^{-9}	0.500	2.8 x 10^{-9}	1.6 x 10^{-9}	1.0 x 10^{-9}	7.0 x 10^{-10}	5.6 x 10^{-10}
Tc-96	4.28 d	1.000	6.7 x 10^{-9}	0.500	5.1 x 10^{-9}	3.0 x 10^{-9}	2.0 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Tc-96m	0.858 h	1.000	1.0 x 10^{-10}	0.500	6.5 x 10^{-11}	3.6 x 10^{-11}	2.3 x 10^{-11}	1.6 x 10^{-11}	1.2 x 10^{-11}
Tc-97	2.60 x 10^6 a	1.000	9.9 x 10^{-10}	0.500	4.9 x 10^{-10}	2.4 x 10^{-10}	1.4 x 10^{-10}	8.8 x 10^{-11}	6.8 x 10^{-11}
Tc-97m	8.70 d	1.000	8.7 x 10^{-9}	0.500	4.1 x 10^{-9}	2.0 x 10^{-9}	1.1 x 10^{-9}	7.0 x 10^{-10}	5.5 x 10^{-10}
Tc-98	4.20 x 10^6 a	1.000	2.3 x 10^{-8}	0.500	1.2 x 10^{-8}	6.1 x 10^{-9}	3.7 x 10^{-9}	2.5 x 10^{-9}	2.0 x 10^{-9}

Tc-99	2.13×10^{5} a	1.000	1.0×10^{-8}	0.500	4.8×10^{-9}	2.3×10^{-9}	1.3×10^{-9}	8.2×10^{-10}	6.4×10^{-10}
Tc-99m	6.02 h	1.000	2.0×10^{-10}	0.500	1.3×10^{-10}	7.2×10^{-11}	4.3×10^{-11}	2.8×10^{-11}	2.2×10^{-11}
Tc-101	0.237 h	1.000	2.4×10^{-10}	0.500	1.3×10^{-10}	6.1×10^{-11}	3.5×10^{-11}	2.4×10^{-11}	1.9×10^{-11}
Tc-104	0.303 h	1.000	1.0×10^{-9}	0.500	5.3×10^{-10}	2.6×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	8.0×10^{-11}
Ruthenium									
Ru-94	0.863 h	0.100	9.3×10^{-10}	0.050	5.9×10^{-10}	3.1×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	9.4×10^{-11}
Ru-97	2.90 d	0.100	1.2×10^{-9}	0.050	8.5×10^{-10}	4.7×10^{-10}	3.0×10^{-10}	1.9×10^{-10}	1.5×10^{-10}
Ru-103	39.3 d	0.100	7.1×10^{-9}	0.050	4.6×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	9.2×10^{-10}	7.3×10^{-10}
Ru-105	4.44 h	0.100	2.7×10^{-9}	0.050	1.8×10^{-9}	9.1×10^{-10}	5.5×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
Ru-106	1.01 a	0.100	8.4×10^{-8}	0.050	4.9×10^{-8}	2.5×10^{-8}	1.5×10^{-8}	8.6×10^{-9}	7.0×10^{-9}
Rhodium									
Rh-99	16.0 d	0.100	4.2×10^{-9}	0.050	2.9×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.5×10^{-10}	5.1×10^{-10}
Rh-99m	4.70 h	0.100	4.9×10^{-10}	0.050	3.5×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	8.3×10^{-11}	6.6×10^{-11}
Rh-100	20.8 h	0.100	4.9×10^{-9}	0.050	3.6×10^{-9}	2.0×10^{-9}	1.4×10^{-9}	8.8×10^{-10}	7.1×10^{-10}
Rh-101	3.20 a	0.100	4.9×10^{-9}	0.050	2.8×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.7×10^{-10}	5.5×10^{-10}
Rh-101m	4.34 d	0.100	1.7×10^{-9}	0.050	1.2×10^{-9}	6.8×10^{-10}	4.4×10^{-10}	2.8×10^{-10}	2.2×10^{-10}
Rh-102	2.90 a	0.100	1.9×10^{-8}	0.050	1.0×10^{-8}	6.4×10^{-9}	4.3×10^{-9}	3.0×10^{-9}	2.6×10^{-9}
Rh-102m	207 d	0.100	1.2×10^{-8}	0.050	7.4×10^{-9}	3.9×10^{-9}	2.4×10^{-9}	1.4×10^{-9}	1.2×10^{-9}
Rh-103m	0.935 h	0.100	4.7×10^{-11}	0.050	2.7×10^{-11}	1.3×10^{-11}	7.4×10^{-12}	4.8×10^{-12}	3.8×10^{-12}
Rh-105	1.47 d	0.100	4.0×10^{-9}	0.050	2.7×10^{-9}	1.3×10^{-9}	8.0×10^{-10}	4.6×10^{-10}	3.7×10^{-10}
Rh-106m	2.20 h	0.100	1.4×10^{-9}	0.050	9.7×10^{-10}	5.3×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
Rh-107	0.362 h	0.100	2.9×10^{-10}	0.050	1.6×10^{-10}	7.9×10^{-11}	4.5×10^{-11}	3.1×10^{-11}	2.4×10^{-11}
Palladium									
Pd-100	3.63 d	0.050	7.4×10^{-9}	0.005	5.2×10^{-9}	2.9×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.4×10^{-10}
Pd-101	8.27 h	0.050	8.2×10^{-10}	0.005	5.7×10^{-10}	3.1×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	9.4×10^{-11}
Pd-103	17.0 d	0.050	2.2×10^{-9}	0.005	1.4×10^{-9}	7.2×10^{-10}	4.3×10^{-10}	2.4×10^{-10}	1.9×10^{-10}
Pd-107	6.50×10^{6} a	0.050	4.4×10^{-10}	0.005	2.8×10^{-10}	1.4×10^{-10}	8.1×10^{-11}	4.6×10^{-11}	3.7×10^{-11}
Pd-109	13. 4 h	0.050	6.3×10^{-9}	0.005	4.1×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	6.8×10^{-10}	5.5×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Silver									
Ag-102	0.215 h	0.100	4.2×10^{-10}	0.050	2.4×10^{-10}	1.2×10^{-10}	7.3×10^{-11}	5.0×10^{-11}	4.0×10^{-11}
Ag-103	1.09 h	0.100	4.5×10^{-10}	0.050	2.7×10^{-10}	1.4×10^{-10}	8.3×10^{-11}	5.5×10^{-11}	4.3×10^{-11}
Ag-104	1.15 h	0.100	4.3×10^{-10}	0.050	2.9×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	7.5×10^{-11}	6.0×10^{-11}
Ag-104m	0.558 h	0.100	5.6×10^{-10}	0.050	3.3×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	6.8×10^{-11}	5.4×10^{-11}
Ag-105	41.0 d	0.100	3.9×10^{-9}	0.050	2.5×10^{-9}	1.4×10^{-9}	9.1×10^{-10}	5.9×10^{-10}	4.7×10^{-10}
Ag-106	0.399 h	0.100	3.7×10^{-10}	0.050	2.1×10^{-10}	1.0×10^{-10}	6.0×10^{-11}	4.1×10^{-11}	3.2×10^{-11}
Ag-106m	8.41 d	0.100	9.7×10^{-9}	0.050	6.9×10^{-9}	4.1×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.5×10^{-9}
Ag-108m	1.27×10^{2} a	0.100	2.1×10^{-8}	0.050	1.1×10^{-8}	6.5×10^{-9}	4.3×10^{-9}	2.8×10^{-9}	2.3×10^{-9}
Ag-110m	250 d	0.100	2.4×10^{-8}	0.050	1.4×10^{-8}	7.8×10^{-9}	5.2×10^{-9}	3.4×10^{-9}	2.8×10^{-9}
Ag-111	7.45 d	0.100	1.4×10^{-8}	0.050	9.3×10^{-9}	4.6×10^{-9}	2.7×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Ag-112	3.12 h	0.100	4.9×10^{-9}	0.050	3.0×10^{-9}	1.5×10^{-9}	8.9×10^{-10}	5.4×10^{-10}	4.3×10^{-10}
Ag-115	0.333 h	0.100	7.2×10^{-10}	0.050	4.1×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	7.7×10^{-11}	6.0×10^{-11}
Cadmium									
Cd-104	0.961 h	0.100	4.2×10^{-10}	0.050	2.9×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	5.4×10^{-11}
Cd-107	6.49 h	0.100	7.1×10^{-10}	0.050	4.6×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	7.8×10^{-11}	6.2×10^{-11}
Cd-109	1.27 a	0.100	2.1×10^{-8}	0.050	9.5×10^{-9}	5.5×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	2.0×10^{-9}
Cd-113	9.30×10^{15} a	0.100	1.0×10^{-7}	0.050	4.8×10^{-8}	3.7×10^{-8}	3.0×10^{-8}	2.6×10^{-8}	2.5×10^{-8}
Cd-113m	13.6 a	0.100	1.2×10^{-7}	0.050	5.6×10^{-8}	3.9×10^{-8}	2.9×10^{-8}	2.4×10^{-8}	2.3×10^{-8}
Cd-115	2.23 d	0.100	1.4×10^{-8}	0.050	9.7×10^{-9}	4.9×10^{-9}	2.9×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Cd-115m	44.6 d	0.100	4.1×10^{-8}	0.050	1.9×10^{-8}	9.7×10^{-9}	6.9×10^{-9}	4.1×10^{-9}	3.3×10^{-9}
Cd-117	2.49 h	0.100	2.9×10^{-9}	0.050	1.9×10^{-9}	9.5×10^{-10}	5.7×10^{-10}	3.5×10^{-10}	2.8×10^{-10}
Cd-117m	3.36 h	0.100	2.6×10^{-9}	0.050	1.7×10^{-9}	9.0×10^{-10}	5.6×10^{-10}	3.5×10^{-10}	2.8×10^{-10}

Indium									
In-109	4.20 h	0.040	5.2×10^{-10}	0.020	3.6×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	8.2×10^{-11}	6.6×10^{-11}
In-110	4.90 h	0.040	1.5×10^{-9}	0.020	1.1×10^{-9}	6.5×10^{-10}	4.4×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
In-110	1.15 h	0.040	1.1×10^{-9}	0.020	6.4×10^{-10}	3.2×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
In-111	2.83 d	0.040	2.4×10^{-9}	0.020	1.7×10^{-9}	9.1×10^{-10}	5.9×10^{-10}	3.7×10^{-10}	2.9×10^{-10}
In-112	0.240 h	0.040	1.2×10^{-10}	0.020	6.7×10^{-11}	3.3×10^{-11}	1.9×10^{-11}	1.3×10^{-11}	1.0×10^{-11}
In-113m	1.66 h	0.040	3.0×10^{-10}	0.020	1.8×10^{-10}	9.3×10^{-11}	6.2×10^{-11}	3.6×10^{-11}	2.8×10^{-11}
In-114m	49.5 d	0.040	5.6×10^{-8}	0.020	3.1×10^{-8}	1.5×10^{-8}	9.0×10^{-9}	5.2×10^{-9}	4.1×10^{-9}
In-115	5.10 x1 0^{15} a	0.040	1.3×10^{-7}	0.020	6.4×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	3.6×10^{-8}	3.2×10^{-8}
In-115m	4.49 h	0.040	9.6×10^{-10}	0.020	6.0×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	8.6×10^{-11}
In-116m	0.902 h	0.040	5.8×10^{-10}	0.020	3.6×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	8.0×10^{-11}	6.4×10^{-11}
In-117	0.730 h	0.040	3.3×10^{-10}	0.020	1.9×10^{-10}	9.7×10^{-11}	5.8×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
In-117m	1.94 h	0.040	1.4×10^{-9}	0.020	8.6×10^{-10}	4.3×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.2×10^{-10}
In-119m	0.300 h	0.040	5.9×10^{-10}	0.020	3.2×10^{-10}	1.6×10^{-10}	8.8×10^{-11}	6.0×10^{-11}	4.7×10^{-11}
Tin									
Sn-110	4.00 h	0.040	3.5×10^{-9}	0.020	2.3×10^{-9}	1.2×10^{-9}	7.4×10^{-10}	4.4×10^{-10}	3.5×10^{-10}
Sn-111	0.588 h	0.040	2.5×10^{-10}	0.020	1.5×10^{-10}	7.4×10^{-11}	4.4×10^{-11}	3.0×10^{-11}	2.3×10^{-11}
Sn-113	115 d	0.040	7.8×10^{-9}	0.020	5.0×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	9.2×10^{-10}	7.3×10^{-10}
Sn-117m	13.6 d	0.040	7.7×10^{-9}	0.020	5.0×10^{-9}	2.5×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	7.1×10^{-10}
Sn-119m	293 d	0.040	4.1×10^{-9}	0.020	2.5×10^{-9}	1.3×10^{-9}	7.5×10^{-10}	4.3×10^{-10}	3.4×10^{-10}
Sn-121	1.13 d	0.040	2.6×10^{-9}	0.020	1.7×10^{-9}	8.4×10^{-10}	5.0×10^{-10}	2.8×10^{-10}	2.3×10^{-10}
Sn-121m	55.0 a	0.040	4.6×10^{-9}	0.020	2.7×10^{-9}	1.4×10^{-9}	8.2×10^{-10}	4.7×10^{-10}	3.8×10^{-10}
Sn-123	129 d	0.040	2.5×10^{-8}	0.020	1.6×10^{-8}	7.8×10^{-9}	4.6×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
Sn-123m	0.668 h	0.040	4.7×10^{-10}	0.020	2.6×10^{-10}	1.3×10^{-10}	7.3×10^{-11}	4.9×10^{-11}	3.8×10^{-11}
Sn-125	9.64 d	0.040	3.5×10^{-8}	0.020	2.2×10^{-8}	1.1×10^{-8}	6.7×10^{-9}	3.8×10^{-9}	3.1×10^{-9}
Sn-126	1.00×10^{5} a	0.040	5.0×10^{-8}	0.020	3.0×10^{-8}	1.6×10^{-8}	9.8×10^{-9}	5.9×10^{-9}	4.7×10^{-9}
Sn-127	2.10 h	0.040	2.0×10^{-9}	0.020	1.3×10^{-9}	6.6×10^{-10}	4.0×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
Sn-128	0.985 h	0.040	1.6×10^{-9}	0.020	9.7×10^{-10}	4.9×10^{-10}	3.0×10^{-10}	1.9×10^{-10}	1.5×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Antimony									
Sb-115	0.530 h	0.200	2.5×10^{-10}	0.100	1.5×10^{-10}	7.5×10^{-11}	4.5×10^{-11}	3.1×10^{-11}	2.4×10^{-11}
Sb-116	0.263 h	0.200	2.7×10^{-10}	0.100	1.6×10^{-10}	8.0×10^{-11}	4.8×10^{-11}	3.3×10^{-11}	2.6×10^{-11}
Sb-116m	1.00 h	0.200	5.0×10^{-10}	0.100	3.3×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	8.3×10^{-11}	6.7×10^{-11}
Sb-117	2.80 h	0.200	1.6×10^{-10}	0.100	1.0×10^{-10}	5.6×10^{-11}	3.5×10^{-11}	2.2×10^{-11}	1.8×10^{-11}
Sb-118m	5.00 h	0.200	1.3×10^{-9}	0.100	1.0×10^{-9}	5.8×10^{-10}	3.9×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Sb-119	1.59 d	0.200	8.4×10^{-10}	0.100	5.8×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	1.0×10^{-10}	8.0×10^{-11}
Sb-120	5.76 d	0.200	8.1×10^{-9}	0.100	6.0×10^{-9}	3.5×10^{-9}	2.3×10^{-9}	1.6×10^{-9}	1.2×10^{-9}
Sb-120	0.265 h	0.200	1.7×10^{-10}	0.100	9.4×10^{-10}	4.6×10^{-11}	2.7×10^{-11}	1.8×10^{-11}	1.4×10^{-11}
Sb-122	2.70 d	0.200	1.8×10^{-8}	0.100	1.2×10^{-8}	6.1×10^{-9}	3.7×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Sb-124	60.2 d	0.200	2.5×10^{-8}	0.100	1.6×10^{-8}	8.4×10^{-9}	5.2×10^{-9}	3.2×10^{-9}	2.5×10^{-9}
Sb-124m	0.337 h	0.200	8.5×10^{-11}	0.100	4.9×10^{-11}	2.5×10^{-11}	1.5×10^{-11}	1.0×10^{-11}	8.0×10^{-12}
Sb-125	2.77 a	0.200	1.1×10^{-8}	0.100	6.1×10^{-9}	3.4×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Sb-126	12.4 d	0.200	2.0×10^{-8}	0.100	1.4×10^{-8}	7.6×10^{-9}	4.9×10^{-9}	3.1×10^{-9}	2.4×10^{-9}
Sb-126m	0.317 h	0.200	3.9×10^{-10}	0.100	2.2×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	4.5×10^{-11}	3.6×10^{-11}
Sb-127	3.85 d	0.200	1.7×10^{-8}	0.100	1.2×10^{-8}	5.9×10^{-9}	3.6×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Sb-128	9.01 h	0.200	6.3×10^{-9}	0.100	4.5×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	9.5×10^{-10}	7.6×10^{-10}
Sb-128	0.173 h	0.200	3.7×10^{-10}	0.100	2.1×10^{-10}	1.0×10^{-10}	6.0×10^{-11}	4.1×10^{-11}	3.3×10^{-11}
Sb-129	4.32 h	0.200	4.3×10^{-9}	0.100	2.8×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	5.3×10^{-10}	4.2×10^{-10}
Sb-130	0.667 h	0.200	9.1×10^{-10}	0.100	5.4×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	9.1×10^{-11}
Sb-131	0.383 h	0.200	1.1×10^{-9}	0.100	7.3×10^{-10}	3.9×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.0×10^{-10}
Tellurium									
Te-116	2.49 h	0.600	1.4×10^{-9}	0.300	1.0×10^{-9}	5.5×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Te-121	17.0 d	0.600	3.1×10^{-9}	0.300	2.0×10^{-9}	1.2×10^{-9}	8.0×10^{-10}	5.4×10^{-10}	4.3×10^{-10}
Te-121m	154 d	0.600	2.7×10^{-8}	0.300	1.2×10^{-8}	6.9×10^{-9}	4.2×10^{-9}	2.8×10^{-9}	2.3×10^{-9}

Te-123	1.00×10^{13} a	0.600	2.0×10^{-8}	0.300	9.3×10^{-9}	6.9×10^{-9}	5.4×10^{-9}	4.7×10^{-9}	4.4×10^{-9}
Te-123m	120 d	0.600	1.9×10^{-8}	0.300	8.8×10^{-9}	4.9×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Te-125m	58.0 d	0.600	1.3×10^{-8}	0.300	6.3×10^{-9}	3.3×10^{-9}	1.9×10^{-9}	1.1×10^{-9}	8.7×10^{-10}
Te-127	9.35 h	0.600	1.5×10^{-9}	0.300	1.2×10^{-9}	6.2×10^{-10}	3.6×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Te-127m	109 d	0.600	4.1×10^{-8}	0.300	1.8×10^{-8}	9.5×10^{-9}	5.2×10^{-9}	3.0×10^{-9}	2.3×10^{-9}
Te-129	1.16 h	0.600	7.5×10^{-10}	0.300	4.4×10^{-10}	2.1×10^{-10}	1.2×10^{-10}	8.0×10^{-11}	6.3×10^{-11}
Te-129m	33.6 d	0.600	4.4×10^{-8}	0.300	2.4×10^{-8}	1.2×10^{-8}	6.6×10^{-9}	3.9×10^{-9}	3.0×10^{-9}
Te-131	0.417 h	0.600	9.0×10^{-10}	0.300	6.6×10^{-10}	3.5×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	8.7×10^{-11}
Te-131m	1.25 d	0.600	2.0×10^{-8}	0.300	1.4×10^{-9}	7.8×10^{-9}	4.3×10^{-9}	2.7×10^{-9}	1.9×10^{-9}
Te-132	3.26 d	0.600	4.8×10^{-8}	0.300	3.0×10^{-8}	1.6×10^{-8}	8.3×10^{-9}	5.3×10^{-9}	3.8×10^{-9}
Te-133	0.207 h	0.600	8.4×10^{-10}	0.300	6.3×10^{-10}	3.3×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	7.2×10^{-11}
Te-133m	0.923 h	0.600	3.1×10^{-9}	0.300	2.4×10^{-9}	1.3×10^{-9}	6.3×10^{-10}	4.1×10^{-10}	2.8×10^{-10}
Te-134	0.969 h	0.600	1.1×10^{-9}	0.300	7.5×10^{-10}	3.9×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Iodine									
I-120	1.35 h	1.000	3.9×10^{-9}	1.000	2.8×10^{-9}	1.4×10^{-9}	7.2×10^{-10}	4.8×10^{-10}	3.4×10^{-10}
I-120m	0.883 h	1.000	0.3×10^{-9}	1.000	1.5×10^{-9}	7.8×10^{-10}	4.2×10^{-10}	2.9×10^{-10}	2.1×10^{-10}
I-121	2.12 h	1.000	6.2×10^{-10}	1.000	5.3×10^{-10}	3.1×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	8.2×10^{-11}
I-123	13.2 h	1.000	2.2×10^{-9}	1.000	1.9×10^{-9}	1.1×10^{-9}	4.9×10^{-10}	3.3×10^{-10}	2.1×10^{-10}
I-124	4.18 d	1.000	1.2×10^{-7}	1.000	1.1×10^{-7}	6.3×10^{-8}	3.1×10^{-8}	2.0×10^{-8}	1.3×10^{-8}
I-125	60.1 d	1.000	5.2×10^{-8}	1.000	5.7×10^{-8}	4.1×10^{-8}	3.1×10^{-8}	2.2×10^{-8}	1.5×10^{-8}
I-126	13.0 d	1.000	2.1×10^{-7}	1.000	2.1×10^{-7}	1.3×10^{-7}	6.8×10^{-8}	4.5×10^{-8}	2.9×10^{-8}
I-128	0.416 h	1.000	5.7×10^{-10}	1.000	3.3×10^{-10}	1.6×10^{-10}	8.9×10^{-11}	6.0×10^{-11}	4.6×10^{-11}
I-129	1.57×10^{7} a	1.000	1.8×10^{-7}	1.000	2.2×10^{-7}	1.7×10^{-7}	1.9×10^{-7}	1.4×10^{-7}	1.1×10^{-7}
I-130	12.4 h	1.000	2.1×10^{-8}	1.000	1.8×10^{-10}	9.8×10^{-9}	4.6×10^{-9}	3.0×10^{-9}	2.0×10^{-9}
I-131	8.04 d	1.000	1.8×10^{-7}	1.000	1.8×10^{-7}	1.0×10^{-7}	5.2×10^{-8}	3.4×10^{-8}	2.2×10^{-8}
I-132	2.30 h	1.000	3.0×10^{-9}	1.000	2.4×10^{-9}	1.3×10^{-9}	6.2×10^{-10}	4.1×10^{-10}	2.9×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
I-132m	1.39 h	1.000	2.4×10^{-9}	1.000	2.0×10^{-9}	1.1×10^{-9}	5.0×10^{-10}	3.3×10^{-10}	2.2×10^{-10}
I-133	20.8 h	1.000	4.9×10^{-8}	1.000	4.4×10^{-8}	2.3×10^{-8}	1.0×10^{-8}	6.8×10^{-9}	4.3×10^{-9}
I-134	0.876 h	1.000	1.1×10^{-9}	1.000	7.5×10^{-10}	3.9×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
I-135	6.61 h	1.000	1.0×10^{-8}	1.000	8.9×10^{-9}	4.7×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	9.3×10^{-10}
Caesium									
Cs-125	0.750 h	1.000	3.9×10^{-10}	1.000	2.2×10^{-10}	1.1×10^{-10}	6.5×10^{-11}	4.4×10^{-11}	3.5×10^{-11}
Cs-127	6.25 h	1.000	1.8×10^{-10}	1.000	1.2×10^{-10}	6.2×10^{-11}	4.2×10^{-11}	2.9×10^{-11}	2.4×10^{-11}
Cs-129	1.34 d	1.000	4.4×10^{-10}	1.000	3.0×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	6.0×10^{-11}
Cs-130	0.498 h	1.000	3.3×10^{-10}	1.000	1.8×10^{-10}	9.0×10^{-11}	5.2×10^{-11}	3.6×10^{-11}	2.8×10^{-11}
Cs-131	9.69 d	1.000	4.6×10^{-10}	1.000	2.9×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	6.9×10^{-11}	5.8×10^{-11}
Cs-132	6.48 d	1.000	2.7×10^{-9}	1.000	1.8×10^{-9}	1.1×10^{-9}	7.7×10^{-10}	5.7×10^{-10}	5.0×10^{-10}
Cs-134	2.06 a	1.000	2.6×10^{-8}	1.000	1.6×10^{-8}	1.3×10^{-8}	1.4×10^{-8}	1.9×10^{-8}	1.9×10^{-8}
Cs-134m	2.90 h	1.000	2.1×10^{-10}	1.000	1.2×10^{-10}	5.9×10^{-11}	3.5×10^{-11}	2.5×10^{-11}	2.0×10^{-11}
Cs-135	2.30×10^{6} a	1.000	4.1×10^{-9}	1.000	2.3×10^{-9}	1.7×10^{-9}	1.7×10^{-9}	2.0×10^{-9}	2.0×10^{-9}
Cs-135m	0.883 h	1.000	1.3×10^{-10}	1.000	8.6×10^{-11}	4.9×10^{-11}	3.2×10^{-11}	2.3×10^{-11}	1.9×10^{-11}
Cs-136	13.1 d	1.000	1.5×10^{-8}	1.000	9.5×10^{-9}	6.1×10^{-9}	4.4×10^{-9}	3.4×10^{-9}	3.0×10^{-9}
Cs-137	30.0 a	1.000	2.1×10^{-8}	1.000	1.2×10^{-8}	9.6×10^{-9}	1.0×10^{-8}	1.3×10^{-8}	1.3×10^{-8}
Cs-138	0.536 h	1.000	1.1×10^{-9}	1.000	5.9×10^{-10}	2.9×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	9.2×10^{-11}
Barium [a]									
Ba-126	1.61 h	0.600	2.7×10^{-9}	0.200	1.7×10^{-9}	8.5×10^{-10}	5.0×10^{-10}	3.1×10^{-10}	2.6×10^{-10}
Ba-128	2.43 d	0.600	2.0×10^{-8}	0.200	1.7×10^{-8}	9.0×10^{-9}	5.2×10^{-9}	3.0×10^{-9}	2.7×10^{-9}
Ba-131	11.8 d	0.600	4.2×10^{-9}	0.200	2.6×10^{-9}	1.4×10^{-9}	9.4×10^{-10}	6.2×10^{-10}	4.5×10^{-10}
Ba-131m	0.243 h	0.600	5.8×10^{-11}	0.200	3.2×10^{-11}	1.6×10^{-11}	9.3×10^{-12}	6.3×10^{-12}	4.9×10^{-12}
Ba-133	10.7 a	0.600	2.2×10^{-8}	0.200	6.2×10^{-9}	3.9×10^{-9}	4.6×10^{-9}	7.3×10^{-9}	1.5×10^{-9}

Ba-133m	1.62 d	0.600	4.2×10^{-9}	0.200	3.6×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	5.9×10^{-10}	5.4×10^{-10}
Ba-135m	1.20 d	0.600	3.3×10^{-9}	0.200	2.9×10^{-9}	1.5×10^{-9}	8.5×10^{-10}	4.7×10^{-10}	4.3×10^{-10}
Ba-139	1.38 h	0.600	1.4×10^{-9}	0.200	8.4×10^{-10}	4.1×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Ba-140	12.7 d	0.600	3.2×10^{-8}	0.200	1.8×10^{-8}	9.2×10^{-9}	5.8×10^{-9}	3.7×10^{-9}	2.6×10^{-9}
Ba-141	0.305 h	0.600	7.6×10^{-10}	0.200	4.7×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	8.6×10^{-11}	7.0×10^{-11}
Ba-142	0.177 h	0.600	3.6×10^{-10}	0.200	2.2×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	4.3×10^{-11}	3.5×10^{-11}
Lanthanum									
La-131	0.983 h	0.005	3.5×10^{-10}	5.0×10^{-4}	2.1×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	4.4×10^{-11}	3.5×10^{-11}
La-132	4.80 h	0.005	3.8×10^{-9}	5.0×10^{-4}	2.4×10^{-9}	1.3×10^{-9}	7.8×10^{-10}	4.8×10^{-10}	3.9×10^{-10}
La-135	19.5 h	0.005	2.8×10^{-10}	5.0×10^{-4}	1.9×10^{-10}	1.0×10^{-10}	6.4×10^{-11}	3.9×10^{-11}	3.0×10^{-11}
La-137	6.00×10^{4} a	0.005	1.1×10^{-9}	5.0×10^{-4}	4.5×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	8.1×10^{-11}
La-138	1.35×10^{11} a	0.005	1.3×10^{-8}	5.0×10^{-4}	4.6×10^{-9}	2.7×10^{-9}	1.9×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
La-140	1.68 d	0.005	2.0×10^{-8}	5.0×10^{-4}	1.3×10^{-8}	6.8×10^{-9}	4.2×10^{-9}	2.5×10^{-9}	2.0×10^{-9}
La-141	3.93 h	0.005	4.3×10^{-9}	5.0×10^{-4}	2.6×10^{-9}	1.3×10^{-9}	7.6×10^{-10}	4.5×10^{-10}	3.6×10^{-10}
La-142	1.54 h	0.005	1.9×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	5.8×10^{-10}	3.5×10^{-10}	2.3×10^{-10}	1.8×10^{-10}
La-143	0.237 h	0.005	6.9×10^{-10}	5.0×10^{-4}	3.9×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	7.1×10^{-11}	5.6×10^{-11}
Cerium									
Ce-134	3.00 d	0.005	2.8×10^{-8}	5.0×10^{-4}	1.8×10^{-8}	9.1×10^{-9}	5.5×10^{-9}	3.2×10^{-9}	2.5×10^{-9}
Ce-135	17.6 h	0.005	7.0×10^{-9}	5.0×10^{-4}	4.7×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	7.9×10^{-10}
Ce-137	9.00 h	0.005	2.6×10^{-10}	5.0×10^{-4}	1.7×10^{-10}	8.8×10^{-11}	5.4×10^{-11}	3.2×10^{-11}	2.5×10^{-11}
Ce-137m	1.43 d	0.005	6.1×10^{-9}	5.0×10^{-4}	3.9×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	6.8×10^{-10}	5.4×10^{-10}
Ce-139	138 d	0.005	2.6×10^{-9}	5.0×10^{-4}	1.6×10^{-9}	8.6×10^{-10}	5.4×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
Ce-141	32.5 d	0.005	8.1×10^{-9}	5.0×10^{-4}	5.1×10^{-9}	2.6×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	7.1×10^{-10}
Ce-143	1.38 d	0.005	1.2×10^{-8}	5.0×10^{-4}	8.0×10^{-9}	4.1×10^{-9}	2.4×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Ce-144	284 d	0.005	6.6×10^{-8}	5.0×10^{-4}	3.9×10^{-8}	1.9×10^{-8}	1.1×10^{-8}	6.5×10^{-9}	5.2×10^{-9}
Praseodymium									
Pr-136	0.218 h	0.005	3.7×10^{-10}	5.0×10^{-4}	2.1×10^{-10}	1.0×10^{-10}	6.1×10^{-11}	4.2×10^{-11}	3.3×10^{-11}
Pr-137	1.28 h	0.005	4.1×10^{-10}	5.0×10^{-4}	2.5×10^{-10}	1.3×10^{-10}	7.7×10^{-11}	5.0×10^{-11}	4.0×10^{-11}

[a] The f_1 value for barium for 1 to 15 years old is 0.3

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Pr-138m	2.10 h	0.005	1.0×10^{-9}	5.0×10^{-4}	7.4×10^{-10}	4.1×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
Pr-139	4.51 h	0.005	3.2×10^{-10}	5.0×10^{-4}	2.0×10^{-10}	1.1×10^{-10}	6.5×10^{-11}	4.0×10^{-11}	3.1×10^{-11}
Pr-142	19.1 h	0.005	1.5×10^{-8}	5.0×10^{-4}	9.8×10^{-9}	4.9×10^{-9}	2.9×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Pr-142m	0.243 h	0.005	2.0×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	6.2×10^{-11}	3.7×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
Pr-143	13.6 d	0.005	1.4×10^{-8}	5.0×10^{-4}	8.7×10^{-9}	4.3×10^{-9}	2.6×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Pr-144	0.288 h	0.005	6.4×10^{-10}	5.0×10^{-4}	3.5×10^{-10}	1.7×10^{-10}	9.5×10^{-11}	6.5×10^{-11}	5.0×10^{-11}
Pr-145	5.98 h	0.005	4.7×10^{-9}	5.0×10^{-4}	2.9×10^{-9}	1.4×10^{-9}	8.5×10^{-10}	4.9×10^{-10}	3.9×10^{-10}
Pr-147	0.227 h	0.005	3.9×10^{-10}	5.0×10^{-4}	2.2×10^{-10}	1.1×10^{-10}	6.1×10^{-11}	4.2×10^{-11}	3.3×10^{-11}
Neodymium									
Nd-136	0.844 h	0.005	1.0×10^{-9}	5.0×10^{-4}	6.1×10^{-10}	3.1×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	9.9×10^{-11}
Nd-138	5.04 h	0.005	7.2×10^{-9}	5.0×10^{-4}	4.5×10^{-9}	2.3×10^{-9}	1.3×10^{-9}	8.0×10^{-10}	6.4×10^{-10}
Nd-139	0.495 h	0.005	2.1×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	6.3×10^{-11}	3.7×10^{-11}	2.5×10^{-11}	2.0×10^{-11}
Nd-139m	5.50 h	0.005	2.1×10^{-9}	5.0×10^{-4}	1.4×10^{-9}	7.8×10^{-10}	5.0×10^{-10}	3.1×10^{-10}	2.5×10^{-10}
Nd-141	2.49 h	0.005	7.8×10^{-11}	5.0×10^{-4}	5.0×10^{-11}	2.7×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	8.3×10^{-12}
Nd-147	11.0 d	0.005	1.2×10^{-8}	5.0×10^{-4}	7.8×10^{-9}	3.9×10^{-9}	2.3×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Nd-149	1.73 h	0.005	1.4×10^{-9}	5.0×10^{-4}	8.7×10^{-10}	4.3×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	1.2×10^{-10}
Nd-151	0.207 h	0.005	3.4×10^{-10}	5.0×10^{-4}	2.0×10^{-10}	9.7×10^{-11}	5.7×10^{-11}	3.8×10^{-11}	3.0×10^{-11}
Promethium									
Pm-141	0.348 h	0.005	4.2×10^{-10}	5.0×10^{-4}	2.4×10^{-10}	1.2×10^{-10}	6.8×10^{-11}	4.6×10^{-11}	3.6×10^{-11}
Pm-143	265 d	0.005	1.9×10^{-9}	5.0×10^{-4}	1.2×10^{-9}	6.7×10^{-10}	4.4×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
Pm-144	363 d	0.005	7.6×10^{-9}	5.0×10^{-4}	4.7×10^{-9}	2.7×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	9.7×10^{-10}
Pm-145	17.7 a	0.005	1.5×10^{-9}	5.0×10^{-4}	6.8×10^{-10}	3.7×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Pm-146	5.53 a	0.005	1.0×10^{-8}	5.0×10^{-4}	5.1×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	9.0×10^{-10}
Pm-147	2.62 a	0.005	3.6×10^{-9}	5.0×10^{-4}	1.9×10^{-9}	9.6×10^{-10}	5.7×10^{-10}	3.2×10^{-10}	2.6×10^{-10}

Pm-148	5.37 d	0.005	3.0×10^{-8}	5.0×10^{-4}	1.9×10^{-8}	9.7×10^{-9}	5.8×10^{-9}	3.3×10^{-9}	2.7×10^{-9}	
Pm-148m	41.3 d	0.005	1.5×10^{-8}	5.0×10^{-4}	1.0×10^{-8}	5.5×10^{-9}	3.5×10^{-9}	2.2×10^{-9}	1.9×10^{-9}	
Pm-149	2.21 d	0.005	1.2×10^{-8}	5.0×10^{-4}	7.4×10^{-9}	3.7×10^{-9}	2.2×10^{-9}	1.2×10^{-9}	9.9×10^{-10}	
Pm-150	2.68 h	0.005	2.8×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	8.7×10^{-10}	5.2×10^{-10}	3.2×10^{-10}	2.6×10^{-10}	
Pm-151	1.18 d	0.005	8.0×10^{-9}	5.0×10^{-4}	5.1×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	9.1×10^{-10}	7.3×10^{-10}	
Samarium										
Sm-141	0.170 h	0.005	4.5×10^{-10}	5.0×10^{-4}	2.5×10^{-10}	1.3×10^{-10}	7.3×10^{-11}	5.0×10^{-11}	3.9×10^{-11}	
Sm-141m	0.377 h	0.005	7.0×10^{-10}	5.0×10^{-4}	4.0×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	8.2×10^{-11}	6.5×10^{-11}	
Sm-142	1.21 h	0.005	2.2×10^{-9}	5.0×10^{-4}	1.3×10^{-9}	6.2×10^{-10}	3.6×10^{-10}	2.4×10^{-10}	1.9×10^{-10}	
Sm-145	340 d	0.005	2.4×10^{-9}	5.0×10^{-4}	1.4×10^{-9}	7.3×10^{-10}	4.5×10^{-10}	2.7×10^{-10}	2.1×10^{-10}	
Sm-146	1.03×10^{8} a	0.005	1.5×10^{-6}	5.0×10^{-4}	1.5×10^{-7}	1.0×10^{-7}	7.0×10^{-8}	5.8×10^{-8}	5.4×10^{-8}	
Sm-147	1.06×10^{11} a	0.005	1.4×10^{-6}	5.0×10^{-4}	1.4×10^{-7}	9.2×10^{-8}	6.4×10^{-8}	5.2×10^{-8}	4.9×10^{-8}	
Sm-151	90.0 a	0.005	1.5×10^{-9}	5.0×10^{-4}	6.4×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.8×10^{-11}	
Sm-153	1.95 d	0.005	8.4×10^{-9}	5.0×10^{-4}	5.4×10^{-9}	2.7×10^{-9}	1.6×10^{-9}	9.2×10^{-10}	7.4×10^{-10}	
Sm-155	0.368 h	0.005	3.6×10^{-10}	5.0×10^{-4}	2.0×10^{-10}	9.7×10^{-11}	5.5×10^{-11}	3.7×10^{-11}	2.9×10^{-11}	
Sm-156	9.40 h	0.005	2.8×10^{-9}	5.0×10^{-4}	1.8×10^{-9}	9.0×10^{-10}	5.4×10^{-10}	3.1×10^{-10}	2.5×10^{-10}	
Europium										
Eu-145	5.94 d	0.005	5.1×10^{-9}	5.0×10^{-4}	3.7×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	9.4×10^{-10}	7.5×10^{-10}	
Eu-146	4.61 d	0.005	8.5×10^{-9}	5.0×10^{-4}	6.2×10^{-9}	3.6×10^{-9}	2.4×10^{-9}	1.6×10^{-9}	1.3×10^{-9}	
Eu-147	24.0 d	0.005	3.7×10^{-9}	5.0×10^{-4}	2.5×10^{-9}	1.4×10^{-9}	8.9×10^{-10}	5.6×10^{-10}	4.4×10^{-10}	
Eu-148	54.5 d	0.005	8.5×10^{-9}	5.0×10^{-4}	6.0×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	1.6×10^{-9}	1.3×10^{-9}	
Eu-149	93.1 d	0.005	9.7×10^{-10}	5.0×10^{-4}	6.3×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	1.0×10^{-10}	
Eu-150	34.2 a	0.005	1.3×10^{-8}	5.0×10^{-4}	5.7×10^{-9}	3.4×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.3×10^{-9}	
Eu-150	12.6 h	0.005	4.4×10^{-9}	5.0×10^{-4}	2.8×10^{-9}	1.4×10^{-9}	8.2×10^{-10}	4.7×10^{-10}	3.8×10^{-10}	
Eu-152	13.3 a	0.005	1.6×10^{-8}	5.0×10^{-4}	7.4×10^{-9}	4.1×10^{-9}	2.6×10^{-9}	1.7×10^{-9}	1.4×10^{-9}	
Eu-152m	9.32 h	0.005	5.7×10^{-9}	5.0×10^{-4}	3.6×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.2×10^{-10}	5.0×10^{-10}	
Eu-154	8.80 a	0.005	2.5×10^{-8}	5.0×10^{-4}	1.2×10^{-8}	6.5×10^{-9}	4.1×10^{-9}	2.5×10^{-9}	2.0×10^{-9}	
Eu-155	4.96 a	0.005	4.3×10^{-9}	5.0×10^{-4}	2.2×10^{-9}	1.1×10^{-9}	6.8×10^{-10}	4.0×10^{-10}	3.2×10^{-10}	

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Eu-156	15.2 d	0.005	2.2×10^{-8}	5.0×10^{-4}	1.5×10^{-8}	7.5×10^{-9}	4.6×10^{-9}	2.7×10^{-9}	2.2×10^{-9}
Eu-157	15.1 h	0.005	6.7×10^{-9}	5.0×10^{-4}	4.3×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	7.5×10^{-10}	6.0×10^{-10}
Eu-158	0.765 h	0.005	1.1×10^{-9}	5.0×10^{-4}	6.2×10^{-10}	3.1×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	9.4×10^{-11}
Gadolinium									
Gd-145	0.382 h	0.005	4.5×10^{-10}	5.0×10^{-4}	2.6×10^{-10}	1.3×10^{-10}	8.1×10^{-11}	5.6×10^{-11}	4.4×10^{-11}
Gd-146	48.3 d	0.005	9.4×10^{-9}	5.0×10^{-4}	6.0×10^{-9}	3.2×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	9.6×10^{-10}
Gd-147	1.59 d	0.005	4.5×10^{-9}	5.0×10^{-4}	3.2×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	7.7×10^{-10}	6.1×10^{-10}
Gd-148	93.0 a	0.005	1.7×10^{-6}	5.0×10^{-4}	1.6×10^{-7}	1.1×10^{-7}	7.3×10^{-8}	5.9×10^{-8}	5.6×10^{-8}
Gd-149	9.40 d	0.005	4.0×10^{-9}	5.0×10^{-4}	2.7×10^{-9}	1.5×10^{-9}	9.3×10^{-10}	5.7×10^{-10}	4.5×10^{-10}
Gd-151	120 d	0.005	2.1×10^{-9}	5.0×10^{-4}	1.3×10^{-9}	6.8×10^{-10}	4.2×10^{-10}	2.4×10^{-10}	2.0×10^{-10}
Gd-152	1.08×10^{14} a	0.005	1.2×10^{-6}	5.0×10^{-4}	1.2×10^{-7}	7.7×10^{-8}	5.3×10^{-8}	4.3×10^{-8}	4.1×10^{-8}
Gd-153	242 d	0.005	2.9×10^{-9}	5.0×10^{-4}	1.8×10^{-9}	9.4×10^{-10}	5.8×10^{-10}	3.4×10^{-10}	2.7×10^{-10}
Gd-159	18.6 h	0.005	5.7×10^{-9}	5.0×10^{-4}	3.6×10^{-9}	1.8×10^{-9}	1.1×10^{-10}	6.2×10^{-10}	4.9×10^{-10}
Terbium									
Tb-147	1.65 h	0.005	1.5×10^{-9}	5.0×10^{-4}	1.0×10^{-9}	5.4×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
Tb-149	4.15 h	0.005	2.4×10^{-9}	5.0×10^{-4}	1.5×10^{-9}	8.0×10^{-10}	5.0×10^{-10}	3.1×10^{-10}	2.5×10^{-10}
Tb-150	3.27 h	0.005	2.5×10^{-9}	5.0×10^{-4}	1.6×10^{-9}	8.3×10^{-10}	5.1×10^{-10}	3.2×10^{-10}	2.5×10^{-10}
Tb-151	17.6 h	0.005	2.7×10^{-9}	5.0×10^{-4}	1.9×10^{-9}	1.0×10^{-9}	6.7×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
Tb-153	2.34 d	0.005	2.3×10^{-9}	5.0×10^{-4}	1.5×10^{-9}	8.2×10^{-10}	5.1×10^{-10}	3.1×10^{-10}	2.5×10^{-10}
Tb-154	21.4 h	0.005	4.7×10^{-9}	5.0×10^{-4}	3.4×10^{-9}	1.9×10^{-9}	1.3×10^{-9}	8.1×10^{-10}	6.5×10^{-10}
Tb-155	5.32 d	0.005	1.9×10^{-9}	5.0×10^{-4}	1.3×10^{-9}	6.8×10^{-10}	4.3×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Tb-156	5.34 d	0.005	9.0×10^{-9}	5.0×10^{-4}	6.3×10^{-9}	3.5×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Tb-156m	1.02 d	0.005	1.5×10^{-9}	5.0×10^{-4}	1.0×10^{-9}	5.6×10^{-10}	3.5×10^{-10}	2.2×10^{-10}	1.7×10^{-10}
Tb-156m	5.00 h	0.005	8.0×10^{10}	5.0×10^{-4}	5.2×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	8.1×10^{-11}

Tb-157	1.50 x 10^2 a	0.005	4.9 x 10^{10}	5.0 x 10^{-4}	2.2 x 10^{-10}	1.1 x 10^{-10}	6.8 x 10^{-11}	4.1 x 10^{-11}	3.4 x 10^{-11}
Tb-158	1.50 x 10^2 a	0.005	1.3 x 10^8	5.0 x 10^{-4}	5.9 x 10^{-9}	3.3 x 10^{-9}	2.1 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Tb-160	72.3 d	0.005	1.6 x 10^8	5.0 x 10^{-4}	1.0 x 10^{-8}	5.4 x 10^{-9}	3.3 x 10^{-9}	2.0 x 10^{-9}	1.6 x 10^{-9}
Tb-161	6.91 d	0.005	8.3 x 10^9	5.0 x 10^{-4}	5.3 x 10^{-9}	2.7 x 10^{-9}	1.6 x 10^{-9}	9.0 x 10^{-10}	7.2 x 10^{-10}
Dysprosium									
Dy-155	10.0 h	0.005	9.7 x 10^{-10}	5.0 x 10^{-4}	6.8 x 10^{-10}	3.8 x 10^{-10}	2.5 x 10^{-10}	1.6 x 10^{-10}	1.3 x 10^{-10}
Dy-157	8.10 h	0.005	4.4 x 10^{-10}	5.0 x 10^{-4}	3.1 x 10^{-10}	1.8 x 10^{-10}	1.2 x 10^{-10}	7.7 x 10^{-11}	6.1 x 10^{-11}
Dy-159	144 d	0.005	1.0 x 10^{-9}	5.0 x 10^{-4}	6.4 x 10^{-10}	3.4 x 10^{-10}	2.1 x 10^{-10}	1.3 x 10^{-10}	1.0 x 10^{-10}
Dy-165	2.33 h	0.005	1.3 x 10^{-9}	5.0 x 10^{-4}	7.9 x 10^{-10}	3.9 x 10^{-10}	2.3 x 10^{-10}	1.4 x 10^{-10}	1.1 x 10^{-10}
Dy-166	3.40 d	0.005	1.9 x 10^{-8}	5.0 x 10^{-4}	1.2 x 10^{-8}	6.0 x 10^{-9}	3.6 x 10^{-9}	2.0 x 10^{-9}	1.6 x 10^{-9}
Holmium									
Ho-155	0.800 h	0.005	3.8 x 10^{-10}	5.0 x 10^{-4}	2.3 x 10^{-10}	1.2 x 10^{-10}	7.1 x 10^{-11}	4.7 x 10^{-11}	3.7 x 10^{-11}
Ho-157	0.210 h	0.005	5.8 x 10^{-11}	5.0 x 10^{-4}	3.6 x 10^{-11}	1.9 x 10^{-11}	1.2 x 10^{-11}	8.1 x 10^{-12}	6.5 x 10^{-12}
Ho-159	0.550 h	0.005	7.1 x 10^{-11}	5.0 x 10^{-4}	4.3 x 10^{-11}	2.3 x 10^{-11}	1.4 x 10^{-11}	9.9 x 10^{-12}	7.9 x 10^{-12}
Ho-161	2.50 h	0.005	1.4 x 10^{-10}	5.0 x 10^{-4}	8.1 x 10^{-11}	4.2 x 10^{-11}	2.5 x 10^{-11}	1.6 x 10^{-11}	1.3 x 10^{-11}
Ho-162	0.250 h	0.005	3.5 x 10^{-11}	5.0 x 10^{-4}	2.0 x 10^{-11}	1.0 x 10^{-11}	6.0 x 10^{-12}	4.2 x 10^{-12}	3.3 x 10^{-12}
Ho-162m	1.13 h	0.005	2.4 x 10^{-10}	5.0 x 10^{-4}	1.5 x 10^{-10}	7.9 x 10^{-11}	4.9 x 10^{-11}	3.3 x 10^{-11}	2.6 x 10^{-11}
Ho-164	0.483 h	0.005	1.2 x 10^{-10}	5.0 x 10^{-4}	6.5 x 10^{-11}	3.2 x 10^{-11}	1.8 x 10^{-11}	1.2 x 10^{-11}	9.5 x 10^{-12}
Ho-164m	0.625 h	0.005	2.0 x 10^{-10}	5.0 x 10^{-4}	1.1 x 10^{-10}	5.5 x 10^{-11}	3.2 x 10^{-11}	2.1 x 10^{-11}	1.6 x 10^{-11}
Ho-166	1.12 d	0.005	1.6 x 10^{-8}	5.0 x 10^{-4}	1.0 x 10^{-8}	5.2 x 10^{-9}	3.1 x 10^{-9}	1.7 x 10^{-9}	1.4 x 10^{-9}
Ho-166m	1.20 x 10^3 a	0.005	2.6 x 10^{-8}	5.0 x 10^{-4}	9.3 x 10^{-9}	5.3 x 10^{-9}	3.5 x 10^{-9}	2.4 x 10^{-9}	2.0 x 10^{-9}
Ho-167	3.10 h	0.005	8.8 x 10^{-10}	5.0 x 10^{-4}	5.5 x 10^{-10}	2.8 x 10^{-10}	1.7 x 10^{-10}	1.0 x 10^{-10}	8.3 x 10^{-11}
Erbium									
Er-161	3.24 h	0.005	6.5 x 10^{-10}	5.0 x 10^{-4}	4.4 x 10^{-10}	2.4 x 10^{-10}	1.6 x 10^{-10}	1.0 x 10^{-10}	8.0 x 10^{-11}
Er-165	10.4 h	0.005	1.7 x 10^{-10}	5.0 x 10^{-4}	1.1 x 10^{-10}	6.2 x 10^{-11}	3.9 x 10^{-11}	2.4 x 10^{-11}	1.9 x 10^{-11}
Er-169	9.30 d	0.005	4.4 x 10^{-9}	5.0 x 10^{-4}	2.8 x 10^{-9}	1.4 x 10^{-9}	8.2 x 10^{-10}	4.7 x 10^{-10}	3.7 x 10^{-10}
Er-171	7.52 h	0.005	4.0 x 10^{-9}	5.0 x 10^{-4}	2.5 x 10^{-9}	1.3 x 10^{-9}	7.6 x 10^{-10}	4.5 x 10^{-10}	3.6 x 10^{-10}
Er-172	2.05 d	0.005	1.0 x 10^{-8}	5.0 x 10^{-4}	6.8 x 10^{-9}	3.5 x 10^{-9}	2.1 x 10^{-9}	1.3 x 10^{-9}	1.0 x 10^{-9}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Thulium									
Tm-162	0.362 h	0.005	2.9×10^{-10}	5.0×10^{-4}	1.7×10^{-10}	8.7×10^{-11}	5.2×10^{-11}	3.6×10^{-11}	2.9×10^{-11}
Tm-166	7.70 h	0.005	2.1×10^{-9}	5.0×10^{-4}	1.5×10^{-9}	8.3×10^{-10}	5.5×10^{-10}	3.5×10^{-10}	2.8×10^{-10}
Tm-167	9.24 d	0.005	6.0×10^{-9}	5.0×10^{-4}	3.9×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	7.0×10^{-10}	5.6×10^{-10}
Tm-170	129 d	0.005	1.6×10^{-8}	5.0×10^{-4}	9.8×10^{-9}	4.9×10^{-9}	2.9×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Tm-171	1.92 a	0.005	1.5×10^{-9}	5.0×10^{-4}	7.8×10^{-10}	3.9×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
Tm-172	2.65 d	0.005	1.9×10^{-8}	5.0×10^{-4}	1.2×10^{-8}	6.1×10^{-9}	3.7×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Tm-173	8.24 h	0.005	3.3×10^{-9}	5.0×10^{-4}	2.1×10^{-9}	1.1×10^{-9}	6.5×10^{-10}	3.8×10^{-10}	3.1×10^{-10}
Tm-175	0.253 h	0.005	3.1×10^{-10}	5.0×10^{-4}	1.7×10^{-10}	8.6×10^{-11}	5.0×10^{-11}	3.4×10^{-11}	2.7×10^{-11}
Ytterbium									
Yb-162	0.315 h	0.005	2.2×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.9×10^{-11}	4.2×10^{-11}	2.9×10^{-11}	2.3×10^{-11}
Yb-166	2.36 d	0.005	7.7×10^{-9}	5.0×10^{-4}	5.4×10^{-9}	2.9×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.5×10^{-10}
Yb-167	0.292 h	0.005	7.0×10^{-11}	5.0×10^{-4}	4.1×10^{-11}	2.1×10^{-11}	1.2×10^{-11}	8.4×10^{-12}	6.7×10^{-12}
Yb-169	32.0 d	0.005	7.1×10^{-9}	5.0×10^{-4}	4.6×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	7.1×10^{-10}
Yb-175	4.19 d	0.005	5.0×10^{-9}	5.0×10^{-4}	3.2×10^{-9}	1.6×10^{-9}	9.5×10^{-10}	5.4×10^{-10}	4.4×10^{-10}
Yb-177	1.90 h	0.005	1.0×10^{-9}	5.0×10^{-4}	6.8×10^{-10}	3.4×10^{-10}	2.0×10^{-10}	1.1×10^{-10}	8.8×10^{-11}
Yb-178	1.23 h	0.005	1.4×10^{-9}	5.0×10^{-4}	8.4×10^{-10}	4.2×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Lutetium									
Lu-169	1.42 d	0.005	3.5×10^{-9}	5.0×10^{-4}	2.4×10^{-9}	1.4×10^{-9}	8.9×10^{-10}	5.7×10^{-10}	4.6×10^{-10}
Lu-170	2.00 d	0.005	7.4×10^{-9}	5.0×10^{-4}	5.2×10^{-9}	2.9×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.9×10^{-10}
Lu-171	8.22 d	0.005	5.9×10^{-9}	5.0×10^{-4}	4.0×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	8.5×10^{-10}	6.7×10^{-10}
Lu-172	6.70 d	0.005	1.0×10^{-9}	5.0×10^{-4}	7.0×10^{-9}	3.9×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Lu-173	1.37 a	0.005	2.7×10^{-9}	5.0×10^{-4}	1.6×10^{-9}	8.6×10^{-10}	5.3×10^{-10}	3.2×10^{-10}	2.6×10^{-10}
Lu-174	3.31 a	0.005	3.2×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	9.1×10^{-10}	5.6×10^{-10}	3.3×10^{-10}	2.7×10^{-10}

Lu-174m	142 d	0.005	6.2×10^{-9}	5.0×10^{-4}	3.8×10^{-9}	1.9×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.3×10^{-10}
Lu-176	3.60×10^{10} a	0.005	2.4×10^{-8}	5.0×10^{-4}	1.1×10^{-8}	5.7×10^{-9}	3.5×10^{-9}	2.2×10^{-9}	1.8×10^{-9}
Lu-176m	3.68 h	0.005	2.0×10^{-9}	5.0×10^{-4}	1.2×10^{-9}	6.0×10^{-10}	3.5×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Lu-177	6.71 d	0.005	6.1×10^{-9}	5.0×10^{-4}	3.9×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	6.6×10^{-10}	5.3×10^{-10}
Lu-177m	161 d	0.005	1.7×10^{-8}	5.0×10^{-4}	1.1×10^{-8}	5.8×10^{-9}	3.6×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Lu-178	0.473 h	0.005	5.9×10^{-10}	5.0×10^{-4}	3.3×10^{-10}	1.6×10^{-10}	9.0×10^{-11}	6.1×10^{-11}	4.7×10^{-11}
Lu-178m	0.378 h	0.005	4.3×10^{-10}	5.0×10^{-4}	2.4×10^{-10}	1.2×10^{-10}	7.1×10^{-11}	4.9×10^{-11}	3.8×10^{-11}
Lu-179	4.59 h	0.005	2.4×10^{-9}	5.0×10^{-4}	1.5×10^{-9}	7.5×10^{-10}	4.4×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Hafnium									
Hf-170	16.0 h	0.020	3.9×10^{-9}	0.002	2.7×10^{-9}	1.5×10^{-9}	9.5×10^{-10}	6.0×10^{-10}	4.8×10^{-10}
Hf-172	1.87 a	0.020	1.9×10^{-8}	0.002	6.1×10^{-9}	3.3×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	1.0×10^{-9}
Hf-173	24.0 h	0.020	1.9×10^{-9}	0.002	1.3×10^{-9}	7.2×10^{-10}	4.6×10^{-10}	2.8×10^{-10}	2.3×10^{-10}
Hf-175	70.0 d	0.020	3.8×10^{-9}	0.002	2.4×10^{-9}	1.3×10^{-9}	8.4×10^{-10}	5.2×10^{-10}	4.1×10^{-10}
Hf-177m	0.856 h	0.020	7.8×10^{-10}	0.002	4.7×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	8.1×10^{-11}
Hf-178m	31.0 a	0.020	7.0×10^{-8}	0.002	1.9×10^{-8}	1.1×10^{-8}	7.8×10^{-9}	5.5×10^{-9}	4.7×10^{-9}
Hf-179m	25.1 d	0.020	1.2×10^{-8}	0.002	7.8×10^{-9}	4.1×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	1.2×10^{-9}
Hf-180m	5.50 h	0.020	1.4×10^{-9}	0.002	9.7×10^{-10}	5.3×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Hf-181	42.4 d	0.020	1.2×10^{-8}	0.002	7.4×10^{-9}	3.8×10^{-9}	2.3×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Hf-182	9.00×10^{6} a	0.020	5.6×10^{-8}	0.002	7.9×10^{-9}	5.4×10^{-9}	4.0×10^{-9}	3.3×10^{-9}	3.0×10^{-9}
Hf-182m	1.02 h	0.020	4.1×10^{-10}	0.002	2.5×10^{-10}	1.3×10^{-10}	7.8×10^{-11}	5.2×10^{-11}	4.2×10^{-11}
Hf-183	1.07 h	0.020	8.1×10^{-10}	0.002	4.8×10^{-10}	2.4×10^{-10}	1.4×10^{-10}	9.3×10^{-11}	7.3×10^{-11}
Hf-184	4.12 h	0.020	5.5×10^{-9}	0.002	3.6×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.2×10^{-10}
Tantalum									
Ta-172	0.613 h	0.010	5.5×10^{10}	0.001	3.2×10^{-10}	1.6×10^{-10}	9.8×10^{-11}	6.6×10^{-11}	5.3×10^{-11}
Ta-173	3.65 h	0.010	2.0×10^{9}	0.001	1.3×10^{-9}	6.5×10^{-10}	3.9×10^{-10}	2.4×10^{-10}	1.9×10^{-10}
Ta-174	1.20 h	0.010	6.2×10^{10}	0.001	3.7×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	5.7×10^{-11}
Ta-175	10.5 h	0.010	1.6×10^{-9}	0.001	1.1×10^{-9}	6.2×10^{-10}	4.0×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Ta-176	8.08 h	0.010	2.4×10^{-9}	0.001	1.7×10^{-9}	9.2×10^{-10}	6.1×10^{-10}	3.9×10^{-10}	3.1×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Ta-177	2.36 d	0.010	1.0×10^{-9}	0.001	6.9×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
Ta-178	2.20 h	0.010	6.3×10^{-10}	0.001	4.5×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	9.1×10^{-11}	7.2×10^{-11}
Ta-179	1.82 a	0.010	6.2×10^{-10}	0.001	4.1×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	8.1×10^{-11}	6.5×10^{-11}
Ta-180	1.00×10^{13} a	0.010	8.1×10^{-9}	0.001	5.3×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	8.4×10^{-10}
Ta-180m	8.10 h	0.010	5.8×10^{-10}	0.001	3.7×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	6.7×10^{-11}	5.4×10^{-11}
Ta-182	115 d	0.010	1.4×10^{-8}	0.001	9.4×10^{-9}	5.0×10^{-9}	3.1×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
Ta-182m	0.264 h	0.010	1.4×10^{-10}	0.001	7.5×10^{-11}	3.7×10^{-11}	2.1×10^{-11}	1.5×10^{-11}	1.2×10^{-11}
Ta-183	5.10 d	0.010	1.4×10^{-8}	0.001	9.3×10^{-9}	4.7×10^{-9}	2.8×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Ta-184	8.70 h	0.010	6.7×10^{-9}	0.001	4.4×10^{-9}	2.3×10^{-9}	1.4×10^{-9}	8.5×10^{-10}	6.8×10^{-10}
Ta-185	0.816 h	0.010	8.3×10^{-10}	0.001	4.6×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	8.6×10^{-11}	6.8×10^{-11}
Ta-186	0.175 h	0.010	3.8×10^{-10}	0.001	2.1×10^{-10}	1.1×10^{-10}	6.1×10^{-11}	4.2×10^{-11}	3.3×10^{-11}
Tungsten									
W-176	2.30 h	0.600	6.8×10^{-10}	0.300	5.5×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
W-177	2.25 h	0.600	4.4×10^{-10}	0.300	3.2×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	5.8×10^{-11}
W-178	21.7 d	0.600	1.8×10^{-9}	0.300	1.4×10^{-9}	7.3×10^{-10}	4.5×10^{-10}	2.7×10^{-10}	2.2×10^{-10}
W-179	0.625 h	0.600	3.4×10^{-11}	0.300	2.0×10^{-11}	1.0×10^{-11}	6.2×10^{-12}	4.2×10^{-12}	3.3×10^{-12}
W-181	121 d	0.600	6.3×10^{-10}	0.300	4.7×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	9.5×10^{-11}	7.6×10^{-11}
W-185	75.1 d	0.600	4.4×10^{-9}	0.300	3.3×10^{-9}	1.6×10^{-9}	9.7×10^{-10}	5.5×10^{-10}	4.4×10^{-10}
W-187	23.9 h	0.600	5.5×10^{-9}	0.300	4.3×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	7.8×10^{-10}	6.3×10^{-10}
W-188	69.4 d	0.600	2.1×10^{-8}	0.300	1.5×10^{-8}	7.7×10^{-9}	4.6×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
Rhenium									
Re-177	0.233 h	1.000	2.5×10^{-10}	0.800	1.4×10^{-10}	7.2×10^{-11}	4.1×10^{-11}	2.8×10^{-11}	2.2×10^{-11}
Re-178	0.220 h	1.000	2.9×10^{-10}	0.800	1.6×10^{-10}	7.9×10^{-11}	4.6×10^{-11}	3.1×10^{-11}	2.5×10^{-11}
Re-181	20.0 h	1.000	4.2×10^{-9}	0.800	2.8×10^{-9}	1.4×10^{-9}	8.2×10^{-10}	5.4×10^{-10}	4.2×10^{-10}

Re-182	2.67 d	1.000	1.4×10^{-8}	0.800	8.9×10^{-9}	4.7×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.4×10^{-9}
Re-182	12.7 h	1.000	2.4×10^{-9}	0.800	1.7×10^{-9}	8.9×10^{-10}	5.2×10^{-10}	3.5×10^{-10}	2.7×10^{-10}
Re-184	38.0 d	1.000	8.9×10^{-9}	0.800	5.6×10^{-9}	3.0×10^{-9}	1.8×10^{-9}	1.3×10^{-9}	1.0×10^{-9}
Re-184m	165 d	1.000	1.7×10^{-8}	0.800	9.8×10^{-9}	4.9×10^{-9}	2.8×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
Re-186	3.78 d	1.000	1.9×10^{-8}	0.800	1.1×10^{-8}	5.5×10^{-9}	3.0×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
Re-186m	2.00×10^{5} a	1.000	3.0×10^{-8}	0.800	1.6×10^{-8}	7.6×10^{-9}	4.4×10^{-9}	2.8×10^{-9}	2.2×10^{-9}
Re-187	5.00×10^{10} a	1.000	6.8×10^{-11}	0.800	3.8×10^{-11}	1.8×10^{-11}	1.0×10^{-11}	6.6×10^{-12}	5.1×10^{-12}
Re-188	17.0 h	1.000	1.7×10^{-8}	0.800	1.1×10^{-8}	5.4×10^{-9}	2.9×10^{-9}	1.8×10^{-9}	1.4×10^{-9}
Re-188m	0.310 h	1.000	3.8×10^{-10}	0.800	2.3×10^{-10}	1.1×10^{-10}	6.1×10^{-11}	4.0×10^{-11}	3.0×10^{-11}
Re-189	1.01 d	1.000	9.8×10^{-9}	0.800	6.2×10^{-9}	3.0×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	7.8×10^{-10}
Osmium									
Os-180	0.366 h	0.020	1.6×10^{-10}	0.010	9.8×10^{-11}	5.1×10^{-11}	3.2×10^{-11}	2.2×10^{-11}	1.7×10^{-11}
Os-181	1.75 h	0.020	7.6×10^{-10}	0.010	5.0×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.9×10^{-11}
Os-182	22.0 h	0.020	4.6×10^{-9}	0.010	3.2×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	7.0×10^{-10}	5.6×10^{-10}
Os-185	94.0 d	0.020	3.8×10^{-9}	0.010	2.6×10^{-9}	1.5×10^{-9}	9.8×10^{-10}	6.5×10^{-10}	5.1×10^{-10}
Os-189m	6.00 h	0.020	2.1×10^{-10}	0.010	1.3×10^{-10}	6.5×10^{-11}	3.8×10^{-11}	2.2×10^{-11}	1.8×10^{-11}
Os-191	15.4 d	0.020	6.3×10^{-9}	0.010	4.1×10^{-9}	2.1×10^{-9}	1.2×10^{-9}	7.0×10^{-10}	5.7×10^{-10}
Os-191m	13.0 h	0.020	1.1×10^{-9}	0.010	7.1×10^{-10}	3.5×10^{-10}	2.1×10^{-10}	1.2×10^{-10}	9.6×10^{-11}
Os-193	1.25 d	0.020	9.3×10^{-9}	0.010	6.0×10^{-9}	3.0×10^{-9}	1.8×10^{-9}	1.0×10^{-9}	8.1×10^{-10}
Os-194	6.00 a	0.020	2.9×10^{-8}	0.010	1.7×10^{-8}	8.8×10^{-9}	5.2×10^{-9}	3.0×10^{-9}	2.4×10^{-9}
Iridium									
Ir-182	0.250 h	0.020	5.3×10^{-10}	0.010	3.0×10^{-10}	1.5×10^{-10}	8.9×10^{-11}	6.0×10^{-11}	4.8×10^{-11}
Ir-184	3.02 h	0.020	1.5×10^{-9}	0.010	9.7×10^{-10}	5.2×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Ir-185	14.0 h	0.020	2.4×10^{-9}	0.010	1.6×10^{-9}	8.6×10^{-10}	5.3×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
Ir-186	15.8 h	0.020	3.8×10^{-9}	0.010	2.7×10^{-9}	1.5×10^{-9}	9.6×10^{-10}	6.1×10^{-10}	4.9×10^{-10}
Ir-186	1.75 h	0.020	5.8×10^{-10}	0.010	3.6×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.7×10^{-11}	6.1×10^{-11}
Ir-187	10.5 h	0.020	1.1×10^{-9}	0.010	7.3×10^{-10}	3.9×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Ir-188	1.73 d	0.020	4.6×10^{-9}	0.010	3.3×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	7.9×10^{-10}	6.3×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Ir-189	13.3 d	0.020	2.5×10^{-9}	0.010	1.7×10^{-9}	8.6×10^{-10}	5.2×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
Ir-190	12.1 d	0.020	1.0×10^{-8}	0.010	7.1×10^{-9}	3.9×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.2×10^{-9}
Ir-190m	3.10 h	0.020	9.4×10^{-10}	0.010	6.4×10^{-10}	3.5×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Ir-190m	1.20 h	0.020	7.9×10^{-11}	0.010	5.0×10^{-11}	2.6×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	8.0×10^{-12}
Ir-192	74.0 d	0.020	1.3×10^{-8}	0.010	8.7×10^{-9}	4.6×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Ir-192m	2.41×10^{2} a	0.020	2.8×10^{-9}	0.010	1.4×10^{-9}	8.3×10^{-10}	5.5×10^{-10}	3.7×10^{-10}	3.1×10^{-10}
Ir-193m	11.9 d	0.020	3.2×10^{-9}	0.010	2.0×10^{-9}	1.0×10^{-9}	6.0×10^{-10}	3.4×10^{-10}	2.7×10^{-10}
Ir-194	19.1 h	0.020	1.5×10^{-8}	0.010	9.8×10^{-9}	4.9×10^{-9}	2.9×10^{-9}	1.7×10^{-9}	1.3×10^{-9}
Ir-194m	171 d	0.020	1.7×10^{-8}	0.010	1.1×10^{-8}	6.4×10^{-9}	4.1×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
Ir-195	2.50 h	0.020	1.2×10^{-9}	0.010	7.3×10^{-10}	3.6×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
Ir-195m	3.80 h	0.020	2.3×10^{-9}	0.010	1.5×10^{-9}	7.3×10^{-10}	4.3×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Platinum									
Pt-186	2.00 h	0.020	7.8×10^{-10}	0.010	5.3×10^{-10}	2.9×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	9.3×10^{-11}
Pt-188	10.2 d	0.020	6.7×10^{-9}	0.010	4.5×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	9.5×10^{-10}	7.6×10^{-10}
Pt-189	10.9 h	0.020	1.1×10^{-9}	0.010	7.4×10^{-10}	3.9×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Pt-191	2.80 d	0.020	3.1×10^{-9}	0.010	2.1×10^{-9}	1.1×10^{-9}	6.9×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
Pt-193	50.0 a	0.020	3.7×10^{-10}	0.010	2.4×10^{-10}	1.2×10^{-10}	6.9×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
Pt-193m	4.33 d	0.020	5.2×10^{-9}	0.010	3.4×10^{-9}	1.7×10^{-9}	9.9×10^{-10}	5.6×10^{-10}	4.5×10^{-10}
Pt-195m	4.02 d	0.020	7.1×10^{-9}	0.010	4.6×10^{-9}	2.3×10^{-9}	1.4×10^{-9}	7.9×10^{-10}	6.3×10^{-10}
Pt-197	18.3 h	0.020	4.7×10^{-9}	0.010	3.0×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	5.1×10^{-10}	4.0×10^{-10}
Pt-197m	1.57 h	0.020	1.0×10^{-9}	0.010	6.1×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	8.4×10^{-11}
Pt-199	0.513 h	0.020	4.7×10^{-10}	0.010	2.7×10^{-10}	1.3×10^{-10}	7.5×10^{-11}	5.0×10^{-11}	3.9×10^{-11}
Pt-200	12.5 h	0.020	1.4×10^{-8}	0.010	8.8×10^{-9}	4.4×10^{-9}	2.6×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Gold									
Au-193	17.6 h	0.200	1.2×10^{-9}	0.100	8.8×10^{-10}	4.6×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	1.3×10^{-10}

Au-194	1.65 d	0.200	2.9×10^{-9}	0.100	2.2×10^{-9}	1.2×10^{-9}	8.1×10^{-10}	5.3×10^{-10}	4.2×10^{-10}
Au-195	183 d	0.200	2.4×10^{-9}	0.100	1.7×10^{-9}	8.9×10^{-10}	5.4×10^{-10}	3.2×10^{-10}	2.5×10^{-10}
Au-198	2.69 d	0.200	1.0×10^{-8}	0.100	7.2×10^{-9}	3.7×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	1.0×10^{-9}
Au-198m	2.30 d	0.200	1.2×10^{-8}	0.100	8.5×10^{-9}	4.4×10^{-9}	2.7×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Au-199	3.14 d	0.200	4.5×10^{-9}	0.100	3.1×10^{-9}	1.6×10^{-9}	9.5×10^{-10}	5.5×10^{-10}	4.4×10^{-10}
Au-200	0.807 h	0.200	8.3×10^{-10}	0.100	4.7×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	8.7×10^{-10}	6.8×10^{-11}
Au-200m	18.7 h	0.200	9.2×10^{-9}	0.100	6.6×10^{-9}	3.5×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Au-201	0.440 h	0.200	3.1×10^{-10}	0.100	1.7×10^{-10}	8.2×10^{-11}	4.6×10^{-11}	3.1×10^{-11}	2.4×10^{-11}
Mercury									
Hg-193	3.50 h	1.000	3.3×10^{-10}	1.000	1.9×10^{-10}	9.8×10^{-11}	5.8×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
(organic)		0.800	4.7×10^{-10}	0.400	4.4×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	8.3×10^{-10}	6.6×10^{-11}
Hg-193	3.50 h	0.040	8.5×10^{-10}	0.020	5.5×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	8.2×10^{-11}
(inorganic)									
Hg-193m	11.1 h	1.000	1.1×10^{-9}	1.000	6.8×10^{-10}	3.7×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	1.3×10^{-10}
(organic)		0.800	1.6×10^{-9}	0.400	1.8×10^{-9}	9.5×10^{-10}	6.0×10^{-10}	3.7×10^{-10}	3.0×10^{-10}
Hg-193m	11.1 h	0.040	3.6×10^{-9}	0.020	2.4×10^{-9}	1.3×10^{-9}	8.1×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
(inorganic)									
Hg-194	2.60×10^{2} a	1.000	1.3×10^{-7}	1.000	1.2×10^{-7}	8.4×10^{-8}	6.6×10^{-8}	5.5×10^{-8}	5.1×10^{-8}
(organic)		0.800	1.1×10^{-7}	0.400	4.8×10^{-8}	3.5×10^{-8}	2.7×10^{-8}	2.3×10^{-8}	2.1×10^{-8}
Hg-194	2.60×10^{2} a	0.040	7.2×10^{-9}	0.020	3.6×10^{-9}	2.6×10^{-9}	1.9×10^{-9}	1.5×10^{-9}	1.4×10^{-9}
(inorganic)									
Hg-195	9.90 h	1.000	3.0×10^{-10}	1.000	2.0×10^{-10}	1.0×10^{-10}	6.4×10^{-11}	4.2×10^{-11}	3.4×10^{-11}
(organic)		0.800	4.6×10^{-10}	0.400	4.8×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	9.3×10^{-10}	7.5×10^{-11}
Hg-195	9.90 h	0.040	9.5×10^{-10}	0.020	6.3×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.7×10^{-11}
(inorganic)									
Hg-195m	1.73 d	1.000	2.1×10^{-9}	1.000	1.3×10^{-9}	6.8×10^{-10}	4.2×10^{-10}	2.7×10^{-10}	2.2×10^{-10}
(organic)		0.800	2.6×10^{-9}	0.400	2.8×10^{-9}	1.4×10^{-9}	8.7×10^{-10}	5.1×10^{-10}	4.1×10^{-10}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Hg-195m (inorganic)	1.73 d	0.040	5.8×10^{-9}	0.020	3.8×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	7.0×10^{-10}	5.6×10^{-10}
Hg-197	2.67 d	1.000	9.7×10^{-10}	1.000	6.2×10^{-10}	3.1×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	9.9×10^{-10}
(organic)		0.800	1.3×10^{-9}	0.400	1.2×10^{-9}	6.1×10^{-10}	3.7×10^{-10}	2.2×10^{-10}	1.7×10^{-10}
Hg-197 (inorganic)	2.67 d	0.040	2.5×10^{-9}	0.020	1.6×10^{-9}	8.3×10^{-10}	5.0×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
Hg-197m	23.8 h	1.000	1.5×10^{-9}	1.000	9.5×10^{-10}	4.8×10^{-10}	2.9×10^{-10}	1.8×10^{-10}	1.5×10^{-10}
(organic)		0.800	2.2×10^{-9}	0.400	2.5×10^{-9}	1.2×10^{-9}	7.3×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
Hg-197m (inorganic)	23.8 h	0.040	5.2×10^{-9}	0.020	3.4×10^{-9}	1.7×10^{-9}	1.0×10^{-9}	5.9×10^{-10}	4.7×10^{-10}
Hg-199m	0.710 h	1.000	3.4×10^{-10}	1.000	1.9×10^{-10}	9.3×10^{-11}	5.3×10^{-11}	3.6×10^{-11}	2.8×10^{-11}
(organic)		0.800	3.6×10^{-10}	0.400	2.1×10^{-10}	1.0×10^{-10}	5.8×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
Hg-199m (inorganic)	0.710 h	0.040	3.7×10^{-10}	0.020	2.1×10^{-10}	1.0×10^{-10}	5.9×10^{-11}	3.9×10^{-11}	3.1×10^{-11}
Hg-203	46.6 d	1.000	1.5×10^{-8}	1.000	1.1×10^{-8}	5.7×10^{-9}	3.6×10^{-9}	2.3×10^{-9}	1.9×10^{-9}
(organic)		0.800	1.3×10^{-8}	0.400	6.4×10^{-9}	3.4×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Hg-203 (inorganic)	46.6 d	0.040	5.5×10^{-9}	0.020	3.6×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.7×10^{-10}	5.4×10^{-10}
Thallium									
Tl-194	0.550 h	1.000	6.1×10^{-11}	1.000	3.9×10^{-11}	2.2×10^{-11}	1.4×10^{-11}	1.0×10^{-11}	8.1×10^{-12}
Tl-194m	0.546 h	1.000	3.8×10^{-10}	1.000	2.2×10^{-10}	1.2×10^{-10}	7.0×10^{-11}	4.9×10^{-11}	4.0×10^{-11}
Tl-195	1.16 h	1.000	2.3×10^{-10}	1.000	1.4×10^{-10}	7.5×10^{-11}	4.7×10^{-11}	3.3×10^{-11}	2.7×10^{-11}
Tl-197	2.84 h	1.000	2.1×10^{-10}	1.000	1.3×10^{-10}	6.7×10^{-11}	4.2×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
Tl-198	5.30 h	1.000	4.7×10^{-10}	1.000	3.3×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	8.7×10^{-11}	7.3×10^{-11}

Tl-198m	1.87 h	1.000	4.8×10^{-10}	1.000	3.0×10^{-10}	1.6×10^{-10}	9.7×10^{-11}	6.7×10^{-11}	5.4×10^{-11}
Tl-199	7.42 h	1.000	2.3×10^{-10}	1.000	1.5×10^{-10}	7.7×10^{-11}	4.8×10^{-11}	3.2×10^{-11}	2.6×10^{-11}
Tl-200	1.09 d	1.000	1.3×10^{-9}	1.000	9.1×10^{-10}	5.3×10^{-10}	3.5×10^{-10}	2.4×10^{-10}	2.0×10^{-10}
Tl-201	3.04 d	1.000	8.4×10^{-10}	1.000	5.5×10^{-10}	2.9×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	9.5×10^{-11}
Tl-202	12.2 d	1.000	2.9×10^{-9}	1.000	2.1×10^{-9}	1.2×10^{-9}	7.9×10^{-10}	5.4×10^{-10}	4.5×10^{-10}
Tl-204	3.78 a	1.000	1.3×10^{-8}	1.000	8.5×10^{-9}	4.2×10^{-9}	2.5×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Lead [a]									
Pb-195m	0.263 h	0.600	2.6×10^{-10}	0.200	1.6×10^{-10}	8.4×10^{-11}	5.2×10^{-11}	3.5×10^{-11}	2.9×10^{-11}
Pb-198	2.40 h	0.600	5.9×10^{-10}	0.200	4.8×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	1.0×10^{-10}
Pb-199	1.50 h	0.600	3.5×10^{-10}	0.200	2.6×10^{-10}	1.5×10^{-10}	9.4×10^{-11}	6.3×10^{-11}	5.4×10^{-11}
Pb-200	21.5 h	0.600	2.5×10^{-9}	0.200	2.0×10^{-9}	1.1×10^{-9}	7.0×10^{-10}	4.4×10^{-10}	4.0×10^{-10}
Pb-201	9.40 h	0.600	9.4×10^{-10}	0.200	7.8×10^{-10}	4.3×10^{-10}	2.7×10^{-10}	1.8×10^{-10}	1.6×10^{-10}
Pb-202	3.00×10^{5} a	0.600	3.4×10^{-8}	0.200	1.6×10^{-8}	1.3×10^{-8}	1.9×10^{-8}	2.7×10^{-8}	8.8×10^{-9}
Pb-202m	3.62 h	0.600	7.6×10^{-10}	0.200	6.1×10^{-10}	3.5×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	1.3×10^{-10}
Pb-203	2.17 d	0.600	1.6×10^{-9}	0.200	1.3×10^{-9}	6.8×10^{-10}	4.3×10^{-10}	2.7×10^{-10}	2.4×10^{-10}
Pb-205	1.43×10^{7} a	0.600	2.1×10^{-9}	0.200	9.9×10^{-10}	6.2×10^{-10}	6.1×10^{-10}	6.5×10^{-10}	2.8×10^{-10}
Pb-209	3.25 h	0.600	5.7×10^{-10}	0.200	3.8×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	5.7×10^{-11}
Pb-210	22.3 a	0.600	8.4×10^{-6}	0.200	3.6×10^{-6}	2.2×10^{-6}	1.9×10^{-6}	1.9×10^{-6}	6.9×10^{-7}
Pb-211	0.601 h	0.600	3.1×10^{-9}	0.200	1.4×10^{-9}	7.1×10^{-10}	4.1×10^{-10}	2.7×10^{-10}	1.8×10^{-10}
Pb-212	10.6 h	0.600	1.5×10^{-7}	0.200	6.3×10^{-8}	3.3×10^{-8}	2.0×10^{-8}	1.3×10^{-8}	6.0×10^{-9}
Pb-214	0.447 h	0.600	2.7×10^{-9}	0.200	1.0×10^{-9}	5.2×10^{-10}	3.1×10^{-10}	2.0×10^{-10}	1.4×10^{-10}
Bismuth									
Bi-200	0.606 h	0.100	4.2×10^{-10}	0.050	2.7×10^{-10}	1.5×10^{-10}	9.5×10^{-11}	6.4×10^{-11}	5.1×10^{-11}
Bi-201	1.80 h	0.100	1.0×10^{-9}	0.050	6.7×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
Bi-202	1.67 h	0.100	6.4×10^{-10}	0.050	4.4×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.9×10^{-11}
Bi-203	11.8 h	0.100	3.5×10^{-9}	0.050	2.5×10^{-9}	1.4×10^{-9}	9.3×10^{-10}	6.0×10^{-10}	4.8×10^{-10}
Bi-205	15.3 d	0.100	6.1×10^{-9}	0.050	4.5×10^{-9}	2.6×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	9.0×10^{-10}

[a] The f_1 value for lead for 1 to 15 years old is 0.4

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Bi-206	6.24 d	0.100	1.4×10^{-8}	0.050	1.0×10^{-8}	5.7×10^{-9}	3.7×10^{-9}	2.4×10^{-9}	1.9×10^{-9}
Bi-207	38.0 a	0.100	1.0×10^{-8}	0.050	7.1×10^{-9}	3.9×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Bi-210	5.01 d	0.100	1.5×10^{-8}	0.050	9.7×10^{-9}	4.8×10^{-9}	2.9×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Bi-210m	3.00×10^{6} a	0.100	2.1×10^{-7}	0.050	9.1×10^{-8}	4.7×10^{-8}	3.0×10^{-8}	1.9×10^{-8}	1.5×10^{-8}
Bi-212	1.01 h	0.100	3.2×10^{-9}	0.050	1.8×10^{-9}	8.7×10^{-10}	5.0×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
Bi-213	0.761 h	0.100	2.5×10^{-9}	0.050	1.4×10^{-9}	6.7×10^{-10}	3.9×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
Bi-214	0.332 h	0.100	1.4×10^{-9}	0.050	7.4×10^{-10}	3.6×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Polonium									
Po-203	0.612 h	1.000	2.9×10^{-10}	0.050	2.4×10^{-10}	1.3×10^{-10}	8.5×10^{-11}	5.8×10^{-11}	4.6×10^{-11}
Po-205	1.80 h	1.000	3.5×10^{-10}	0.050	2.8×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	5.8×10^{-11}
Po-207	5.83 h	1.000	4.4×10^{-10}	0.050	5.7×10^{-10}	3.2×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Po-210	138 d	1.000	2.6×10^{-5}	0.050	8.8×10^{-6}	4.4×10^{-6}	2.6×10^{-6}	1.6×10^{-6}	1.2×10^{-6}
Astatine									
At-207	1.80 h	1.000	2.5×10^{-9}	1.000	1.6×10^{-9}	8.0×10^{-10}	4.8×10^{-10}	2.9×10^{-10}	2.4×10^{-10}
At-211	7.21 h	1.000	1.2×10^{-7}	1.000	7.8×10^{-8}	3.8×10^{-8}	2.3×10^{-8}	1.3×10^{-8}	1.1×10^{-8}
Francium									
Fr-222	0.240 h	1.000	6.2×10^{-9}	1.000	3.9×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	8.5×10^{-10}	7.2×10^{-10}
Fr-223	0.363 h	1.000	2.6×10^{-8}	1.000	1.7×10^{-8}	8.3×10^{-9}	5.0×10^{-9}	2.9×10^{-9}	2.4×10^{-9}
Radium [a]									
Ra-223	11.4 d	0.600	5.3×10^{-6}	0.200	1.1×10^{-6}	5.7×10^{-7}	4.5×10^{-7}	3.7×10^{-7}	1.0×10^{-7}
Ra-224	3.66 d	0.600	2.7×10^{-6}	0.200	6.6×10^{-7}	3.5×10^{-7}	2.6×10^{-7}	2.0×10^{-7}	6.5×10^{-8}
Ra-225	14.8 d	0.600	7.1×10^{-6}	0.200	1.2×10^{-6}	6.1×10^{-7}	5.0×10^{-7}	4.4×10^{-7}	9.9×10^{-8}
Ra-226	1.60×10^{3} a	0.600	4.7×10^{-6}	0.200	9.6×10^{-7}	6.2×10^{-7}	8.0×10^{-7}	1.5×10^{-6}	2.8×10^{-7}
Ra-227	0.703 h	0.600	1.1×10^{-9}	0.200	4.3×10^{-10}	2.5×10^{-10}	1.7×10^{-10}	1.3×10^{-10}	8.1×10^{-11}
Ra-228	5.75 a	0.600	3.0×10^{-5}	0.200	5.7×10^{-6}	3.4×10^{-6}	3.9×10^{-6}	5.3×10^{-6}	6.9×10^{-7}

Actinium									
Ac-224	2.90 h	0.005	1.0×10^{-8}	5.0×10^{-4}	5.2×10^{-9}	2.6×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	7.0×10^{-10}
Ac-225	10.0 d	0.005	4.6×10^{-7}	5.0×10^{-4}	1.8×10^{-7}	9.1×10^{-8}	5.4×10^{-8}	3.0×10^{-8}	2.4×10^{-8}
Ac-226	1.21 d	0.005	1.4×10^{-7}	5.0×10^{-4}	7.6×10^{-8}	3.8×10^{-8}	2.3×10^{-8}	1.3×10^{-8}	1.0×10^{-8}
Ac-227	21.8 a	0.005	3.3×10^{-5}	5.0×10^{-4}	3.1×10^{-6}	2.2×10^{-6}	1.5×10^{-6}	1.2×10^{-6}	1.1×10^{-6}
Ac-228	6.13 h	0.005	7.4×10^{-9}	5.0×10^{-4}	2.8×10^{-9}	1.4×10^{-9}	8.7×10^{-10}	5.3×10^{-10}	4.3×10^{-10}
Thorium									
Th-226	0.515 h	0.005	4.4×10^{-9}	5.0×10^{-4}	2.4×10^{-9}	1.2×10^{-9}	6.7×10^{-10}	4.5×10^{-10}	3.5×10^{-10}
Th-227	18.7 d	0.005	3.0×10^{-7}	5.0×10^{-4}	7.0×10^{-8}	3.6×10^{-8}	2.3×10^{-8}	1.5×10^{-8}	8.8×10^{-9}
Th-228	1.91 a	0.005	3.7×10^{-6}	5.0×10^{-4}	3.7×10^{-7}	2.2×10^{-7}	1.5×10^{-7}	9.4×10^{-8}	7.2×10^{-8}
Th-229	7.34×10^{3} a	0.005	1.1×10^{-5}	5.0×10^{-4}	1.0×10^{-6}	7.8×10^{-7}	6.2×10^{-7}	5.3×10^{-7}	4.9×10^{-7}
Th-230	7.70×10^{4} a	0.005	4.1×10^{-6}	5.0×10^{-4}	4.1×10^{-7}	3.1×10^{-7}	2.4×10^{-7}	2.2×10^{-7}	2.1×10^{-7}
Th-231	1.06 d	0.005	3.9×10^{-9}	5.0×10^{-4}	2.5×10^{-9}	1.2×10^{-9}	7.4×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
Th-232	1.40×10^{10} a	0.005	4.6×10^{-6}	5.0×10^{-4}	4.5×10^{-7}	3.5×10^{-7}	2.9×10^{-7}	2.5×10^{-7}	2.3×10^{-7}
Th-234	24.1 d	0.005	4.0×10^{-8}	5.0×10^{-4}	2.5×10^{-8}	1.3×10^{-8}	7.4×10^{-9}	4.2×10^{-9}	3.4×10^{-9}
Protactinium									
Pa-227	0.638 h	0.005	5.8×10^{-9}	5.0×10^{-4}	3.2×10^{-9}	1.5×10^{-9}	8.7×10^{-10}	5.8×10^{-10}	4.5×10^{-10}
Pa-228	22.0 h	0.005	1.2×10^{-8}	5.0×10^{-4}	4.8×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	9.7×10^{-10}	7.8×10^{-10}
Pa-230	17.4 d	0.005	2.6×10^{-8}	5.0×10^{-4}	5.7×10^{-9}	3.1×10^{-9}	1.9×10^{-9}	1.1×10^{-9}	9.2×10^{-10}
Pa-231	3.27×10^{4} a	0.005	1.3×10^{-5}	5.0×10^{-4}	1.3×10^{-6}	1.1×10^{-6}	9.2×10^{-7}	8.0×10^{-7}	7.1×10^{-7}
Pa-232	1.31 d	0.005	6.3×10^{-9}	5.0×10^{-4}	4.2×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	8.9×10^{-10}	7.2×10^{-10}
Pa-233	27.0 d	0.005	9.7×10^{-9}	5.0×10^{-4}	6.2×10^{-9}	3.2×10^{-9}	1.9×10^{-9}	1.1×10^{-9}	8.7×10^{-10}
Pa-234	6.70 h	0.005	5.0×10^{-9}	5.0×10^{-4}	3.2×10^{-9}	1.7×10^{-9}	1.0×10^{-9}	6.4×10^{-10}	5.1×10^{-10}
Uranium									
U-230	20.8 d	0.040	7.9×10^{-7}	0.020	3.0×10^{-7}	1.5×10^{-7}	1.0×10^{-7}	6.6×10^{-8}	5.6×10^{-8}
U-231	4.20 d	0.040	3.1×10^{-9}	0.020	2.0×10^{-9}	1.0×10^{-9}	6.1×10^{-10}	3.5×10^{-10}	2.8×10^{-10}
U-232	72.0 a	0.040	2.5×10^{-6}	0.020	8.2×10^{-7}	5.8×10^{-7}	5.7×10^{-7}	6.4×10^{-7}	3.3×10^{-7}
U-233	1.58×10^{5} a	0.040	3.8×10^{-7}	0.020	1.4×10^{-7}	9.2×10^{-8}	7.8×10^{-8}	7.8×10^{-8}	5.1×10^{-8}

[a] The f_1 value for radium for 1 to 15 years old is 0.3

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
U-234	2.44 x 10^5 a	0.040	3.7 x 10^{-7}	0.020	1.3 x 10^{-7}	8.8 x 10^{-8}	7.4 x 10^{-8}	7.4 x 10^{-8}	4.9 x 10^{-8}
U-235	7.04 x 10^8 a	0.040	3.5 x 10^{-7}	0.020	1.3 x 10^{-7}	8.5 x 10^{-8}	7.1 x 10^{-8}	7.0 x 10^{-8}	4.7 x 10^{-8}
U-236	2.34 x 10^7 a	0.040	3.5 x 10^{-7}	0.020	1.3 x 10^{-7}	8.4 x 10^{-8}	7.0 x 10^{-8}	7.0 x 10^{-8}	4.7 x 10^{-8}
U-237	6.75 d	0.040	8.3 x 10^{-9}	0.020	5.4 x 10^{-9}	2.8 x 10^{-9}	1.6 x 10^{-9}	9.5 x 10^{-10}	7.6 x 10^{-10}
U-238	4.47 x 10^9 a	0.040	3.4 x 10^{-7}	0.020	1.2 x 10^{-7}	8.0 x 10^{-8}	6.8 x 10^{-8}	6.7 x 10^{-8}	4.5 x 10^{-8}
U-239	0.392 h	0.040	3.4 x 10^{-10}	0.020	1.9 x 10^{-10}	9.3 x 10^{-11}	5.4 x 10^{-11}	3.5 x 10^{-11}	2.7 x 10^{-11}
U-240	14.1 h	0.040	1.3 x 10^{-8}	0.020	8.1 x 10^{-9}	4.1 x 10^{-9}	2.4 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Neptunium									
Np-232	0.245 h	0.005	8.7 x 10^{-11}	5.0 x 10^{-4}	5.1 x 10^{-11}	2.7 x 10^{-11}	1.7 x 10^{-11}	1.2 x 10^{-11}	9.7 x 10^{-12}
Np-233	0.603 h	0.005	2.1 x 10^{-11}	5.0 x 10^{-4}	1.3 x 10^{-11}	6.6 x 10^{-12}	4.0 x 10^{-12}	2.8 x 10^{-12}	2.2 x 10^{-12}
Np-234	4.40 d	0.005	6.2 x 10^{-9}	5.0 x 10^{-4}	4.4 x 10^{-9}	2.4 x 10^{-9}	1.6 x 10^{-9}	1.0 x 10^{-9}	8.1 x 10^{-10}
Np-235	1.08 a	0.005	7.1 x 10^{-10}	5.0 x 10^{-4}	4.1 x 10^{-10}	2.0 x 10^{-10}	1.2 x 10^{-10}	6.8 x 10^{-11}	5.3 x 10^{-11}
Np-236	1.15 x 10^5 a	0.005	1.9 x 10^{-7}	5.0 x 10^{-4}	2.4 x 10^{-8}	1.8 x 10^{-8}	1.8 x 10^{-8}	1.8 x 10^{-8}	1.7 x 10^{-8}
Np-236	22.5 h	0.005	2.5 x 10^{-9}	5.0 x 10^{-4}	1.3 x 10^{-9}	6.6 x 10^{-10}	4.0 x 10^{-10}	2.4 x 10^{-10}	1.9 x 10^{-10}
Np-237	2.14 x 10^6 a	0.005	2.0 x 10^{-6}	5.0 x 10^{-4}	2.1 x 10^{-7}	1.4 x 10^{-7}	1.1 x 10^{-7}	1.1 x 10^{-7}	1.1 x 10^{-7}
Np-238	2.12 d	0.005	9.5 x 10^{-9}	5.0 x 10^{-4}	6.2 x 10^{-9}	3.2 x 10^{-9}	1.9 x 10^{-9}	1.1 x 10^{-9}	9.1 x 10^{-10}
Np-239	2.36 d	0.005	8.9 x 10^{-9}	5.0 x 10^{-4}	5.7 x 10^{-9}	2.9 x 10^{-9}	1.7 x 10^{-9}	1.0 x 10^{-9}	8.0 x 10^{-10}
Np-240	1.08 h	0.005	8.7 x 10^{-10}	5.0 x 10^{-4}	5.2 x 10^{-10}	2.6 x 10^{-10}	1.6 x 10^{-10}	1.0 x 10^{-10}	8.2 x 10^{-11}
Plutonium									
Pu-234	8.80 h	0.005	2.1 x 10^{-9}	5.0 x 10^{-4}	1.1 x 10^{-9}	5.5 x 10^{-10}	3.3 x 10^{-10}	2.0 x 10^{-10}	1.6 x 10^{-10}
Pu-235	0.422 h	0.005	2.2 x 10^{-11}	5.0 x 10^{-4}	1.3 x 10^{-11}	6.5 x 10^{-12}	3.9 x 10^{-12}	2.7 x 10^{-12}	2.1 x 10^{-12}
Pu-236	2.85 a	0.005	2.1 x 10^{-6}	5.0 x 10^{-4}	2.2 x 10^{-7}	1.4 x 10^{-7}	1.0 x 10^{-7}	8 5 x 10^{-8}	8.7 x 10^{-8}
Pu-237	45.3 d	0.005	1.1 x 10^{-9}	5.0 x 10^{-4}	6.9 x 10^{-10}	3.6 x 10^{-10}	2.2 x 10^{-10}	1 3 x 10^{-10}	1.0 x 10^{-10}
Pu-238	87.7 a	0.005	4.0 x 10^{-6}	5.0 x 10^{-4}	4.0 x 10^{-7}	3.1 x 10^{-7}	2.4 x 10^{-7}	2.2 x 10^{-7}	2.3 x 10^{-7}

Pu-239	2.41×10^{4} a	0.005	4.2×10^{-6}	5.0×10^{-4}	4.2×10^{-7}	3.3×10^{-7}	2.7×10^{-7}	2.4×10^{-7}	2.5×10^{-7}
Pu-240	6.54×10^{3} a	0.005	4.2×10^{-6}	5.0×10^{-4}	4.2×10^{-7}	3.3×10^{-7}	2.7×10^{-7}	2.4×10^{-7}	2.5×10^{-7}
Pu-241	14.4 a	0.005	5.6×10^{-8}	5.0×10^{-4}	5.7×10^{-9}	5.5×10^{-9}	5.1×10^{-9}	4.8×10^{-9}	4.8×10^{-9}
Pu-242	3.76×10^{5} a	0.005	4.0×10^{-6}	5.0×10^{-4}	4.0×10^{-7}	3.2×10^{-7}	2.6×10^{-7}	2.3×10^{-7}	2.4×10^{-7}
Pu-243	4.95 h	0.005	1.0×10^{-9}	5.0×10^{-4}	6.2×10^{-10}	3.1×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	8.5×10^{-11}
Pu-244	8.26×10^{7} a	0.005	4.0×10^{-6}	5.0×10^{-4}	4.1×10^{-7}	3.2×10^{-7}	2.6×10^{-7}	2.3×10^{-7}	2.4×10^{-7}
Pu-245	10.5 h	0.005	8.0×10^{-9}	5.0×10^{-4}	5.1×10^{-9}	2.6×10^{-9}	1.5×10^{-9}	8.9×10^{-10}	7.2×10^{-10}
Pu-246	10.9 d	0.005	3.6×10^{-8}	5.0×10^{-4}	2.3×10^{-8}	1.2×10^{-8}	7.1×10^{-9}	4.1×10^{-9}	3.3×10^{-9}
Americium									
Am-237	1.22 h	0.005	1.7×10^{-10}	5.0×10^{-4}	1.0×10^{-10}	5.5×10^{-11}	3.3×10^{-11}	2.2×10^{-11}	1.8×10^{-11}
Am-238	1.63 h	0.005	2.5×10^{-10}	5.0×10^{-4}	1.6×10^{-10}	9.1×10^{-11}	5.9×10^{-11}	4.0×10^{-11}	3.2×10^{-11}
Am-239	11.9 h	0.005	2.6×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	8.4×10^{-10}	5.1×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
Am-240	2.12 d	0.005	4.7×10^{-9}	5.0×10^{-4}	3.3×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	7.3×10^{-10}	5.8×10^{-10}
Am-241	4.32×10^{2} a	0.005	3.7×10^{-6}	5.0×10^{-4}	3.7×10^{-7}	2.7×10^{-7}	2.2×10^{-7}	2.0×10^{-7}	2.0×10^{-7}
Am-242	16.0 h	0.005	5.0×10^{-9}	5.0×10^{-4}	2.2×10^{-9}	1.1×10^{-9}	6.4×10^{-10}	3.7×10^{-10}	3.0×10^{-10}
Am-242m	1.52×10^{2} a	0.005	3.1×10^{-6}	5.0×10^{-4}	3.0×10^{-7}	2.3×10^{-7}	2.0×10^{-7}	1.9×10^{-7}	1.9×10^{-7}
Am-243	7.38×10^{3} a	0.005	3.6×10^{-6}	5.0×10^{-4}	3.7×10^{-7}	2.7×10^{-7}	2.2×10^{-7}	2.0×10^{-7}	2.0×10^{-7}
Am-244	10.1 h	0.005	4.9×10^{-9}	5.0×10^{-4}	3.1×10^{-9}	1.6×10^{-9}	9.6×10^{-10}	5.8×10^{-10}	4.6×10^{-10}
Am-244m	0.433 h	0.005	3.7×10^{-10}	5.0×10^{-4}	2.0×10^{-10}	9.6×10^{-11}	5.5×10^{-11}	3.7×10^{-11}	2.9×10^{-11}
Am-245	2.05 h	0.005	6.8×10^{-10}	5.0×10^{-4}	4.5×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	7.9×10^{-11}	6.2×10^{-11}
Am-246	0.650 h	0.005	6.7×10^{-10}	5.0×10^{-4}	3.8×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	7.3×10^{-11}	5.8×10^{-11}
Am-246m	0.417 h	0.005	3.9×10^{-10}	5.0×10^{-4}	2.2×10^{-10}	1.1×10^{-10}	6.4×10^{-11}	4.4×10^{-11}	3.4×10^{-11}
Curium									
Cm-238	2.40 h	0.005	7.8×10^{-10}	5.0×10^{-4}	4.9×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	8.0×10^{-11}
Cm-240	27.0 d	0.005	2.2×10^{-7}	5.0×10^{-4}	4.8×10^{-8}	2.5×10^{-8}	1.5×10^{-8}	9.2×10^{-9}	7.6×10^{-9}
Cm-241	32.8 d	0.005	1.1×10^{-8}	5.0×10^{-4}	5.7×10^{-9}	3.0×10^{-9}	1.9×10^{-9}	1.1×10^{-9}	9.1×10^{-10}
Cm-242	163 d	0.005	5.9×10^{-7}	5.0×10^{-4}	7.6×10^{-8}	3.9×10^{-8}	2.4×10^{-8}	1.5×10^{-8}	1.2×10^{-8}

Nuclide	*Physical half-life*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
		f_1	*e(g)*						
Cm-243	28.5 a	0.005	3.2×10^{-6}	5.0×10^{-4}	3.3×10^{-7}	2.2×10^{-7}	1.6×10^{-7}	1.4×10^{-7}	1.5×10^{-7}
Cm-244	18.1 a	0.005	2.9×10^{-6}	5.0×10^{-4}	2.9×10^{-7}	1.9×10^{-7}	1.4×10^{-7}	1.2×10^{-7}	1.2×10^{-7}
Cm-245	8.50×10^{3} a	0.005	3.7×10^{-6}	5.0×10^{-4}	3.7×10^{-7}	2.8×10^{-7}	2.3×10^{-7}	2.1×10^{-7}	2.1×10^{-7}
Cm-246	4.73×10^{3} a	0.005	3.7×10^{-6}	5.0×10^{-4}	3.7×10^{-7}	2.8×10^{-7}	2.2×10^{-7}	2.1×10^{-7}	2.1×10^{-7}
Cm-247	1.56×10^{7} a	0.005	3.4×10^{-6}	5.0×10^{-4}	3.5×10^{-7}	2.6×10^{-7}	2.1×10^{-7}	1.9×10^{-7}	1.9×10^{-7}
Cm-248	3.39×10^{5} a	0.005	1.4×10^{-5}	5.0×10^{-4}	1.4×10^{-6}	1.0×10^{-6}	8.4×10^{-7}	7.7×10^{-7}	7.7×10^{-7}
Cm-249	1.07 h	0.005	3.9×10^{-10}	5.0×10^{-4}	2.2×10^{-10}	1.1×10^{-10}	6.1×10^{-11}	4.0×10^{-11}	3.1×10^{-11}
Cm-250	6.90×10^{3} a	0.005	7.8×10^{-5}	5.0×10^{-4}	8.2×10^{-6}	6.0×10^{-6}	4.9×10^{-6}	4.4×10^{-6}	4.4×10^{-6}
Berkelium									
Bk-245	4.94 d	0.005	6.1×10^{-9}	5.0×10^{-4}	3.9×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	7.2×10^{-10}	5.7×10^{-10}
Bk-246	1.83 d	0.005	3.7×10^{-9}	5.0×10^{-4}	2.6×10^{-9}	1.4×10^{-9}	9.4×10^{-10}	6.0×10^{-10}	4.8×10^{-10}
Bk-247	1.38×10^{3} a	0.005	8.9×10^{-6}	5.0×10^{-4}	8.6×10^{-7}	6.3×10^{-7}	4.6×10^{-7}	3.8×10^{-7}	3.5×10^{-7}
Bk-249	320 d	0.005	2.2×10^{-8}	5.0×10^{-4}	2.9×10^{-9}	1.9×10^{-9}	1.4×10^{-9}	1.1×10^{-9}	9.7×10^{-10}
Bk-250	3.22 h	0.005	1.5×10^{-9}	5.0×10^{-4}	8.5×10^{-10}	4.4×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
Californium									
Cf-244	0.323 h	0.005	9.8×10^{-10}	5.0×10^{-4}	4.8×10^{-10}	2.4×10^{-10}	1.3×10^{-10}	8.9×10^{-11}	7.0×10^{-11}
Cf-246	1.49 d	0.005	5.0×10^{-8}	5.0×10^{-4}	2.4×10^{-8}	1.2×10^{-8}	7.3×10^{-9}	4.1×10^{-9}	3.3×10^{-9}
Cf-248	334 d	0.005	1.5×10^{-6}	5.0×10^{-4}	1.6×10^{-7}	9.9×10^{-8}	6.0×10^{-8}	3.3×10^{-8}	2.8×10^{-8}
Cf-249	3.50×10^{2} a	0.005	9.0×10^{-6}	5.0×10^{-4}	8.7×10^{-7}	6.4×10^{-7}	4.7×10^{-7}	3.8×10^{-7}	3.5×10^{-7}
Cf-250	13.1 a	0.005	5.7×10^{-6}	5.0×10^{-4}	5.5×10^{-7}	3.7×10^{-7}	2.3×10^{-7}	1.7×10^{-7}	1.6×10^{-7}
Cf-251	8.98×10^{2} a	0.005	9.1×10^{-6}	5.0×10^{-4}	8.8×10^{-7}	6.5×10^{-7}	4.7×10^{-7}	3.9×10^{-7}	3.6×10^{-7}
Cf-252	2.64 a	0.005	5.0×10^{-6}	5.0×10^{-4}	5.1×10^{-7}	3.2×10^{-7}	1.9×10^{-7}	1.0×10^{-7}	9.0×10^{-8}
Cf-253	17.8 d	0.005	1.0×10^{-7}	5.0×10^{-4}	1.1×10^{-8}	6.0×10^{-9}	3.7×10^{-9}	1.8×10^{-9}	1.4×10^{-9}
Cf-254	60.5 d	0.005	1.1×10^{-5}	5.0×10^{-4}	2.6×10^{-6}	1.4×10^{-6}	8.4×10^{-7}	5.0×10^{-7}	4.0×10^{-7}

Einsteinium									
Es-250	2.10 h	0.005	2.3×10^{-10}	5.0×10^{-4}	9.9×10^{-11}	5.7×10^{-11}	3.7×10^{-11}	2.6×10^{-11}	2.1×10^{-11}
Es-251	1.38 d	0.005	1.9×10^{-9}	5.0×10^{-4}	1.2×10^{-9}	6.1×10^{-10}	3.7×10^{-10}	2.2×10^{-10}	1.7×10^{-10}
Es-253	20.5 d	0.005	1.7×10^{-7}	5.0×10^{-4}	4.5×10^{-8}	2.3×10^{-8}	1.4×10^{-8}	7.6×10^{-9}	6.1×10^{-9}
Es-254	276 d	0.005	1.4×10^{-6}	5.0×10^{-4}	1.6×10^{-7}	9.8×10^{-8}	6.0×10^{-8}	3.3×10^{-8}	2.8×10^{-8}
Es-254m	1.64 d	0.005	5.7×10^{-8}	5.0×10^{-4}	3.0×10^{-8}	1.5×10^{-8}	9.1×10^{-9}	5.2×10^{-9}	4.2×10^{-9}
Fermium									
Fm-252	22.7 h	0.005	3.8×10^{-8}	5.0×10^{-4}	2.0×10^{-8}	9.9×10^{-9}	5.9×10^{-9}	3.3×10^{-9}	2.7×10^{-9}
Fm-253	3.00 d	0.005	2.5×10^{-8}	5.0×10^{-4}	6.7×10^{-9}	3.4×10^{-9}	2.1×10^{-9}	1.1×10^{-9}	9.1×10^{-10}
Fm-254	3.24 h	0.005	5.6×10^{-9}	5.0×10^{-4}	3.2×10^{-9}	1.6×10^{-9}	9.3×10^{-10}	5.6×10^{-10}	4.4×10^{-10}
Fm-255	20.1 h	0.005	3.3×10^{-8}	5.0×10^{-4}	1.9×10^{-8}	9.5×10^{-9}	5.6×10^{-9}	3.2×10^{-9}	2.5×10^{-9}
Fm-257	101 d	0.005	9.8×10^{-7}	5.0×10^{-4}	1.1×10^{-7}	6.5×10^{-8}	4.0×10^{-8}	1.9×10^{-8}	1.5×10^{-8}
Mendelevium									
Md-257	5.20 h	0.005	3.1×10^{-9}	5.0×10^{-4}	8.8×10^{-10}	4.5×10^{-10}	2.7×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Md-258	55.0 d	0.005	6.3×10^{-7}	5.0×10^{-4}	8.9×10^{-8}	5.0×10^{-8}	3.0×10^{-8}	1.6×10^{-8}	1.3×10^{-8}

Table VII

COMMITTED EFFECTIVE DOSE PER UNIT INTAKE [e(g)]
THROUGH INHALATION ($Sv.Bq^{-1}$)—FOR MEMBERS OF THE PUBLIC

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Hydrogen										
Tritiated	12.3 a	F	1.000	2.6×10^{-11}	1.000	2.0×10^{-11}	1.1×10^{-11}	8.2×10^{-12}	5.9×10^{-12}	6.2×10^{-12}
Water		M	0.200	3.4×10^{-10}	0.100	2.7×10^{-10}	1.4×10^{-10}	8.2×10^{-11}	5.3×10^{-11}	4.5×10^{-11}
		S	0.020	1.2×10^{-9}	0.010	1.0×10^{-9}	6.3×10^{-10}	3.8×10^{-10}	2.8×10^{-10}	2.6×10^{-10}
Beryllium										
Be-7	53.3 d	M	0.020	2.5×10^{-10}	0.005	1.2×10^{-10}	1.2×10^{-10}	8.3×10^{-11}	6.2×10^{-11}	5.0×10^{-11}
		S	0.020	2.8×10^{-10}	0.005	2.4×10^{-10}	1.4×10^{-10}	9.6×10^{-11}	6.8×10^{-11}	5.5×10^{-11}
Be-10	1.60×10^{6} a	M	0.020	4.1×10^{-8}	0.005	3.4×10^{-8}	2.0×10^{-8}	1.3×10^{-8}	1.1×10^{-8}	9.6×10^{-9}
		S	0.020	9.9×10^{-8}	0.005	9.1×10^{-8}	6.1×10^{-8}	4.2×10^{-8}	3.7×10^{-8}	3.5×10^{-8}
Carbon										
C-11	0.340 h	F	1.000	1.0×10^{-10}	1.000	7.0×10^{-11}	3.2×10^{-11}	2.1×10^{-11}	1.3×10^{-11}	1.1×10^{-11}
		M	0.200	1.5×10^{-10}	0.100	1.1×10^{-10}	4.9×10^{-11}	3.2×10^{-11}	2.1×10^{-11}	1.8×10^{-11}
		S	0.020	1.6×10^{-10}	0.010	1.1×10^{-10}	5.1×10^{-11}	3.3×10^{-11}	2.2×10^{-11}	1.8×10^{-11}
C-14	5.73×10^{3} a	F	1.000	6.1×10^{-10}	1.000	6.7×10^{-10}	3.6×10^{-10}	2.9×10^{-10}	1.9×10^{-10}	2.0×10^{-10}
		M	0.200	8.3×10^{-9}	0.100	6.6×10^{-9}	4.0×10^{-9}	2.8×10^{-9}	2.5×10^{-9}	2.0×10^{-9}
		S	0.020	1.9×10^{-8}	0.010	1.7×10^{-8}	1.1×10^{-8}	7.4×10^{-9}	6.4×10^{-9}	5.8×10^{-9}
Fluorine										
F-18	1.83 h	F	1.000	2.6×10^{-10}	1.000	1.9×10^{-10}	9.1×10^{-11}	5.6×10^{-11}	3.4×10^{-11}	2.8×10^{-11}
		M	1.000	4.1×10^{-10}	1.000	2.9×10^{-10}	1.5×10^{-10}	9.7×10^{-11}	6.9×10^{-11}	5.6×10^{-11}
		S	1.000	4.2×10^{-10}	1.000	3.1×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	7.3×10^{-11}	5.9×10^{-11}

Sodium										
Na-22	2.60 a	F	1.000	9.7×10^{-9}	1.000	7.3×10^{-9}	3.8×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	1.3×10^{-9}
Na-24	15.0 h	F	1.000	2.3×10^{-9}	1.000	1.8×10^{-9}	9.3×10^{-10}	5.7×10^{-10}	3.4×10^{-10}	2.7×10^{-10}
Magnesium										
Mg-28	20.9 h	F	1.000	5.3×10^{-9}	0.500	4.7×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	7.3×10^{-10}	6.0×10^{-10}
		M	1.000	7.3×10^{-9}	0.500	7.2×10^{-9}	3.5×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Aluminium										
Al-26	7.16×10^{5} a	F	0.020	8.1×10^{-8}	0.010	6.2×10^{-8}	3.2×10^{-8}	2.0×10^{-8}	1.3×10^{-8}	1.1×10^{-8}
		M	0.020	8.8×10^{-8}	0.010	7.4×10^{-8}	4.4×10^{-8}	2.9×10^{-8}	2.2×10^{-8}	2.0×10^{-8}
Silicon										
Si-31	2.62 h	F	0.020	3.6×10^{-10}	0.010	2.3×10^{-10}	9.5×10^{-11}	5.9×10^{-11}	3.2×10^{-11}	2.7×10^{-11}
		M	0.020	6.9×10^{-10}	0.010	4.4×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	8.9×10^{-11}	7.4×10^{-11}
		S	0.020	7.2×10^{-10}	0.010	4.7×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	9.5×10^{-11}	7.9×10^{-11}
Si-32	4.50×10^{2} a	F	0.020	3.0×10^{-8}	0.010	2.3×10^{-8}	1.1×10^{-8}	6.4×10^{-9}	3.8×10^{-9}	3.2×10^{-9}
		M	0.020	7.1×10^{-8}	0.010	6.0×10^{-8}	3.6×10^{-8}	2.4×10^{-8}	1.9×10^{-8}	1.7×10^{-8}
		S	0.020	2.8×10^{-7}	0.010	2.7×10^{-7}	1.9×10^{-7}	1.3×10^{-7}	1.1×10^{-7}	1.1×10^{-7}
Phosphorus										
P-32	14.3 d	F	1.000	1.2×10^{-8}	0.800	7.5×10^{-9}	3.2×10^{-9}	1.8×10^{-9}	9.8×10^{-10}	7.7×10^{-10}
		M	1.000	2.2×10^{-8}	0.800	1.5×10^{-8}	8.0×10^{-9}	5.3×10^{-9}	4.0×10^{-9}	3.4×10^{-9}
P-33	25.4 d	F	1.000	1.2×10^{-9}	0.800	7.8×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.1×10^{-10}	9.2×10^{-11}
		M	1.000	6.1×10^{-9}	0.800	4.6×10^{-9}	2.8×10^{-9}	2.1×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
Sulphur										
S-35	87.4 d	F	1.000	5.5×10^{-10}	0.800	3.9×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	6.0×10^{-11}	5.1×10^{-11}
(inorganic)		M	0.200	5.9×10^{-9}	0.100	4.5×10^{-9}	2.8×10^{-9}	2.0×10^{-9}	1.8×10^{-9}	1.4×10^{-9}
		S	0.020	7.7×10^{-9}	0.010	6.0×10^{-9}	3.6×10^{-9}	2.6×10^{-9}	2.3×10^{-9}	1.9×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Chlorine										
Cl-36	3.01 x 10^5 a	F	1.000	3.9 x 10^{-9}	1.000	2.6 x 10^{-9}	1.1 x 10^{-9}	7.1 x 10^{-10}	3.9 x 10^{-10}	3.3 x 10^{-10}
		M	1.000	3.1 x 10^{-8}	1.000	2.6 x 10^{-8}	1.5 x 10^{-8}	1.0 x 10^{-8}	8.8 x 10^{-9}	7.3 x 10^{-9}
Cl-38	0.620 h	F	1.000	2.9 x 10^{-10}	1.000	1.9 x 10^{-10}	8.4 x 10^{-11}	5.1 x 10^{-11}	3.0 x 10^{-11}	2.5 x 10^{-11}
		M	1.000	4.7 x 10^{-10}	1.000	3.0 x 10^{-10}	1.4 x 10^{-10}	8.5 x 10^{-11}	5.4 x 10^{-11}	4.5 x 10^{-11}
Cl-39	0.927 h	F	1.000	2.7 x 10^{-10}	1.000	1.8 x 10^{-10}	8.4 x 10^{-11}	5.1 x 10^{-11}	3.1 x 10^{-11}	2.5 x 10^{-11}
		M	1.000	4.3 x 10^{-10}	1.000	2.8 x 10^{-10}	1.3 x 10^{-10}	8.5 x 10^{-11}	5.6 x 10^{-11}	4.6 x 10^{-11}
Potassium										
K-40	1.28 x 10^9 a	F	1.000	2.4 x 10^{-8}	1.000	1.7 x 10^{-8}	7.5 x 10^{-9}	4.5 x 10^{-9}	2.5 x 10^{-9}	2.1 x 10^{-9}
K-42	12.4 h	F	1.000	1.6 x 10^{-9}	1.000	1.0 x 10^{-9}	4.4 x 10^{-10}	2.6 x 10^{-10}	1.5 x 10^{-10}	1.2 x 10^{-10}
K-43	22.6 h	F	1.000	1.3 x 10^{-9}	1.000	9.7 x 10^{-10}	4.7 x 10^{-10}	2.9 x 10^{-10}	1.7 x 10^{-10}	1.4 x 10^{-10}
K-44	0.369 h	F	1.000	2.2 x 10^{-10}	1.000	1.4 x 10^{-10}	6.5 x 10^{-11}	4.0 x 10^{-11}	2.4 x 10^{-11}	2.0 x 10^{-11}
K-45	0.333 h	F	1.000	1.5 x 10^{-10}	1.000	1.0 x 10^{-10}	4.8 x 10^{-11}	3.0 x 10^{-11}	1.8 x 10^{-11}	1.5 x 10^{-11}
Calcium[a]										
Ca-41	1.40 x 10^5 a	F	0.600	6.7 x 10^{-10}	0.300	3.8 x 10^{-10}	2.6 x 10^{-10}	3.3 x 10^{-10}	3.3 x 10^{-10}	1.7 x 10^{-10}
		M	0.200	4.2 x 10^{-10}	0.100	2.6 x 10^{-10}	1.7 x 10^{-10}	1.7 x 10^{-10}	1.6 x 10^{-10}	9.5 x 10^{-11}
		S	0.020	6.7 x 10^{-10}	0.010	6.0 x 10^{-10}	3.8 x 10^{-10}	2.4 x 10^{-10}	1.9 x 10^{-10}	1.8 x 10^{-10}
Ca-45	163 d	F	0.600	5.7 x 10^{-9}	0.300	3.0 x 10^{-9}	1.4 x 10^{-9}	1.0 x 10^{-9}	7.6 x 10^{-10}	4.6 x 10^{-10}
		M	0.200	1.2 x 10^{-8}	0.100	8.8 x 10^{-9}	5.3 x 10^{-9}	3.9 x 10^{-9}	3.5 x 10^{-9}	2.7 x 10^{-9}
		S	0.020	1.5 x 10^{-8}	0.010	1.2 x 10^{-8}	7.2 x 10^{-9}	5.1 x 10^{-9}	4.6 x 10^{-9}	3.7 x 10^{-9}
Ca -47	4.53 d	F	0.600	4.9 x 10^{-9}	0.300	3.6 x 10^{-9}	1.7 x 10^{-9}	1.1 x 10^{-9}	6.1 x 10^{-10}	5.5 x 10^{-10}
		M	0.200	1.0 x 10^{-8}	0.100	7.7 x 10^{-9}	4.2 x 10^{-9}	2.9 x 10^{-9}	2.4 x 10^{-9}	1.9 x 10^{-9}
		S	0.020	1.2 x 10^{-8}	0.010	8.5 x 10^{-9}	4.6 x 10^{-9}	3.3 x 10^{-9}	2.6 x 10^{-9}	2.1 x 10^{-9}

Scandium										
Sc-43	3.89 h	S	0.001	9.3×10^{-10}	1.0×10^{-4}	6.7×10^{-10}	3.3×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Sc-44	3.93 h	S	0.001	1.6×10^{-9}	1.0×10^{-4}	1.2×10^{-9}	5.6×10^{-10}	3.6×10^{-10}	2.3×10^{-10}	1.8×10^{-10}
Sc-44m	2.44 d	S	0.001	1.1×10^{-8}	1.0×10^{-4}	8.4×10^{-9}	4.2×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Sc-46	83.8 d	S	0.001	2.8×10^{-8}	1.0×10^{-4}	2.3×10^{-8}	1.4×10^{-8}	9.8×10^{-9}	8.4×10^{-9}	6.8×10^{-9}
Sc-47	3.35 d	S	0.001	4.0×10^{-9}	1.0×10^{-4}	2.8×10^{-9}	1.5×10^{-9}	1.1×10^{-9}	9.2×10^{-10}	7.3×10^{-10}
Sc-48	1.82 d	S	0.001	7.8×10^{-9}	1.0×10^{-4}	5.9×10^{-9}	3.1×10^{-9}	2.0×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Sc-49	0.956 h	S	0.001	3.9×10^{-10}	1.0×10^{-4}	2.4×10^{-10}	1.1×10^{-10}	7.1×10^{-11}	4.7×10^{-11}	4.0×10^{-11}
Titanium										
Ti-44	47.3 a	F	0.020	3.1×10^{-7}	0.010	2.6×10^{-7}	1.5×10^{-7}	9.6×10^{-8}	6.6×10^{-8}	6.1×10^{-8}
		M	0.020	1.7×10^{-7}	0.010	1.5×10^{-7}	9.2×10^{-8}	5.9×10^{-8}	4.6×10^{-8}	4.2×10^{-8}
		S	0.020	3.2×10^{-7}	0.010	3.1×10^{-7}	2.1×10^{-7}	1.5×10^{-7}	1.3×10^{-7}	1.2×10^{-7}
Ti-45	3.08 h	F	0.020	4.4×10^{-10}	0.010	3.2×10^{-10}	1.5×10^{-10}	9.1×10^{-11}	5.1×10^{-11}	4.2×10^{-11}
		M	0.020	7.4×10^{-10}	0.010	5.2×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.8×10^{-11}
		S	0.020	7.7×10^{-10}	0.010	5.5×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	9.3×10^{-11}
Vanadium										
V-47	0.543 h	F	0.020	1.8×10^{-10}	0.010	1.2×10^{-10}	5.6×10^{-11}	3.5×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
		M	0.020	2.8×10^{-10}	0.010	1.9×10^{-10}	8.6×10^{-11}	5.5×10^{-11}	3.5×10^{-11}	2.9×10^{-11}
V-48	16.2 d	F	0.020	8.4×10^{-9}	0.010	6.4×10^{-9}	3.3×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
		M	0.020	1.4×10^{-8}	0.010	1.1×10^{-8}	6.3×10^{-9}	4.3×10^{-9}	2.9×10^{-9}	2.4×10^{-9}
V-49	330 d	F	0.020	2.0×10^{-10}	0.010	1.6×10^{-10}	7.7×10^{-11}	4.3×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
		M	0.020	2.8×10^{-10}	0.010	2.1×10^{-10}	1.1×10^{-10}	6.3×10^{-11}	4.0×10^{-11}	3.4×10^{-11}
Chromium										
Cr-48	23.0 h	F	0.200	7.6×10^{-10}	0.100	6.0×10^{-10}	3.1×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.9×10^{-11}
		M	0.200	1.1×10^{-9}	0.100	9.1×10^{-10}	5.1×10^{-10}	3.4×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
		S	0.200	1.2×10^{-9}	0.100	9.8×10^{-10}	5.5×10^{-10}	3.7×10^{-10}	2.8×10^{-10}	2.2×10^{-10}
Cr-49	0.702 h	F	0.200	1.9×10^{-10}	0.100	1.3×10^{-10}	6.0×10^{-11}	3.7×10^{-11}	2.2×10^{-11}	1.9×10^{-11}
		M	0.200	3.0×10^{-10}	0.100	2.0×10^{-10}	9.5×10^{-11}	6.1×10^{-11}	4.0×10^{-11}	3.3×10^{-11}

Notes: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.
[a] The f_1 value for calsium for 1 to 15 years old for Type F is 0.4

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
		S	0.200	3.1×10^{-10}	0.100	2.1×10^{-10}	9.9×10^{-11}	6.4×10^{-11}	4.2×10^{-11}	3.5×10^{-11}
Cr-51	27.7 d	F	0.200	1.7×10^{-10}	0.100	1.3×10^{-10}	6.3×10^{-11}	4.0×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
		M	0.200	2.6×10^{-10}	0.100	1.9×10^{-10}	1.0×10^{-10}	6.4×10^{-11}	3.9×10^{-11}	3.2×10^{-11}
		S	0.200	2.6×10^{-10}	0.100	2.1×10^{-10}	1.0×10^{-10}	6.6×10^{-11}	4.5×10^{-11}	3.7×10^{-11}
Manganese										
Mn-51	0.770 h	F	0.200	2.5×10^{-10}	0.100	1.7×10^{-10}	7.5×10^{-11}	4.6×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
		M	0.200	4.0×10^{-10}	0.100	2.7×10^{-10}	1.2×10^{-10}	7.8×10^{-11}	5.0×10^{-11}	4.1×10^{-11}
Mn-52	5.59 d	F	0.200	7.0×10^{-9}	0.100	5.5×10^{-9}	2.9×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	9.4×10^{-10}
		M	0.200	8.6×10^{-9}	0.100	6.8×10^{-9}	3.7×10^{-9}	2.4×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Mn-52m	0.352 h	F	0.200	1.9×10^{-10}	0.100	1.3×10^{-10}	6.1×10^{-11}	3.8×10^{-11}	2.2×10^{-11}	1.9×10^{-11}
		M	0.200	2.8×10^{-10}	0.100	1.9×10^{-10}	8.7×10^{-11}	5.5×10^{-11}	3.4×10^{-11}	2.9×10^{-11}
Mn-53	3.70×10^{6}a	F	0.200	3.2×10^{-10}	0.100	2.2×10^{-10}	1.1×10^{-10}	6.0×10^{-11}	3.4×10^{-11}	2.9×10^{-11}
		M	0.200	4.6×10^{-10}	0.100	3.4×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	6.4×10^{-11}	5.4×10^{-11}
Mn-54	312 d	F	0.200	5.2×10^{-9}	0.100	4.1×10^{-9}	2.2×10^{-9}	1.5×10^{-9}	9.9×10^{-10}	8.5×10^{-10}
		M	0.200	7.5×10^{-9}	0.100	6.2×10^{-9}	3.8×10^{-9}	2.4×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
Mn-56	2.58 h	F	0.200	6.9×10^{-10}	0.100	4.9×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	7.8×10^{-11}	6.4×10^{-11}
		M	0.200	1.1×10^{-9}	0.100	7.8×10^{-10}	3.7×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Iron[a]										
Fe-52	8.28 h	F	0.600	5.2×10^{-9}	0.100	3.6×10^{-9}	1.5×10^{-9}	8.9×10^{-10}	4.9×10^{-10}	3.9×10^{-10}
		M	0.200	5.8×10^{-9}	0.100	4.1×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	7.4×10^{-10}	6.0×10^{-10}
		S	0.020	6.0×10^{-9}	0.100	4.2×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	7.7×10^{-10}	6.3×10^{-10}
Fe-55	2.70 a	F	0.600	4.2×10^{-9}	0.100	3.2×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	9.4×10^{-10}	7.7×10^{-10}
		M	0.200	1.9×10^{-9}	0.100	1.4×10^{-9}	9.9×10^{-10}	6.2×10^{-10}	4.4×10^{-10}	3.8×10^{-10}
		S	0.020	1.0×10^{-9}	0.010	8.5×10^{-10}	5.0×10^{-10}	2.9×10^{-10}	2.0×10^{-10}	1.8×10^{-10}
Fe-59	44.5 d	F	0.600	2.1×10^{-8}	0.100	1.3×10^{-8}	7.1×10^{-9}	4.2×10^{-9}	2.6×10^{-9}	2.2×10^{-9}

		M	0.200	1.8×10^{-8}	0.100	1.3×10^{-8}	7.9×10^{-9}	5.5×10^{-9}	4.6×10^{-9}	3.7×10^{-9}
		S	0.020	1.7×10^{-8}	0.010	1.3×10^{-8}	8.1×10^{-9}	5.8×10^{-9}	5.1×10^{-9}	4.0×10^{-9}
Fe-60	1.00×10^{5} a	F	0.600	4.4×10^{-7}	0.100	3.9×10^{-7}	3.5×10^{-7}	3.2×10^{-7}	2.9×10^{-7}	2.8×10^{-7}
		M	0.200	2.0×10^{-7}	0.100	1.7×10^{-7}	1.6×10^{-7}	1.4×10^{-7}	1.4×10^{-7}	1.4×10^{-7}
		S	0.020	9.3×10^{-8}	0.010	8.8×10^{-8}	6.7×10^{-8}	5.2×10^{-8}	4.9×10^{-8}	4.9×10^{-8}
Cobalt[b]										
Co-55	1.75 h	F	0.600	2.2×10^{-9}	0.100	1.8×10^{-9}	9.0×10^{-10}	5.5×10^{-10}	3.1×10^{-10}	2.7×10^{-10}
		M	0.200	4.1×10^{-9}	0.100	3.1×10^{-9}	1.5×10^{-9}	9.8×10^{-10}	6.1×10^{-10}	5.0×10^{-10}
		S	0.020	4.6×10^{-9}	0.010	3.3×10^{-9}	1.6×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.3×10^{-10}
Co-56	78.7 d	F	0.600	1.4×10^{-8}	0.100	1.0×10^{-8}	5.5×10^{-9}	3.5×10^{-9}	2.2×10^{-9}	1.8×10^{-9}
		M	0.200	2.5×10^{-8}	0.100	2.1×10^{-8}	1.1×10^{-8}	7.4×10^{-9}	5.8×10^{-9}	4.8×10^{-9}
		S	0.020	2.9×10^{-8}	0.010	2.5×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	8.0×10^{-9}	6.7×10^{-9}
Co-57	271 d	F	0.600	1.5×10^{-9}	0.100	1.1×10^{-9}	5.6×10^{-10}	3.7×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
		M	0.200	2.8×10^{-9}	0.100	2.2×10^{-9}	1.3×10^{-9}	8.5×10^{-10}	6.7×10^{-10}	5.5×10^{-10}
		S	0.020	4.4×10^{-9}	0.010	3.7×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.2×10^{-9}	1.0×10^{-9}
Co-58	70.8 d	F	0.600	4.0×10^{-9}	0.100	3.0×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.4×10^{-9}	5.3×10^{-10}
		M	0.200	7.3×10^{-9}	0.100	6.5×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	2.0×10^{-9}	1.6×10^{-9}
		S	0.020	9.0×10^{-9}	0.010	7.5×10^{-9}	4.5×10^{-9}	3.1×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
Co-58m	9.15 h	F	0.600	4.8×10^{-11}	0.100	3.6×10^{-11}	1.7×10^{-11}	1.1×10^{-11}	5.9×10^{-12}	5.2×10^{-12}
		M	0.200	1.1×10^{-10}	0.100	7.6×10^{-11}	3.8×10^{-11}	2.4×10^{-11}	1.6×10^{-11}	1.3×10^{-11}
		S	0.020	1.3×10^{-10}	0.010	9.0×10^{-11}	4.5×10^{-11}	3.0×10^{-11}	2.0×10^{-11}	1.7×10^{-11}
Co-60	5.27 a	F	0.600	3.0×10^{-8}	0.100	2.3×10^{-8}	1.4×10^{-8}	8.9×10^{-9}	6.1×10^{-9}	5.2×10^{-9}
		M	0.200	4.2×10^{-8}	0.100	3.4×10^{-8}	2.1×10^{-8}	1.5×10^{-8}	1.2×10^{-8}	1.0×10^{-8}
		S	0.020	9.2×10^{-8}	0.010	8.6×10^{-8}	5.9×10^{-8}	4.0×10^{-8}	3.4×10^{-8}	3.1×10^{-8}
Co-60m	0.174 h	F	0.600	4.4×10^{-12}	0.100	2.8×10^{-12}	1.5×10^{-12}	1.0×10^{-12}	8.3×10^{-13}	6.9×10^{-13}
		M	0.200	7.1×10^{-12}	0.100	4.7×10^{-12}	2.7×10^{-12}	1.8×10^{-12}	1.5×10^{-12}	1.2×10^{-12}
		S	0.020	7.6×10^{-12}	0.010	5.1×10^{-12}	2.9×10^{-12}	2.0×10^{-12}	1.7×10^{-12}	1.4×10^{-12}

Notes: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.
[a] The f_1 value for iron for for 1 to 15 years old for Type F is 0.2
[b] The f_1 value for cobalt for 1 to 15 years old for Type F is 0.3

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Co-61	1.65 h	F	0.600	2.1×10^{-10}	0.100	1.4×10^{-10}	6.0×10^{-11}	3.8×10^{-11}	2.2×10^{-11}	1.9×10^{-11}
		M	0.200	4.0×10^{-10}	0.100	2.7×10^{-10}	1.2×10^{-10}	8.2×10^{-11}	5.7×10^{-11}	4.7×10^{-11}
		S	0.020	4.3×10^{-10}	0.010	2.8×10^{-10}	1.3×10^{-10}	8.8×10^{-11}	6.1×10^{-11}	5.1×10^{-11}
Co-62m	0.232 h	F	0.600	1.4×10^{-10}	0.100	9.5×10^{-11}	4.5×10^{-11}	2.8×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		M	0.200	1.9×10^{-10}	0.100	1.3×10^{-10}	6.1×10^{-11}	3.8×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
		S	0.020	2.0×10^{-10}	0.010	1.3×10^{-10}	6.3×10^{-11}	4.0×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
Nickel										
Ni-56	6.10 d	F	0.100	3.3×10^{-9}	0.050	2.8×10^{-9}	1.5×10^{-9}	9.3×10^{-10}	5.8×10^{-10}	4.9×10^{-10}
		M	0.100	4.9×10^{-9}	0.050	4.1×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.1×10^{-9}	8.7×10^{-10}
		S	0.020	5.5×10^{-9}	0.010	4.6×10^{-9}	2.7×10^{-9}	1.8×10^{-9}	1.3×10^{-9}	1.0×10^{-9}
Ni-57	1.50 d	F	0.100	2.2×10^{-9}	0.050	1.8×10^{-9}	8.9×10^{-10}	5.5×10^{-10}	3.1×10^{-10}	2.5×10^{-10}
		M	0.100	3.6×10^{-9}	0.050	2.8×10^{-9}	1.5×10^{-9}	9.5×10^{-10}	6.2×10^{-10}	5.0×10^{-10}
		S	0.020	3.9×10^{-9}	0.010	3.0×10^{-9}	1.5×10^{-9}	1.0×10^{-9}	6.6×10^{-10}	5.3×10^{-10}
Ni-59	7.50×10^{4} a	F	0.100	9.6×10^{-10}	0.050	8.1×10^{-10}	4.5×10^{-10}	2.8×10^{-10}	1.9×10^{-10}	1.8×10^{-10}
		M	0.100	7.9×10^{-10}	0.050	6.2×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.3×10^{-10}
		S	0.020	1.7×10^{-9}	0.010	1.5×10^{-9}	9.5×10^{-10}	5.9×10^{-10}	4.6×10^{-10}	4.4×10^{-10}
Ni-63	96.0 a	F	0.100	2.3×10^{-9}	0.050	2.0×10^{-9}	1.1×10^{-9}	6.7×10^{-10}	4.6×10^{-10}	4.4×10^{-10}
		M	0.100	2.5×10^{-9}	0.050	1.9×10^{-9}	1.1×10^{-9}	7.0×10^{-10}	5.3×10^{-10}	4.8×10^{-10}
		S	0.020	4.8×10^{-9}	0.010	4.3×10^{-9}	2.7×10^{-9}	1.7×10^{-9}	1.3×10^{-9}	1.3×10^{-9}
Ni-65	2.52 h	F	0.100	4.4×10^{-10}	0.050	3.0×10^{-10}	1.4×10^{-10}	8.5×10^{-11}	4.9×10^{-11}	4.1×10^{-11}
		M	0.100	7.7×10^{-10}	0.050	5.2×10^{-10}	2.4×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	8.5×10^{-11}
		S	0.020	8.1×10^{-10}	0.010	5.5×10^{-10}	2.6×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	9.0×10^{-11}
Ni-66	2.27 d	F	0.100	5.7×10^{-9}	0.050	3.8×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	5.1×10^{-10}	4.2×10^{-10}
		M	0.100	1.3×10^{-8}	0.050	9.4×10^{-9}	4.5×10^{-9}	2.9×10^{-9}	2.0×10^{-9}	1.6×10^{-9}
		S	0.020	1.5×10^{-8}	0.010	1.0×10^{-8}	5.0×10^{-9}	3.2×10^{-9}	2.2×10^{-9}	1.8×10^{-9}

Copper										
Cu-60	0.387 h	F	1.000	2.1×10^{-10}	0.500	1.6×10^{-10}	7.5×10^{-11}	4.6×10^{-11}	2.9×10^{-11}	2.3×10^{-11}
		M	1.000	3.0×10^{-10}	0.500	2.2×10^{-10}	1.0×10^{-10}	6.5×10^{-11}	4.0×10^{-11}	3.3×10^{-11}
		S	1.000	3.1×10^{-10}	0.500	2.2×10^{-10}	1.1×10^{-10}	6.7×10^{-11}	4.2×10^{-11}	3.4×10^{-11}
Cu-61	3.41 h	F	1.000	3.1×10^{-10}	0.500	2.7×10^{-10}	1.3×10^{-10}	7.9×10^{-11}	4.5×10^{-11}	3.7×10^{-11}
		M	1.000	4.9×10^{-10}	0.500	4.4×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	9.1×10^{-11}	7.4×10^{-11}
		S	1.000	5.1×10^{-10}	0.500	4.5×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	9.6×10^{-11}	7.8×10^{-11}
Cu-64	12.7 h	F	1.000	2.8×10^{-10}	0.500	2.7×10^{-10}	1.2×10^{-10}	7.6×10^{-11}	4.2×10^{-11}	3.5×10^{-11}
		M	1.000	5.5×10^{-10}	0.500	5.4×10^{-10}	2.7×10^{-10}	1.9×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
		S	1.000	5.8×10^{-10}	0.500	5.7×10^{-10}	2.9×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.2×10^{-10}
Cu-67	2.58 d	F	1.000	9.5×10^{-10}	0.500	8.0×10^{-10}	3.5×10^{-10}	2.2×10^{-10}	1.2×10^{-10}	1.0×10^{-10}
		M	1.000	2.3×10^{-9}	0.500	2.0×10^{-9}	1.1×10^{-9}	8.1×10^{-10}	6.9×10^{-10}	5.5×10^{-10}
		S	1.000	2.5×10^{-9}	0.500	2.1×10^{-9}	1.2×10^{-9}	8.9×10^{-10}	7.7×10^{-10}	6.1×10^{-10}
Zinc										
Zn-62	9.26 h	F	1.000	1.7×10^{-9}	0.500	1.7×10^{-9}	7.7×10^{-10}	4.6×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
		M	0.200	4.5×10^{-9}	0.100	3.5×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.0×10^{-10}	5.0×10^{-10}
		S	0.020	5.1×10^{-9}	0.010	3.4×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.5×10^{-10}
Zn-63	0.635 h	F	1.000	2.1×10^{-10}	0.500	1.4×10^{-10}	6.5×10^{-11}	4.0×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
		M	0.200	3.4×10^{-10}	0.100	2.3×10^{-10}	1.0×10^{-10}	6.6×10^{-11}	4.2×10^{-11}	3.5×10^{-11}
		S	0.020	3.6×10^{-10}	0.010	2.4×10^{-10}	1.1×10^{-10}	6.9×10^{-11}	4.4×10^{-11}	3.7×10^{-11}
Zn-65	244 d	F	1.000	1.5×10^{-8}	0.500	1.0×10^{-8}	5.7×10^{-9}	3.8×10^{-9}	2.5×10^{-9}	2.2×10^{-9}
		M	0.200	8.5×10^{-9}	0.100	6.5×10^{-9}	3.7×10^{-9}	2.4×10^{-9}	1.9×10^{-9}	1.6×10^{-9}
		S	0.020	7.6×10^{-9}	0.010	6.7×10^{-9}	4.4×10^{-9}	2.9×10^{-9}	2.4×10^{-9}	2.0×10^{-9}
Zn-69	0.950 h	F	1.000	1.1×10^{-10}	0.500	7.4×10^{-11}	3.2×10^{-11}	2.1×10^{-11}	1.2×10^{-11}	1.1×10^{-11}
		M	0.200	2.2×10^{-10}	0.100	1.4×10^{-10}	6.5×10^{-11}	4.4×10^{-11}	3.1×10^{-11}	2.6×10^{-11}
		S	0.020	2.3×10^{-10}	0.010	1.5×10^{-10}	6.9×10^{-11}	4.7×10^{-11}	3.4×10^{-11}	2.8×10^{-11}
Zn-69m	13.8 h	F	1.000	6.6×10^{-10}	0.500	6.7×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	9.9×10^{-11}	8.2×10^{-11}
		M	0.200	2.1×10^{-9}	0.100	1.5×10^{-9}	7.5×10^{-10}	5.0×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
		S	0.020	2.2×10^{-9}	0.010	1.7×10^{-9}	8.2×10^{-10}	5.4×10^{-10}	3.3×10^{-10}	2.7×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Zn-71m	3.92 h	F	1.000	6.2×10^{-10}	0.500	5.5×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	9.1×10^{-11}	7.4×10^{-11}
		M	0.200	1.3×10^{-9}	0.100	9.4×10^{-10}	4.6×10^{-10}	2.9×10^{-10}	1.9×10^{-10}	1.5×10^{-10}
		S	0.020	1.4×10^{-9}	0.010	1.0×10^{-9}	4.9×10^{-10}	3.1×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
Zn-72	1.94 d	F	1.000	4.3×10^{-9}	0.500	3.5×10^{-9}	1.7×10^{-9}	1.0×10^{-9}	5.9×10^{-10}	4.9×10^{-10}
		M	0.200	8.8×10^{-9}	0.100	6.5×10^{-9}	3.4×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
		S	0.020	9.7×10^{-9}	0.010	7.0×10^{-9}	3.6×10^{-9}	2.4×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Gallium										
Ga-65	0.253 h	F	0.010	1.1×10^{-10}	0.001	7.3×10^{-11}	3.4×10^{-11}	2.1×10^{-11}	1.3×10^{-11}	1.1×10^{-11}
		M	0.010	1.6×10^{-10}	0.001	1.1×10^{-10}	4.8×10^{-11}	3.1×10^{-11}	2.0×10^{-11}	1.7×10^{-11}
Ga-66	9.40 h	F	0.010	2.8×10^{-9}	0.001	2.0×10^{-9}	9.2×10^{-10}	5.7×10^{-10}	3.0×10^{-10}	2.5×10^{-10}
		M	0.010	4.5×10^{-9}	0.001	3.1×10^{-9}	1.5×10^{-9}	9.2×10^{-10}	5.3×10^{-10}	4.4×10^{-10}
Ga-67	3.26 d	F	0.010	6.4×10^{-10}	0.001	4.6×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	7.7×10^{-11}	6.4×10^{-11}
		M	0.010	1.4×10^{-9}	0.001	1.0×10^{-9}	5.0×10^{-10}	3.6×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
Ga-68	1.13 h	F	0.010	2.9×10^{-10}	0.001	1.9×10^{-10}	8.8×10^{-11}	5.4×10^{-11}	3.1×10^{-11}	2.6×10^{-11}
		M	0.010	4.6×10^{-10}	0.001	3.1×10^{-10}	1.4×10^{-10}	9.2×10^{-11}	5.9×10^{-11}	4.9×10^{-11}
Ga-70	0.353 h	F	0.010	9.5×10^{-11}	0.001	6.0×10^{-11}	2.6×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	8.8×10^{-12}
		M	0.010	1.5×10^{-10}	0.001	9.6×10^{-11}	4.3×10^{-11}	2.8×10^{-11}	1.8×10^{-11}	1.6×10^{-11}
Ga-72	14.1 h	F	0.010	2.9×10^{-9}	0.001	2.2×10^{-9}	1.0×10^{-9}	6.4×10^{-10}	3.6×10^{-10}	2.9×10^{-10}
		M	0.010	4.5×10^{-9}	0.001	3.3×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.5×10^{-10}	5.3×10^{-10}
Ga-73	4.91 h	F	0.010	6.7×10^{-10}	0.001	4.5×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	6.4×10^{-11}	5.4×10^{-11}
		M	0.010	1.2×10^{-9}	0.001	8.4×10^{-10}	4.0×10^{-10}	2.6×10^{-10}	1.7×10^{-10}	1.4×10^{-10}

Germanium										
Ge-66	2.27 h	F	1.000	4.5×10^{-10}	1.000	3.5×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	6.7×10^{-11}	5.4×10^{-11}
		M	1.000	6.4×10^{-10}	1.000	4.8×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	9.1×10^{-11}
Ge-67	0.312 h	F	1.000	1.7×10^{-10}	1.000	1.1×10^{-10}	4.9×10^{-11}	3.1×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
		M	1.000	2.5×10^{-10}	1.000	1.6×10^{-10}	7.3×10^{-11}	4.6×10^{-11}	2.9×10^{-11}	2.5×10^{-11}
Ge-68	288 d	F	1.000	5.4×10^{-9}	1.000	3.8×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.3×10^{-10}	5.2×10^{-10}
		M	1.000	6.0×10^{-8}	1.000	5.0×10^{-8}	3.0×10^{-8}	2.0×10^{-8}	1.6×10^{-8}	1.4×10^{-8}
Ge-69	1.63 d	F	1.000	1.2×10^{-9}	1.000	9.0×10^{-10}	4.6×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	1.3×10^{-10}
		M	1.000	1.8×10^{-9}	1.000	1.4×10^{-9}	7.4×10^{-10}	4.9×10^{-10}	3.6×10^{-10}	2.9×10^{-10}
Ge-71	11.8 d	F	1.000	6.0×10^{-11}	1.000	4.3×10^{-11}	2.0×10^{-11}	1.1×10^{-11}	6.1×10^{-12}	4.8×10^{-12}
		M	1.000	1.2×10^{-10}	1.000	8.6×10^{-11}	4.1×10^{-11}	2.4×10^{-11}	1.3×10^{-11}	1.1×10^{-11}
Ge-75	1.38 h	F	1.000	1.6×10^{-10}	1.000	1.0×10^{-10}	4.3×10^{-11}	2.8×10^{-11}	1.7×10^{-11}	1.5×10^{-11}
		M	1.000	2.9×10^{-10}	1.000	1.9×10^{-10}	8.9×10^{-11}	6.1×10^{-11}	4.4×10^{-11}	3.6×10^{-11}
Ge-77	11.3 h	F	1.000	1.3×10^{-9}	1.000	9.5×10^{-10}	4.7×10^{-10}	2.9×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
		M	1.000	2.3×10^{-9}	1.000	1.7×10^{-9}	8.8×10^{-10}	6.0×10^{-10}	4.5×10^{-10}	3.7×10^{-10}
Ge-78	1.45 h	F	1.000	4.3×10^{-10}	1.000	2.9×10^{-10}	1.4×10^{-10}	8.9×10^{-11}	5.5×10^{-11}	4.5×10^{-11}
		M	1.000	7.3×10^{-10}	1.000	5.0×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.2×10^{-10}	9.5×10^{-11}
Arsenic										
As-69	0.253 h	M	1.000	2.1×10^{-10}	0.500	1.4×10^{-10}	6.3×10^{-11}	4.0×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
As-70	0.876 h	M	1.000	5.7×10^{-10}	0.500	4.3×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	8.3×10^{-11}	6.7×10^{-11}
As-71	2.70 d	M	1.000	2.2×10^{-9}	0.500	1.9×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
As-72	1.08 d	M	1.000	5.9×10^{-9}	0.500	5.7×10^{-9}	2.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	9.0×10^{-10}
As-73	80.3 d	M	1.000	5.4×10^{-9}	0.500	4.0×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.2×10^{-9}	1.0×10^{-9}
As-74	17.8 d	M	1.000	1.1×10^{-8}	0.500	8.4×10^{-9}	4.7×10^{-9}	3.3×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
As-76	1.10 d	M	1.000	5.1×10^{-9}	0.500	4.6×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	8.8×10^{-10}	7.4×10^{-10}
As-77	1.62 d	M	1.000	2.2×10^{-9}	0.500	1.7×10^{-9}	8.9×10^{-10}	6.2×10^{-10}	5.0×10^{-10}	3.9×10^{-10}
As-78	1.51 h	M	1.000	8.0×10^{-10}	0.500	5.8×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.9×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Selenium										
Se-70	0.683 h	F	1.000	3.9×10^{-10}	0.800	3.0×10^{-10}	1.5×10^{-10}	9.0×10^{-11}	5.1×10^{-11}	4.2×10^{-11}
		M	0.200	6.5×10^{-10}	0.100	4.7×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	8.9×10^{-11}	7.3×10^{-11}
		S	0.020	6.8×10^{-10}	0.010	4.8×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	9.4×10^{-11}	7.6×10^{-11}
Se-73	7.15 h	F	1.000	7.7×10^{-10}	0.800	6.5×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.0×10^{-10}	8.0×10^{-11}
		M	0.200	1.6×10^{-9}	0.100	1.2×10^{-9}	5.9×10^{-10}	3.8×10^{-10}	2.4×10^{-10}	1.9×10^{-10}
		S	0.020	1.8×10^{-9}	0.010	1.3×10^{-9}	6.3×10^{-10}	4.0×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Se-73m	0.650 h	F	1.000	9.3×10^{-11}	0.800	7.2×10^{-11}	3.5×10^{-11}	2.3×10^{-11}	1.1×10^{-11}	9.2×10^{-12}
		M	0.200	1.8×10^{-10}	0.100	1.3×10^{-10}	6.1×10^{-11}	3.9×10^{-11}	2.5×10^{-11}	2.0×10^{-11}
		S	0.020	1.9×10^{-10}	0.010	1.3×10^{-10}	6.5×10^{-11}	4.1×10^{-11}	2.6×10^{-11}	2.2×10^{-11}
Se-75	120 d	F	1.000	7.8×10^{-9}	0.800	6.0×10^{-9}	3.4×10^{-9}	2.5×10^{-9}	1.2×10^{-9}	1.0×10^{-9}
		M	0.200	5.4×10^{-9}	0.100	4.5×10^{-9}	2.5×10^{-9}	1.7×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
		S	0.020	5.6×10^{-9}	0.010	4.7×10^{-9}	2.9×10^{-9}	2.0×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Se-79	6.50×10^{4} a	F	1.000	1.6×10^{-8}	0.800	1.3×10^{-8}	7.7×10^{-9}	5.6×10^{-9}	1.5×10^{-9}	1.1×10^{-9}
		M	0.200	1.4×10^{-8}	0.100	1.1×10^{-8}	6.9×10^{-9}	4.9×10^{-9}	3.3×10^{-9}	2.6×10^{-9}
		S	0.020	2.3×10^{-8}	0.010	2.0×10^{-8}	1.3×10^{-8}	8.7×10^{-9}	7.6×10^{-9}	6.8×10^{-9}
Se-81	0.308 h	F	1.000	8.6×10^{-11}	0.800	5.4×10^{-11}	2.3×10^{-11}	1.5×10^{-11}	9.2×10^{-12}	8.0×10^{-12}
		M	0.200	1.3×10^{-10}	0.100	8.5×10^{-11}	3.8×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	1.4×10^{-11}
		S	0.020	1.4×10^{-10}	0.010	8.9×10^{-11}	3.9×10^{-11}	2.6×10^{-11}	1.7×10^{-11}	1.5×10^{-11}
Se-81m	0.954 h	F	1.000	1.8×10^{-10}	0.800	1.2×10^{-10}	5.4×10^{-11}	3.4×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
		M	0.200	3.8×10^{-10}	0.100	2.5×10^{-10}	1.2×10^{-10}	8.0×10^{-11}	5.8×10^{-11}	4.7×10^{-11}
		S	0.020	4.1×10^{-10}	0.010	2.7×10^{-10}	1.3×10^{-10}	8.5×10^{-11}	6.2×10^{-11}	5.1×10^{-11}
Se-83	0.375 h	F	1.000	1.7×10^{-10}	0.800	1.2×10^{-10}	5.8×10^{-11}	3.6×10^{-11}	2.1×10^{-11}	1.8×10^{-11}
		M	0.200	2.7×10^{-10}	0.100	1.9×10^{-10}	9.2×10^{-11}	5.9×10^{-11}	3.9×10^{-11}	3.2×10^{-11}
		S	0.020	2.8×10^{-10}	0.010	2.0×10^{-10}	9.6×10^{-11}	6.2×10^{-11}	4.1×10^{-11}	3.4×10^{-11}

Bromine										
Br-74	0.422 h	F	1.000	2.5×10^{-10}	1.000	1.8×10^{-10}	8.6×10^{-11}	5.3×10^{-11}	3.2×10^{-11}	2.6×10^{-11}
		M	1.000	3.6×10^{-10}	1.000	2.5×10^{-10}	1.2×10^{-10}	7.5×10^{-11}	4.6×10^{-11}	3.8×10^{-11}
Br-74m	0.691 h	F	1.000	4.0×10^{-10}	1.000	2.8×10^{-10}	1.3×10^{-10}	8.1×10^{-11}	4.8×10^{-11}	3.9×10^{-11}
		M	1.000	5.9×10^{-10}	1.000	4.1×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	7.5×10^{-11}	6.2×10^{-11}
Br-75	1.63 h	F	1.000	2.9×10^{-10}	1.000	2.1×10^{-10}	9.7×10^{-11}	5.9×10^{-11}	3.5×10^{-11}	2.9×10^{-11}
		M	1.000	4.5×10^{-10}	1.000	3.1×10^{-10}	1.5×10^{-10}	9.7×10^{-11}	6.5×10^{-11}	5.3×10^{-11}
Br-76	16.2 h	F	1.000	2.2×10^{-9}	1.000	1.7×10^{-9}	8.4×10^{-10}	5.1×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
		M	1.000	3.0×10^{-9}	1.000	2.3×10^{-9}	1.2×10^{-9}	7.5×10^{-10}	5.0×10^{-10}	4.1×10^{-10}
Br-77	2.33 d	F	1.000	5.3×10^{-10}	1.000	4.4×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	7.7×10^{-11}	6.2×10^{-11}
		M	1.000	6.3×10^{-10}	1.000	5.1×10^{-10}	2.7×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.4×10^{-11}
Br-80	0.290 h	F	1.000	7.1×10^{-11}	1.000	4.4×10^{-11}	1.8×10^{-11}	1.2×10^{-11}	6.9×10^{-12}	5.9×10^{-12}
		M	1.000	1.1×10^{-10}	1.000	6.5×10^{-11}	2.8×10^{-11}	1.8×10^{-11}	1.1×10^{-11}	9.4×10^{-12}
Br-80m	4.42 h	F	1.000	4.3×10^{-10}	1.000	2.8×10^{-10}	1.2×10^{-10}	7.2×10^{-11}	4.0×10^{-11}	3.3×10^{-11}
		M	1.000	6.8×10^{-10}	1.000	4.5×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	9.3×10^{-11}	7.6×10^{-11}
Br-82	1.47 d	F	1.000	2.7×10^{-9}	1.000	2.2×10^{-9}	1.2×10^{-9}	7.0×10^{-10}	4.2×10^{-10}	3.5×10^{-10}
		M	1.000	3.8×10^{-9}	1.000	3.0×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	7.9×10^{-10}	6.3×10^{-10}
Br-83	2.39 h	F	1.000	1.7×10^{-10}	1.000	1.1×10^{-10}	4.7×10^{-11}	3.0×10^{-11}	1.8×10^{-11}	1.6×10^{-11}
		M	1.000	3.5×10^{-10}	1.000	2.3×10^{-10}	1.1×10^{-10}	7.7×10^{-11}	5.9×10^{-11}	4.8×10^{-11}
Br-84	0.530 h	F	1.00	2.4×10^{-10}	1.000	1.6×10^{-10}	7.1×10^{-11}	4.4×10^{-11}	2.6×10^{-11}	2.2×10^{-11}
		M	1.00	3.7×10^{-10}	1.000	2.4×10^{-10}	1.1×10^{-10}	6.9×10^{-11}	4.4×10^{-11}	3.7×10^{-11}
Rubidium										
Rb-79	0.382 h	F	1.000	1.6×10^{-10}	1.000	1.1×10^{-10}	5.0×10^{-11}	3.2×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
Rb-81	4.58 h	F	1.000	3.2×10^{-10}	1.000	2.5×10^{-10}	1.2×10^{-10}	7.1×10^{-11}	4.2×10^{-11}	3.4×10^{-11}
Rb-81m	0.533 h	F	1.000	6.2×10^{-11}	1.000	4.6×10^{-11}	2.2×10^{-11}	1.4×10^{-11}	8.5×10^{-12}	7.0×10^{-12}
Rb-82m	6.20 h	F	1.000	8.6×10^{-10}	1.000	7.3×10^{-10}	3.9×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Rb-83	86.2 d	F	1.000	4.9×10^{-9}	1.000	3.8×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	7.9×10^{-10}	6.9×10^{-10}
Rb-84	32.8 d	F	1.000	8.6×10^{-9}	1.000	6.4×10^{-9}	3.1×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	1.0×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Rb-86	18.7 d	F	1.000	1.2×10^{-8}	1.000	7.7×10^{-9}	3.4×10^{-9}	2.0×10^{-9}	1.1×10^{-9}	9.3×10^{-10}
Rb-87	4.70×10^{10} a	F	1.000	6.0×10^{-9}	1.000	4.1×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.0×10^{-10}	5.0×10^{-10}
Rb-88	0.297 h	F	1.000	1.9×10^{-10}	1.000	1.2×10^{-10}	5.2×10^{-11}	3.2×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
Rb-89	0.253 h	F	1.000	1.4×10^{-10}	1.000	9.3×10^{-11}	4.3×10^{-11}	2.7×10^{-11}	1.6×10^{-11}	1.4×10^{-11}
Strontium [a]										
Sr-80	1.67 h	F	0.600	7.8×10^{-10}	0.300	5.4×10^{-10}	2.4×10^{-10}	1.4×10^{-10}	7.9×10^{-11}	7.1×10^{-11}
		M	0.200	1.4×10^{-9}	0.100	9.0×10^{-9}	4.1×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.3×10^{-10}
		S	0.020	1.5×10^{-9}	0.010	9.4×10^{-9}	4.3×10^{-10}	2.7×10^{-10}	1.6×10^{-10}	1.4×10^{-10}
Sr-81	0.425 h	F	0.600	2.1×10^{-10}	0.300	1.5×10^{-10}	6.7×10^{-11}	4.1×10^{-11}	2.4×10^{-11}	2.1×10^{-11}
		M	0.200	3.3×10^{-10}	0.100	2.2×10^{-10}	1.0×10^{-10}	6.6×10^{-11}	4.2×10^{-11}	3.5×10^{-11}
		S	0.020	3.4×10^{-10}	0.010	2.3×10^{-10}	1.1×10^{-10}	6.9×10^{-11}	4.4×10^{-11}	3.7×10^{-11}
Sr-82	25.0 d	F	0.600	2.8×10^{-8}	0.300	1.5×10^{-8}	6.6×10^{-9}	4.6×10^{-9}	3.2×10^{-9}	2.1×10^{-9}
		M	0.200	5.5×10^{-8}	0.100	4.0×10^{-8}	2.1×10^{-8}	1.4×10^{-8}	1.0×10^{-8}	8.9×10^{-9}
		S	0.020	6.1×10^{-8}	0.010	4.6×10^{-8}	2.5×10^{-8}	1.7×10^{-8}	1.2×10^{-8}	1.1×10^{-8}
Sr-83	1.35 d	F	0.600	1.4×10^{-9}	0.300	1.1×10^{-9}	5.5×10^{-10}	3.4×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
		M	0.200	2.5×10^{-9}	0.100	1.9×10^{-9}	9.5×10^{-10}	6.0×10^{-10}	3.9×10^{-10}	3.1×10^{-10}
		S	0.020	2.8×10^{-9}	0.010	2.0×10^{-9}	1.0×10^{-9}	6.5×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
Sr-85	64.8 d	F	0.600	4.4×10^{-9}	0.300	2.3×10^{-9}	1.1×10^{-9}	9.6×10^{-10}	8.3×10^{-10}	3.8×10^{-10}
		M	0.200	4.3×10^{-9}	0.100	3.1×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	8.8×10^{-10}	6.4×10^{-10}
		S	0.020	4.4×10^{-9}	0.010	3.7×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	1.0×10^{-9}	8.1×10^{-10}
Sr-85m	1.16 h	F	0.600	2.4×10^{-11}	0.300	1.9×10^{-11}	9.6×10^{-12}	6.0×10^{-12}	3.7×10^{-12}	2.9×10^{-12}
		M	0.200	3.1×10^{-11}	0.100	2.5×10^{-11}	1.3×10^{-11}	8.0×10^{-12}	5.1×10^{-12}	4.1×10^{-12}
		S	0.020	3.2×10^{-11}	0.010	2.6×10^{-11}	1.3×10^{-11}	8.3×10^{-12}	5.4×10^{-12}	4.3×10^{-12}

Sr-87m	2.80 h	F	0.600	9.7×10^{-11}	0.300	7.8×10^{-11}	3.8×10^{-11}	2.3×10^{-11}	1.3×10^{-11}	1.1×10^{-11}
		M	0.200	1.6×10^{-10}	0.100	1.2×10^{-10}	5.9×10^{-11}	3.8×10^{-11}	2.5×10^{-11}	2.0×10^{-11}
		S	0.020	1.7×10^{-10}	0.010	1.2×10^{-10}	6.2×10^{-11}	4.0×10^{-11}	2.6×10^{-11}	2.1×10^{-11}
Sr-89	50.5 d	F	0.600	1.5×10^{-8}	0.300	7.3×10^{-9}	3.2×10^{-9}	2.3×10^{-9}	1.7×10^{-9}	1.0×10^{-9}
		M	0.200	3.3×10^{-8}	0.100	2.4×10^{-8}	1.3×10^{-8}	9.1×10^{-9}	7.3×10^{-9}	6.1×10^{-9}
		S	0.020	3.9×10^{-8}	0.010	3.0×10^{-8}	1.7×10^{-8}	1.2×10^{-8}	9.3×10^{-9}	7.9×10^{-9}
Sr-90	29.1 a	F	0.600	1.3×10^{-7}	0.300	5.2×10^{-8}	3.1×10^{-8}	4.1×10^{-8}	5.3×10^{-8}	2.4×10^{-8}
		M	0.200	1.5×10^{-7}	0.100	1.1×10^{-7}	6.5×10^{-8}	5.1×10^{-8}	5.0×10^{-8}	3.6×10^{-8}
		S	0.020	4.2×10^{-7}	0.010	4.0×10^{-7}	2.7×10^{-7}	1.8×10^{-7}	1.6×10^{-7}	1.6×10^{-7}
Sr-91	9.50 h	F	0.600	1.4×10^{-9}	0.300	1.1×10^{-9}	5.2×10^{-10}	3.1×10^{-10}	1.7×10^{-10}	1.6×10^{-10}
		M	0.200	3.1×10^{-9}	0.100	2.2×10^{-9}	1.1×10^{-9}	6.9×10^{-10}	4.4×10^{-10}	3.7×10^{-10}
		S	0.020	3.5×10^{-9}	0.010	2.5×10^{-9}	1.2×10^{-9}	7.7×10^{-10}	4.9×10^{-10}	4.1×10^{-10}
Sr-92	2.71 h	F	0.600	9.0×10^{-10}	0.300	7.1×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.0×10^{-10}	9.8×10^{-11}
		M	0.200	1.9×10^{-9}	0.100	1.4×10^{-9}	6.5×10^{-10}	4.1×10^{-10}	2.5×10^{-10}	2.1×10^{-10}
		S	0.020	2.2×10^{-9}	0.010	1.5×10^{-9}	7.0×10^{-10}	4.5×10^{-10}	2.7×10^{-10}	2.3×10^{-10}
Yttrium										
Y-86	14.7 h	M	0.001	3.7×10^{-9}	1.0×10^{-4}	2.9×10^{-9}	1.5×10^{-9}	9.3×10^{-10}	5.6×10^{-10}	4.5×10^{-10}
		S	0.001	3.8×10^{-9}	1.0×10^{-4}	3.0×10^{-9}	1.5×10^{-9}	9.6×10^{-10}	5.8×10^{-10}	4.7×10^{-10}
Y-86m	0.80 h	M	0.001	2.2×10^{-10}	1.0×10^{-4}	1.7×10^{-10}	8.7×10^{-11}	5.6×10^{-11}	3.4×10^{-11}	2.7×10^{-11}
		S	0.001	2.3×10^{-10}	1.0×10^{-4}	1.8×10^{-10}	9.0×10^{-11}	5.7×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
Y-87	3.35 d	M	0.001	2.7×10^{-9}	1.0×10^{-4}	2.1×10^{-9}	1.1×10^{-9}	7.0×10^{-10}	4.7×10^{-10}	3.7×10^{-10}
		S	0.001	2.8×10^{-9}	1.0×10^{-4}	2.2×10^{-9}	1.1×10^{-9}	7.3×10^{-10}	5.0×10^{-10}	3.9×10^{-10}
Y-88	107 d	M	0.001	1.9×10^{-8}	1.0×10^{-4}	1.6×10^{-8}	1.0×10^{-8}	6.7×10^{-9}	4.9×10^{-9}	4.1×10^{-9}
		S	0.001	2.0×10^{-8}	1.0×10^{-4}	1.7×10^{-8}	9.8×10^{-9}	6.6×10^{-9}	5.4×10^{-9}	4.4×10^{-9}

Notes: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.
[a] The f_1 value for strontium for 1 to 15 years old for Type F is 0.4

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Y-90	2.67 d	M	0.001	1.3×10^{-8}	1.0×10^{-4}	8.4×10^{-9}	4.0×10^{-9}	2.6×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
		S	0.001	1.3×10^{-8}	1.0×10^{-4}	8.8×10^{-9}	4.2×10^{-9}	2.7×10^{-9}	1.8×10^{-9}	1.5×10^{-9}
Y-90m	3.19 h	M	0.001	7.2×10^{-10}	1.0×10^{-4}	5.7×10^{-10}	2.8×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	9.5×10^{-11}
		S	0.001	7.5×10^{-10}	1.0×10^{-4}	6.0×10^{-10}	2.9×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	1.0×10^{-10}
Y-91	58.5 d	M	0.001	3.9×10^{-8}	1.0×10^{-4}	3.0×10^{-8}	1.6×10^{-8}	1.1×10^{-8}	8.4×10^{-9}	7.1×10^{-9}
		S	0.001	4.3×10^{-8}	1.0×10^{-4}	3.4×10^{-8}	1.9×10^{-8}	1.3×10^{-8}	1.0×10^{-8}	8.9×10^{-9}
Y-91m	0.828 h	M	0.001	7.0×10^{-11}	1.0×10^{-4}	5.5×10^{-11}	2.9×10^{-11}	1.8×10^{-11}	1.2×10^{-11}	1.0×10^{-11}
		S	0.001	7.4×10^{-11}	1.0×10^{-4}	5.9×10^{-11}	3.1×10^{-11}	2.0×10^{-11}	1.4×10^{-11}	1.1×10^{-11}
Y-92	3.54 h	M	0.001	1.8×10^{-9}	1.0×10^{-4}	1.2×10^{-9}	5.3×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.7×10^{-10}
		S	0.001	1.9×10^{-9}	1.0×10^{-4}	1.2×10^{-9}	5.5×10^{-10}	3.5×10^{-10}	2.1×10^{-10}	1.8×10^{-10}
Y-93	10.1 h	M	0.001	4.4×10^{-9}	1.0×10^{-4}	2.9×10^{-9}	1.3×10^{-9}	8.1×10^{-10}	4.7×10^{-10}	4.0×10^{-10}
		S	0.001	4.6×10^{-9}	1.0×10^{-4}	3.0×10^{-9}	1.4×10^{-9}	8.5×10^{-10}	5.0×10^{-10}	4.2×10^{-10}
Y-94	0.318 h	M	0.001	2.8×10^{-10}	1.0×10^{-4}	1.8×10^{-10}	8.1×10^{-11}	5.0×10^{-11}	3.1×10^{-11}	2.7×10^{-11}
		S	0.001	2.9×10^{-10}	1.0×10^{-4}	1.9×10^{-10}	8.4×10^{-11}	5.2×10^{-11}	3.3×10^{-11}	2.8×10^{-11}
Y-95	0.178 h	M	0.001	1.5×10^{-10}	1.0×10^{-4}	9.8×10^{-11}	4.4×10^{-11}	2.8×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
		S	0.001	1.6×10^{-10}	1.0×10^{-4}	1.0×10^{-10}	4.5×10^{-11}	2.9×10^{-11}	1.8×10^{-11}	1.6×10^{-11}
Zirconium										
Zr-86	16.5 h	F	0.020	2.4×10^{-9}	0.002	1.9×10^{-9}	9.5×10^{-10}	5.9×10^{-10}	3.4×10^{-10}	2.7×10^{-10}
		M	0.020	3.4×10^{-9}	0.002	2.6×10^{-9}	1.3×10^{-9}	8.4×10^{-10}	5.2×10^{-10}	4.2×10^{-10}
		S	0.020	3.5×10^{-9}	0.002	2.7×10^{-9}	1.4×10^{-9}	8.7×10^{-10}	5.4×10^{-10}	4.3×10^{-10}
Zr-88	83.4 d	F	0.020	6.9×10^{-9}	0.002	8.3×10^{-9}	5.6×10^{-9}	4.7×10^{-9}	3.6×10^{-9}	3.5×10^{-9}
		M	0.020	8.5×10^{-9}	0.002	7.8×10^{-9}	5.1×10^{-9}	3.6×10^{-9}	3.0×10^{-9}	2.6×10^{-9}
		S	0.020	1.3×10^{-8}	0.002	1.2×10^{-8}	7.7×10^{-9}	5.2×10^{-9}	4.3×10^{-9}	3.6×10^{-9}
Zr-89	3.27 d	F	0.020	2.6×10^{-9}	0.002	2.0×10^{-9}	9.9×10^{-10}	6.1×10^{-10}	3.6×10^{-10}	2.9×10^{-10}
		M	0.020	3.7×10^{-9}	0.002	2.8×10^{-9}	1.5×10^{-9}	9.6×10^{-10}	6.5×10^{-10}	5.2×10^{-10}
		S	0.020	3.9×10^{-9}	0.002	2.9×10^{-9}	1.5×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	5.5×10^{-10}

Zr-93	1.53 x 10^6 a	F	0.020	3.5 x 10^{-9}	0.002	4.8 x 10^{-9}	5.3 x 10^{-9}	9.7 x 10^{-9}	1.8 x 10^{-8}	2.5 x 10^{-8}
		M	0.020	3.3 x 10^{-9}	0.002	3.1 x 10^{-9}	2.8 x 10^{-9}	4.1 x 10^{-9}	7.5 x 10^{-9}	1.0 x 10^{-8}
		S	0.020	7.0 x 10^{-9}	0.002	6.4 x 10^{-9}	4.5 x 10^{-9}	3.3 x 10^{-9}	3.3 x 10^{-9}	3.3 x 10^{-9}
Zr-95	64.0 d	F	0.020	1.2 x 10^{-8}	0.002	1.1 x 10^{-8}	6.4 x 10^{-9}	4.2 x 10^{-9}	2.8 x 10^{-9}	2.5 x 10^{-9}
		M	0.020	2.0 x 10^{-8}	0.002	1.6 x 10^{-8}	9.7 x 10^{-9}	6.8 x 10^{-9}	5.9 x 10^{-9}	4.8 x 10^{-9}
		S	0.020	2.4 x 10^{-8}	0.002	1.9 x 10^{-8}	1.2 x 10^{-8}	8.3 x 10^{-9}	7.3 x 10^{-9}	5.9 x 10^{-9}
Zr-97	16.9 h	F	0.020	5.0 x 10^{-9}	0.002	3.4 x 10^{-9}	1.5 x 10^{-9}	9.1 x 10^{-10}	4.8 x 10^{-10}	3.9 x 10^{-10}
		M	0.020	7.8 x 10^{-9}	0.002	5.3 x 10^{-9}	2.8 x 10^{-9}	1.8 x 10^{-9}	1.1 x 10^{-9}	9.2 x 10^{-10}
		S	0.020	8.2 x 10^{-9}	0.002	5.6 x 10^{-9}	2.9 x 10^{-9}	1.9 x 10^{-9}	1.2 x 10^{-9}	8.9 x 10^{-10}
Niobium										
Nb-88	0.238 h	F	0.020	1.8 x 10^{-10}	0.010	1.3 x 10^{-10}	6.3 x 10^{-11}	3.9 x 10^{-11}	2.4 x 10^{-11}	1.9 x 10^{-11}
		M	0.020	2.5 x 10^{-10}	0.010	1.8 x 10^{-10}	8.5 x 10^{-11}	5.3 x 10^{-11}	3.3 x 10^{-11}	2.7 x 10^{-11}
		S	0.020	2.6 x 10^{-10}	0.010	1.8 x 10^{-10}	8.7 x 10^{-11}	5.5 x 10^{-11}	3.5 x 10^{-11}	2.8 x 10^{-11}
Nb-89	2.03 h	F	0.020	7.0 x 10^{-10}	0.010	4.8 x 10^{-10}	2.2 x 10^{-10}	1.3 x 10^{-10}	7.4 x 10^{-11}	6.1 x 10^{-11}
		M	0.020	1.1 x 10^{-9}	0.010	7.6 x 10^{-10}	3.6 x 10^{-10}	2.2 x 10^{-10}	1.4 x 10^{-10}	1.1 x 10^{-10}
		S	0.020	1.2 x 10^{-9}	0.010	7.9 x 10^{-10}	3.7 x 10^{-10}	2.3 x 10^{-10}	1.5 x 10^{-10}	1.2 x 10^{-10}
Nb-89	1.10 h	F	0.020	4.0 x 10^{-10}	0.010	2.9 x 10^{-10}	1.4 x 10^{-10}	8.3 x 10^{-11}	4.8 x 10^{-11}	3.9 x 10^{-11}
		M	0.020	6.2 x 10^{-10}	0.010	4.3 x 10^{-10}	2.1 x 10^{-10}	1.3 x 10^{-10}	8.2 x 10^{-11}	6.8 x 10^{-11}
		S	0.020	6.4 x 10^{-10}	0.010	4.4 x 10^{-10}	2.1 x 10^{-10}	1.4 x 10^{-10}	8.6 x 10^{-11}	7.1 x 10^{-11}
Nb-90	14.6 h	F	0.020	3.5 x 10^{-9}	0.010	2.7 x 10^{-9}	1.3 x 10^{-9}	8.2 x 10^{-10}	4.7 x 10^{-10}	3.8 x 10^{-10}
		M	0.020	5.1 x 10^{-9}	0.010	3.9 x 10^{-9}	1.9 x 10^{-9}	1.3 x 10^{-9}	7.8 x 10^{-10}	6.3 x 10^{-10}
		S	0.020	5.3 x 10^{-9}	0.010	4.0 x 10^{-9}	2.0 x 10^{-9}	1.3 x 10^{-9}	8.1 x 10^{-10}	6.6 x 10^{-10}
Nb-93m	13.6 a	F	0.020	1.8 x 10^{-9}	0.010	1.4 x 10^{-9}	7.0 x 10^{-10}	4.4 x 10^{-10}	2.7 x 10^{-10}	2.2 x 10^{-10}
		M	0.020	3.1 x 10^{-9}	0.010	2.4 x 10^{-9}	1.3 x 10^{-9}	8.2 x 10^{-10}	5.9 x 10^{-10}	5.1 x 10^{-10}
		S	0.020	7.4 x 10^{-9}	0.010	6.5 x 10^{-9}	4.0 x 10^{-9}	2.5 x 10^{-9}	1.9 x 10^{-9}	1.8 x 10^{-9}
Nb-94	2.03 x 10^4 a	F	0.020	3.1 x 10^{-8}	0.010	2.7 x 10^{-8}	1.5 x 10^{-8}	1.0 x 10^{-8}	6.7 x 10^{-9}	5.8 x 10^{-9}
		M	0.020	4.3 x 10^{-8}	0.010	3.7 x 10^{-8}	2.3 x 10^{-8}	1.6 x 10^{-8}	1.3 x 10^{-8}	1.1 x 10^{-8}
		S	0.020	1.2 x 10^{-7}	0.010	1.2 x 10^{-7}	8.3 x 10^{-8}	5.8 x 10^{-8}	5.2 x 10^{-8}	4.9 x 10^{-8}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Nb-95	35.1 d	F	0.020	4.1×10^{-9}	0.010	3.1×10^{-9}	1.6×10^{-9}	1.2×10^{-9}	7.5×10^{-10}	5.7×10^{-10}
		M	0.020	6.8×10^{-9}	0.010	5.2×10^{-9}	3.1×10^{-9}	2.2×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
		S	0.020	7.7×10^{-9}	0.010	5.9×10^{-9}	3.6×10^{-9}	2.5×10^{-9}	2.2×10^{-9}	1.8×10^{-9}
Nb-95m	3.61 d	F	0.020	2.3×10^{-9}	0.010	1.6×10^{-9}	7.0×10^{-10}	4.2×10^{-10}	2.4×10^{-10}	2.0×10^{-10}
		M	0.020	4.3×10^{-9}	0.010	3.1×10^{-9}	1.7×10^{-9}	1.2×10^{-9}	1.0×10^{-9}	7.9×10^{-10}
		S	0.020	4.6×10^{-9}	0.010	3.4×10^{-9}	1.9×10^{-9}	1.3×10^{-9}	1.1×10^{-9}	8.8×10^{-10}
Nb-96	23.3 h	F	0.020	3.1×10^{-9}	0.010	2.4×10^{-9}	1.2×10^{-9}	7.3×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
		M	0.020	4.7×10^{-9}	0.010	3.6×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	7.8×10^{-10}	6.3×10^{-10}
		S	0.020	4.9×10^{-9}	0.010	3.7×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	8.3×10^{-10}	6.6×10^{-10}
Nb-97	1.20 h	F	0.020	2.2×10^{-10}	0.010	1.5×10^{-10}	6.8×10^{-11}	4.2×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
		M	0.020	3.7×10^{-10}	0.010	2.5×10^{-10}	1.2×10^{-10}	7.7×10^{-11}	5.2×10^{-11}	4.3×10^{-11}
		S	0.020	3.8×10^{-10}	0.010	2.6×10^{-10}	1.2×10^{-10}	8.1×10^{-11}	5.5×10^{-11}	4.5×10^{-11}
Nb-98	0.858 h	F	0.020	3.4×10^{-10}	0.010	2.4×10^{-10}	1.1×10^{-10}	6.9×10^{-11}	4.1×10^{-11}	3.3×10^{-11}
		M	0.020	5.2×10^{-10}	0.010	3.6×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	6.8×10^{-11}	5.6×10^{-11}
		S	0.020	5.3×10^{-10}	0.010	3.7×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	7.1×10^{-11}	5.8×10^{-11}
Molybdenum										
Mo-90	5.67 h	F	1.000	1.2×10^{-9}	0.800	1.1×10^{-9}	5.3×10^{-10}	3.2×10^{-10}	1.9×10^{-10}	1.5×10^{-10}
		M	0.200	2.6×10^{-9}	0.100	2.0×10^{-9}	9.9×10^{-10}	6.5×10^{-10}	4.2×10^{-10}	3.4×10^{-10}
		S	0.020	2.8×10^{-9}	0.010	2.1×10^{-9}	1.1×10^{-9}	6.9×10^{-10}	4.5×10^{-10}	3.6×10^{-10}
Mo-93	3.50×10^{3} a	F	1.000	3.1×10^{-9}	0.800	2.6×10^{-9}	1.7×10^{-9}	1.3×10^{-9}	1.1×10^{-9}	1.0×10^{-9}
		M	0.200	2.2×10^{-9}	0.100	1.8×10^{-9}	1.1×10^{-9}	7.9×10^{-10}	6.6×10^{-10}	5.9×10^{-10}
		S	0.020	6.0×10^{-9}	0.010	5.8×10^{-9}	4.0×10^{-9}	2.8×10^{-9}	2.4×10^{-9}	2.3×10^{-9}
Mo-93m	6.85 h	F	1.000	7.3×10^{-10}	0.800	6.4×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.6×10^{-11}
		M	0.200	1.2×10^{-9}	0.100	9.7×10^{-10}	5.0×10^{-10}	3.2×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
		S	0.020	1.3×10^{-9}	0.010	1.0×10^{-9}	5.2×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.7×10^{-10}

Mo-99	2.75 d	F	1.000	2.3×10^{-9}	0.800	1.7×10^{-9}	7.7×10^{-9}	4.7×10^{-10}	2.6×10^{-10}	2.2×10^{-10}
		M	0.200	6.0×10^{-9}	0.100	4.4×10^{-9}	2.2×10^{-9}	1.5×10^{-9}	1.1×10^{-9}	8.9×10^{-10}
		S	0.020	6.9×10^{-9}	0.010	4.8×10^{-9}	2.4×10^{-9}	1.7×10^{-9}	1.2×10^{-9}	9.9×10^{-10}
Mo-101	0.244 h	F	1.000	1.4×10^{-10}	0.800	9.7×10^{-11}	4.4×10^{-11}	2.8×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		M	0.200	2.2×10^{-10}	0.100	1.5×10^{-10}	7.0×10^{-11}	4.5×10^{-11}	3.0×10^{-11}	2.5×10^{-11}
		S	0.020	2.3×10^{-10}	0.010	1.6×10^{-10}	7.2×10^{-11}	4.7×10^{-11}	3.1×10^{-11}	2.6×10^{-11}
Technetium										
Tc-93	2.75 h	F	1.000	2.4×10^{-10}	0.800	2.1×10^{-10}	1.1×10^{-10}	6.7×10^{-11}	4.0×10^{-11}	3.2×10^{-11}
		M	0.200	2.7×10^{-10}	0.100	2.3×10^{-10}	1.2×10^{-10}	7.5×10^{-11}	4.4×10^{-11}	3.5×10^{-11}
		S	0.020	2.8×10^{-10}	0.010	2.3×10^{-10}	1.2×10^{-10}	7.6×10^{-11}	4.5×10^{-11}	3.5×10^{-11}
Tc-93m	0.725 h	F	1.000	1.2×10^{-10}	0.800	9.8×10^{-11}	4.9×10^{-11}	2.9×10^{-11}	1.8×10^{-11}	1.4×10^{-11}
		M	0.200	1.4×10^{-10}	0.100	1.1×10^{-10}	5.4×10^{-11}	3.4×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
		S	0.020	1.4×10^{-10}	0.010	1.1×10^{-10}	5.4×10^{-11}	3.4×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
Tc-94	4.88 h	F	1.000	8.9×10^{-10}	0.800	7.5×10^{-10}	3.9×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
		M	0.200	9.8×10^{-10}	0.100	8.1×10^{-10}	4.2×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	1.2×10^{-10}
		S	0.020	9.9×10^{-10}	0.010	8.2×10^{-10}	4.3×10^{-10}	2.7×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
Tc-94m	0.867 h	F	1.000	4.8×10^{-10}	0.800	3.4×10^{-10}	1.6×10^{-10}	8.6×10^{-11}	5.2×10^{-11}	4.1×10^{-11}
		M	0.200	4.4×10^{-10}	0.100	3.0×10^{-10}	1.4×10^{-10}	8.8×10^{-11}	5.5×10^{-11}	4.5×10^{-11}
		S	0.020	4.3×10^{-10}	0.010	3.0×10^{-10}	1.4×10^{-10}	8.8×10^{-11}	5.6×10^{-11}	4.6×10^{-11}
Tc-95	20.0 h	F	1.000	7.5×10^{-10}	0.800	6.3×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.6×10^{-11}
		M	0.200	8.3×10^{-10}	0.100	6.9×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
		S	0.020	8.5×10^{-10}	0.010	7.0×10^{-10}	3.6×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Tc-95m	61.0 d	F	1.000	2.4×10^{-9}	0.800	1.8×10^{-9}	9.3×10^{-10}	5.7×10^{-10}	3.6×10^{-10}	2.9×10^{-10}
		M	0.200	4.9×10^{-9}	0.100	4.0×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.1×10^{-9}	8.8×10^{-10}
		S	0.020	6.0×10^{-9}	0.010	5.0×10^{-9}	2.7×10^{-9}	1.8×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Tc-96	4.28 d	F	1.000	4.2×10^{-9}	0.800	3.4×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	7.0×10^{-10}	5.7×10^{-10}
		M	0.200	4.7×10^{-9}	0.100	3.9×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	8.6×10^{-10}	6.8×10^{-10}
		S	0.020	4.8×10^{-9}	0.010	3.9×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	8.9×10^{-10}	7.0×10^{-10}

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Tc-96m	0.858 h	F	1.000	5.3×10^{-11}	0.800	4.1×10^{-11}	2.1×10^{-11}	1.3×10^{-11}	7.7×10^{-12}	6.2×10^{-12}
		M	0.200	5.6×10^{-11}	0.100	4.4×10^{-11}	2.3×10^{-11}	1.4×10^{-11}	9.3×10^{-12}	7.4×10^{-12}
		S	0.020	5.7×10^{-11}	0.010	4.4×10^{-11}	2.3×10^{-11}	1.5×10^{-11}	9.5×10^{-12}	7.5×10^{-12}
Tc-97	2.60×10^{6} a	F	1.000	5.2×10^{-10}	0.800	3.7×10^{-10}	1.7×10^{-10}	9.4×10^{-11}	5.6×10^{-11}	4.3×10^{-11}
		M	0.200	1.2×10^{-9}	0.100	1.0×10^{-9}	5.7×10^{-10}	3.6×10^{-10}	2.8×10^{-10}	2.2×10^{-10}
		S	0.020	5.0×10^{-9}	0.010	4.8×10^{-9}	3.3×10^{-9}	2.2×10^{-9}	1.9×10^{-9}	1.8×10^{-9}
Tc-97m	87.0 d	F	1.000	3.4×10^{-9}	0.800	2.3×10^{-9}	9.8×10^{-10}	5.6×10^{-10}	3.0×10^{-10}	2.7×10^{-10}
		M	0.200	1.3×10^{-8}	0.100	1.0×10^{-8}	6.1×10^{-9}	4.4×10^{-9}	4.1×10^{-9}	3.2×10^{-9}
		S	0.020	1.6×10^{-8}	0.010	1.3×10^{-8}	7.8×10^{-9}	5.7×10^{-9}	5.2×10^{-9}	4.1×10^{-9}
Tc-98	4.20×10^{6} a	F	1.000	1.0×10^{-8}	0.800	6.8×10^{-9}	3.2×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.7×10^{-10}
		M	0.200	3.5×10^{-8}	0.100	2.9×10^{-8}	1.7×10^{-8}	1.2×10^{-8}	1.0×10^{-8}	8.3×10^{-9}
		S	0.020	1.1×10^{-7}	0.010	1.1×10^{-7}	7.6×10^{-8}	5.4×10^{-8}	4.8×10^{-8}	4.5×10^{-8}
Tc-99	2.13×10^{5} a	F	1.000	4.0×10^{-9}	0.800	2.5×10^{-9}	1.0×10^{-9}	5.9×10^{-10}	3.6×10^{-10}	2.9×10^{-10}
		M	0.200	1.7×10^{-8}	0.100	1.3×10^{-8}	8.0×10^{-9}	5.7×10^{-9}	5.0×10^{-9}	4.0×10^{-9}
		S	0.020	4.1×10^{-8}	0.010	3.7×10^{-8}	2.4×10^{-8}	1.7×10^{-8}	1.5×10^{-8}	1.3×10^{-8}
Tc-99m	6.02 h	F	1.000	1.2×10^{-10}	0.800	8.7×10^{-11}	4.1×10^{-11}	2.4×10^{-11}	1.5×10^{-11}	1.2×10^{-11}
		M	0.200	1.3×10^{-10}	0.100	9.9×10^{-11}	5.1×10^{-11}	3.4×10^{-11}	2.4×10^{-11}	1.9×10^{-11}
		S	0.020	1.3×10^{-10}	0.010	1.0×10^{-10}	5.2×10^{-11}	3.5×10^{-11}	2.5×10^{-11}	2.0×10^{-11}
Tc-101	0.237 h	F	1.000	8.5×10^{-11}	0.800	5.6×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	9.7×10^{-12}	8.2×10^{-12}
		M	0.200	1.1×10^{-10}	0.100	7.1×10^{-11}	3.2×10^{-11}	2.1×10^{-11}	1.4×10^{-11}	1.2×10^{-11}
		S	0.020	1.1×10^{-10}	0.010	7.3×10^{-11}	3.3×10^{-11}	2.2×10^{-11}	1.4×10^{-11}	1.2×10^{-11}
Tc-104	0.303 h	F	1.000	2.7×10^{-11}	0.800	1.8×10^{-10}	8.0×10^{-11}	4.6×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
		M	0.200	2.9×10^{-11}	0.100	1.9×10^{-10}	8.6×10^{-11}	5.4×10^{-11}	3.3×10^{-11}	2.8×10^{-11}
		S	0.020	2.9×10^{-11}	0.010	1.9×10^{-10}	8.7×10^{-11}	5.4×10^{-11}	3.4×10^{-11}	2.9×10^{-11}

Ruthenium										
Ru-94	0.863 h	F	0.100	2.5×10^{-10}	0.050	1.9×10^{-10}	9.0×10^{-11}	5.4×10^{-11}	3.1×10^{-11}	2.5×10^{-11}
		M	0.100	3.8×10^{-10}	0.050	2.8×10^{-10}	1.3×10^{-10}	8.4×10^{-11}	5.2×10^{-11}	4.2×10^{-11}
		S	0.020	4.0×10^{-10}	0.010	2.9×10^{-10}	1.4×10^{-10}	8.7×10^{-11}	5.4×10^{-11}	4.4×10^{-11}
Ru-97	2.90 d	F	0.100	5.5×10^{-10}	0.050	4.4×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	7.7×10^{-11}	6.2×10^{-11}
		M	0.100	7.7×10^{-10}	0.050	6.1×10^{-10}	3.1×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
		S	0.020	8.1×10^{-10}	0.010	6.3×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Ru-103	39.3 d	F	0.100	4.2×10^{-9}	0.050	3.0×10^{-9}	1.5×10^{-9}	9.3×10^{-10}	5.6×10^{-10}	4.8×10^{-10}
		M	0.100	1.1×10^{-8}	0.050	8.4×10^{-9}	5.0×10^{-9}	3.5×10^{-9}	3.0×10^{-9}	2.4×10^{-9}
		S	0.020	1.3×10^{-8}	0.010	1.0×10^{-8}	6.0×10^{-9}	4.2×10^{-9}	3.7×10^{-9}	3.0×10^{-9}
Ru-105	4.44 h	F	0.100	7.1×10^{-10}	0.050	5.1×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	7.9×10^{-11}	6.5×10^{-11}
		M	0.100	1.3×10^{-9}	0.050	9.2×10^{-10}	4.5×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.7×10^{-10}
		S	0.020	1.4×10^{-9}	0.010	9.8×10^{-10}	4.8×10^{-10}	3.2×10^{-10}	2.2×10^{-10}	1.8×10^{-10}
Ru-106	1.01 a	F	0.100	7.2×10^{-8}	0.050	5.4×10^{-8}	2.6×10^{-8}	1.6×10^{-8}	9.2×10^{-9}	7.9×10^{-9}
		M	0.100	1.4×10^{-7}	0.050	1.1×10^{-7}	6.4×10^{-8}	4.1×10^{-8}	3.1×10^{-8}	2.8×10^{-8}
		S	0.020	2.6×10^{-7}	0.010	2.3×10^{-7}	1.4×10^{-7}	9.1×10^{-8}	7.1×10^{-8}	6.6×10^{-8}
Rhodium										
Rh-99	16.0 d	F	0.100	2.6×10^{-9}	0.050	2.0×10^{-9}	9.9×10^{-10}	6.2×10^{-10}	3.8×10^{-10}	3.2×10^{-10}
		M	0.100	4.5×10^{-9}	0.050	3.5×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	9.6×10^{-10}	7.7×10^{-10}
		S	0.100	4.9×10^{-9}	0.050	3.8×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	1.1×10^{-9}	8.7×10^{-10}
Rh-99m	4.70 h	F	0.100	2.4×10^{-10}	0.050	2.0×10^{-10}	1.0×10^{-10}	6.1×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
		M	0.100	3.1×10^{-10}	0.050	2.5×10^{-10}	1.3×10^{-10}	8.0×10^{-11}	4.9×10^{-11}	3.9×10^{-11}
		S	0.100	3.2×10^{-10}	0.050	2.6×10^{-10}	1.3×10^{-10}	8.2×10^{-11}	5.1×10^{-11}	4.0×10^{-11}
Rh-100	20.8 h	F	0.100	2.1×10^{-9}	0.050	1.8×10^{-9}	9.1×10^{-10}	5.6×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
		M	0.100	2.7×10^{-9}	0.050	2.2×10^{-9}	1.1×10^{-9}	7.1×10^{-10}	4.3×10^{-10}	3.4×10^{-10}
		S	0.100	2.8×10^{-9}	0.050	2.2×10^{-9}	1.2×10^{-9}	7.3×10^{-10}	4.4×10^{-10}	3.5×10^{-10}
Rh-101	3.20 a	F	0.100	7.4×10^{-9}	0.050	6.1×10^{-9}	3.5×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.4×10^{-9}
		M	0.100	9.8×10^{-9}	0.050	8.0×10^{-9}	4.9×10^{-9}	3.4×10^{-9}	2.8×10^{-9}	2.3×10^{-9}
		S	0.100	1.9×10^{-8}	0.050	1.7×10^{-8}	1.1×10^{-8}	7.4×10^{-9}	6.2×10^{-9}	5.4×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Rh-101m	4.34 d	F	0.100	8.4×10^{-10}	0.050	6.6×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.7×10^{-11}
		M	0.100	1.3×10^{-9}	0.050	9.8×10^{-10}	5.2×10^{-10}	3.5×10^{-10}	2.5×10^{-10}	1.9×10^{-10}
		S	0.100	1.3×10^{-9}	0.050	1.0×10^{-9}	5.5×10^{-10}	3.7×10^{-10}	2.7×10^{-10}	2.1×10^{-10}
Rh-102	2.90 a	F	0.100	3.3×10^{-8}	0.050	2.8×10^{-8}	1.7×10^{-8}	1.1×10^{-8}	7.9×10^{-9}	7.3×10^{-9}
		M	0.100	3.0×10^{-8}	0.050	2.5×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	7.9×10^{-9}	6.9×10^{-9}
		S	0.100	5.4×10^{-8}	0.050	5.0×10^{-8}	3.5×10^{-8}	2.4×10^{-8}	2.0×10^{-8}	1.7×10^{-8}
Rh-102m	207 d	F	0.100	1.2×10^{-8}	0.050	8.7×10^{-9}	4.4×10^{-9}	2.7×10^{-9}	1.7×10^{-9}	1.5×10^{-9}
		M	0.100	2.0×10^{-8}	0.050	1.6×10^{-8}	9.0×10^{-9}	6.0×10^{-9}	4.7×10^{-9}	4.0×10^{-9}
		S	0.100	3.0×10^{-8}	0.050	2.5×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	8.2×10^{-9}	7.1×10^{-9}
Rh-103m	0.935 h	F	0.100	8.6×10^{-12}	0.500	5.9×10^{-12}	2.7×10^{-12}	1.6×10^{-12}	1.0×10^{-12}	8.6×10^{-13}
		M	0.100	1.9×10^{-11}	0.050	1.2×10^{-11}	6.3×10^{-12}	4.0×10^{-12}	3.0×10^{-12}	2.5×10^{-12}
		S	0.100	2.0×10^{-11}	0.050	1.3×10^{-11}	6.7×10^{-12}	4.3×10^{-12}	3.2×10^{-12}	2.7×10^{-12}
Rh-105	1.47 d	F	0.100	1.0×10^{-9}	0.050	6.9×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	9.6×10^{-11}	8.2×10^{-11}
		M	0.100	2.2×10^{-9}	0.050	1.6×10^{-9}	7.4×10^{-10}	5.2×10^{-10}	4.1×10^{-10}	3.2×10^{-10}
		S	0.100	2.4×10^{-9}	0.050	1.7×10^{-9}	8.0×10^{-10}	5.6×10^{-10}	4.5×10^{-10}	3.5×10^{-10}
Rh-106m	2.20 h	F	0.100	5.7×10^{-10}	0.050	4.5×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	8.0×10^{-11}	6.5×10^{-11}
		M	0.100	8.2×10^{-10}	0.050	6.3×10^{-10}	3.2×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
		S	0.100	8.5×10^{-10}	0.050	6.5×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Rh-107	0.362 h	F	0.100	8.9×10^{-11}	0.050	5.9×10^{-11}	2.6×10^{-11}	1.7×10^{-11}	1.0×10^{-11}	9.0×10^{-12}
		M	0.100	1.4×10^{-10}	0.050	9.3×10^{-11}	4.2×10^{-11}	2.8×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
		S	0.100	1.5×10^{-10}	0.050	9.7×10^{-11}	4.4×10^{-11}	2.9×10^{-11}	1.9×10^{-11}	1.7×10^{-11}
Palladium										
Pd-100	3.63 d	F	0.050	3.9×10^{-9}	0.005	3.0×10^{-9}	1.5×10^{-9}	9.7×10^{-10}	5.8×10^{-10}	4.7×10^{-10}
		M	0.050	5.2×10^{-9}	0.005	4.0×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	9.9×10^{-10}	8.0×10^{-10}
		S	0.050	5.3×10^{-9}	0.005	4.1×10^{-9}	2.2×10^{-9}	1.5×10^{-9}	1.0×10^{-9}	8.5×10^{-10}

Pd-101	8.27 h	F	0.050	3.6×10^{-10}	0.005	2.9×10^{-10}	1.4×10^{-10}	8.6×10^{-11}	4.9×10^{-11}	3.9×10^{-11}
		M	0.050	4.8×10^{-10}	0.005	3.8×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	7.5×10^{-11}	5.9×10^{-11}
		S	0.050	5.0×10^{-10}	0.005	3.9×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	7.8×10^{-11}	6.2×10^{-11}
Pd-103	17.0 d	F	0.050	9.7×10^{-10}	0.005	6.5×10^{-10}	3.0×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	8.9×10^{-11}
		M	0.050	2.3×10^{-9}	0.005	1.6×10^{-9}	9.0×10^{-10}	5.9×10^{-10}	4.5×10^{-10}	3.8×10^{-10}
		S	0.050	2.5×10^{-9}	0.005	1.8×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	5.3×10^{-10}	4.5×10^{-10}
Pd-107	6.50×10^{6} a	F	0.050	2.6×10^{-10}	0.005	1.8×10^{-10}	8.2×10^{-11}	5.2×10^{-11}	3.1×10^{-11}	2.5×10^{-11}
		M	0.050	6.5×10^{-10}	0.005	5.0×10^{-10}	2.6×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	8.5×10^{-11}
		S	0.050	2.2×10^{-9}	0.005	2.0×10^{-9}	1.3×10^{-9}	7.8×10^{-10}	6.2×10^{-10}	5.9×10^{-10}
Pd-109	13.4 h	F	0.050	1.5×10^{-9}	0.005	9.9×10^{-10}	4.2×10^{-10}	2.6×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
		M	0.050	2.6×10^{-9}	0.005	1.8×10^{-9}	8.8×10^{-10}	5.9×10^{-10}	4.3×10^{-10}	3.4×10^{-10}
		S	0.050	2.7×10^{-9}	0.005	1.9×10^{-9}	9.3×10^{-10}	6.3×10^{-10}	4.6×10^{-10}	3.7×10^{-10}
Silver										
Ag-102	0.215 h	F	0.100	1.2×10^{-10}	0.050	8.6×10^{-11}	4.2×10^{-11}	2.6×10^{-11}	1.5×10^{-11}	1.3×10^{-11}
		M	0.100	1.6×10^{-10}	0.050	1.1×10^{-10}	5.5×10^{-11}	3.4×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
		S	0.020	1.6×10^{-10}	0.010	1.2×10^{-10}	5.6×10^{-11}	3.5×10^{-11}	2.2×10^{-11}	1.8×10^{-11}
Ag-103	1.09 h	F	0.100	1.4×10^{-10}	0.050	1.0×10^{-10}	4.9×10^{-11}	3.0×10^{-11}	1.8×10^{-11}	1.4×10^{-11}
		M	0.100	2.2×10^{-10}	0.050	1.6×10^{-10}	7.6×10^{-11}	4.8×10^{-11}	3.2×10^{-11}	2.6×10^{-11}
		S	0.020	2.3×10^{-10}	0.010	1.6×10^{-10}	7.9×10^{-11}	5.1×10^{-11}	3.3×10^{-11}	2.7×10^{-11}
Ag-104	1.15 h	F	0.100	2.3×10^{-10}	0.050	1.9×10^{-10}	9.8×10^{-11}	5.9×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
		M	0.100	2.9×10^{-10}	0.050	2.3×10^{-10}	1.2×10^{-10}	7.4×10^{-11}	4.5×10^{-11}	3.6×10^{-11}
		S	0.020	2.9×10^{-10}	0.010	2.4×10^{-10}	1.2×10^{-10}	7.6×10^{-11}	4.6×10^{-11}	3.7×10^{-11}
Ag-104m	0.558 h	F	0.100	1.6×10^{-10}	0.050	1.1×10^{-10}	5.5×10^{-11}	3.4×10^{-11}	2.0×10^{-11}	1.6×10^{-11}
		M	0.100	2.3×10^{-10}	0.050	1.6×10^{-10}	7.7×10^{-11}	4.8×10^{-11}	3.0×10^{-11}	2.5×10^{-11}
		S	0.020	2.4×10^{-10}	0.010	1.7×10^{-10}	8.0×10^{-11}	5.0×10^{-11}	3.1×10^{-11}	2.6×10^{-11}
Ag-105	41.0 d	F	0.100	3.9×10^{-9}	0.050	3.4×10^{-9}	1.7×10^{-9}	1.0×10^{-9}	6.4×10^{-10}	5.4×10^{-10}
		M	0.100	4.5×10^{-9}	0.050	3.5×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	9.0×10^{-10}	7.3×10^{-10}
		S	0.020	4.5×10^{-9}	0.010	3.6×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	1.0×10^{-9}	8.1×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Ag-106	0.399 h	F	0.100	9.4×10^{-11}	0.050	6.4×10^{-11}	2.9×10^{-11}	1.8×10^{-11}	1.1×10^{-11}	9.1×10^{-12}
		M	0.100	1.4×10^{-10}	0.050	9.5×10^{-11}	4.4×10^{-11}	2.8×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
		S	0.020	1.5×10^{-10}	0.010	9.9×10^{-11}	4.5×10^{-11}	2.9×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
Ag-106m	8.41 d	F	0.100	7.7×10^{-9}	0.050	6.1×10^{-9}	3.2×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
		M	0.100	7.2×10^{-9}	0.050	5.8×10^{-9}	3.2×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
		S	0.020	7.0×10^{-9}	0.010	5.7×10^{-9}	3.2×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Ag-108m	1.27×10^{2} a	F	0.100	3.5×10^{-8}	0.050	2.8×10^{-8}	1.6×10^{-8}	1.0×10^{-8}	6.9×10^{-9}	6.1×10^{-9}
		M	0.100	3.3×10^{-8}	0.050	2.7×10^{-8}	1.7×10^{-8}	1.1×10^{-8}	8.6×10^{-9}	7.4×10^{-9}
		S	0.020	8.9×10^{-8}	0.010	8.7×10^{-8}	6.2×10^{-8}	4.4×10^{-8}	3.9×10^{-8}	3.7×10^{-8}
Ag-110m	250 d	F	0.100	3.5×10^{-8}	0.050	2.8×10^{-8}	1.5×10^{-8}	9.7×10^{-9}	6.3×10^{-9}	5.5×10^{-9}
		M	0.100	3.5×10^{-8}	0.050	2.8×10^{-8}	1.7×10^{-8}	1.2×10^{-8}	9.2×10^{-9}	7.6×10^{-9}
		S	0.020	4.6×10^{-8}	0.010	4.1×10^{-8}	2.6×10^{-8}	1.8×10^{-8}	1.5×10^{-8}	1.2×10^{-8}
Ag-111	7.45 d	F	0.100	4.8×10^{-9}	0.050	3.2×10^{-9}	1.4×10^{-9}	8.8×10^{-10}	4.8×10^{-10}	4.0×10^{-10}
		M	0.100	9.2×10^{-9}	0.050	6.6×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
		S	0.020	9.9×10^{-9}	0.010	7.1×10^{-9}	3.8×10^{-9}	2.7×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Ag-112	3.12 h	F	0.100	9.8×10^{-10}	0.050	6.4×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	9.1×10^{-11}	7.6×10^{-11}
		M	0.100	1.7×10^{-9}	0.050	1.1×10^{-9}	5.1×10^{-10}	3.2×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
		S	0.020	1.8×10^{-9}	0.010	1.2×10^{-9}	5.4×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Ag-115	0.333 h	F	0.100	1.6×10^{-10}	0.050	1.0×10^{-10}	4.6×10^{-11}	2.9×10^{-11}	1.7×10^{-11}	1.5×10^{-11}
		M	0.100	2.5×10^{-10}	0.050	1.7×10^{-10}	7.6×10^{-11}	4.9×10^{-11}	3.2×10^{-11}	2.7×10^{-11}
		S	0.020	2.7×10^{-10}	0.010	1.7×10^{-10}	8.0×10^{-11}	5.2×10^{-11}	3.4×10^{-11}	2.9×10^{-11}
Cadmium										
Cd-104	0.961 h	F	0.100	2.0×10^{-10}	0.050	1.7×10^{-10}	8.7×10^{-11}	5.2×10^{-11}	3.1×10^{-11}	2.4×10^{-11}
		M	0.100	2.6×10^{-10}	0.050	2.1×10^{-10}	1.1×10^{-10}	6.9×10^{-11}	4.2×10^{-11}	3.4×10^{-11}
		S	0.100	2.7×10^{-10}	0.050	2.2×10^{-10}	1.1×10^{-10}	7.0×10^{-11}	4.4×10^{-11}	3.5×10^{-11}

Cd-107	6.49 h	F	0.100	2.3×10^{-10}	0.050	1.7×10^{-10}	7.4×10^{-11}	4.6×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
		M	0.100	5.2×10^{-10}	0.050	3.7×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	8.8×10^{-11}	8.3×10^{-11}
		S	0.100	5.5×10^{-10}	0.050	3.9×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	9.7×10^{-11}	7.7×10^{-11}
Cd-109	1.27 a	F	0.100	4.5×10^{-8}	0.050	3.7×10^{-8}	2.1×10^{-8}	1.4×10^{-8}	9.3×10^{-9}	8.1×10^{-9}
		M	0.100	3.0×10^{-8}	0.050	2.3×10^{-8}	1.4×10^{-8}	9.5×10^{-9}	7.8×10^{-9}	6.6×10^{-9}
		S	0.100	2.7×10^{-8}	0.050	2.1×10^{-8}	1.3×10^{-8}	8.9×10^{-9}	7.6×10^{-9}	6.2×10^{-9}
Cd-113	9.30×10^{15} a	F	0.100	2.6×10^{-7}	0.050	2.4×10^{-7}	1.7×10^{-7}	1.4×10^{-7}	1.2×10^{-7}	1.2×10^{-7}
		M	0.100	1.2×10^{-7}	0.050	1.0×10^{-7}	7.6×10^{-8}	6.1×10^{-8}	5.7×10^{-8}	5.5×10^{-8}
		S	0.100	7.8×10^{-8}	0.050	5.8×10^{-8}	4.1×10^{-8}	3.0×10^{-8}	2.7×10^{-8}	2.6×10^{-8}
Cd-113m	13.6 a	F	0.100	3.0×10^{-7}	0.050	2.7×10^{-7}	1.8×10^{-7}	1.3×10^{-7}	1.1×10^{-7}	1.1×10^{-7}
		M	0.100	1.4×10^{-7}	0.050	1.2×10^{-7}	8.1×10^{-8}	6.0×10^{-8}	5.3×10^{-8}	5.2×10^{-8}
		S	0.100	1.1×10^{-7}	0.050	8.4×10^{-8}	5.5×10^{-8}	3.9×10^{-8}	3.3×10^{-8}	3.1×10^{-8}
Cd-115	2.23 d	F	0.100	4.0×10^{-9}	0.050	2.6×10^{-9}	1.2×10^{-9}	7.5×10^{-10}	4.3×10^{-10}	3.5×10^{-10}
		M	0.100	6.7×10^{-9}	0.050	4.8×10^{-9}	2.4×10^{-9}	1.7×10^{-9}	1.2×10^{-9}	9.8×10^{-10}
		S	0.100	7.2×10^{-9}	0.050	5.1×10^{-9}	2.6×10^{-9}	1.8×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Cd-115m	44.6 d	F	0.100	4.6×10^{-8}	0.050	3.2×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	6.4×10^{-9}	5.3×10^{-9}
		M	0.100	4.0×10^{-8}	0.050	2.5×10^{-8}	1.4×10^{-8}	9.4×10^{-9}	7.3×10^{-9}	6.2×10^{-9}
		S	0.100	3.9×10^{-8}	0.050	3.0×10^{-8}	1.7×10^{-8}	1.1×10^{-8}	8.9×10^{-9}	7.7×10^{-9}
Cd-117	2.49 h	F	0.100	7.4×10^{-10}	0.050	5.2×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	8.1×10^{-11}	6.7×10^{-11}
		M	0.100	1.3×10^{-9}	0.050	9.3×10^{-10}	4.5×10^{-10}	2.9×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
		S	0.100	1.4×10^{-9}	0.050	9.8×10^{-10}	4.8×10^{-10}	3.1×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
Cd-117m	3.36 h	F	0.100	8.9×10^{-10}	0.050	6.7×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.1×10^{-10}	9.4×10^{-11}
		M	0.100	1.5×10^{-9}	0.050	1.1×10^{-9}	5.5×10^{-10}	3.6×10^{-10}	2.4×10^{-10}	2.0×10^{-10}
		S	0.100	1.5×10^{-9}	0.050	1.1×10^{-9}	5.7×10^{-10}	3.8×10^{-10}	2.6×10^{-10}	2.1×10^{-10}
Indium										
In-109	4.20 h	F	0.040	2.6×10^{-10}	0.020	2.1×10^{-10}	1.0×10^{-10}	6.3×10^{-11}	3.6×10^{-11}	2.9×10^{-11}
		M	0.040	3.3×10^{-10}	0.020	2.6×10^{-10}	1.3×10^{-10}	8.4×10^{-11}	5.3×10^{-11}	4.2×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
In-110	4.90 h	F	0.040	8.2×10^{-10}	0.020	7.1×10^{-10}	3.7×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	1.1×10^{-11}
		M	0.040	9.9×10^{-10}	0.020	8.3×10^{-10}	4.4×10^{-10}	2.7×10^{-10}	1.6×10^{-10}	1.3×10^{-11}
In-110	1.15 h	F	0.040	3.0×10^{-10}	0.020	2.1×10^{-10}	9.9×10^{-11}	6.0×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
		M	0.040	4.5×10^{-10}	0.020	3.1×10^{-10}	1.5×10^{-10}	9.2×10^{-11}	5.8×10^{-11}	4.7×10^{-11}
In-111	2.83 d	F	0.040	1.2×10^{-9}	0.020	8.6×10^{-10}	4.2×10^{-10}	2.6×10^{-10}	1.5×10^{-10}	1.3×10^{-10}
		M	0.040	1.5×10^{-9}	0.020	1.2×10^{-9}	6.2×10^{-10}	4.1×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
In-112	0.240 h	F	0.040	4.4×10^{-11}	0.020	3.0×10^{-11}	1.3×10^{-11}	8.7×10^{-12}	5.4×10^{-12}	4.7×10^{-12}
		M	0.040	6.5×10^{-11}	0.020	4.4×10^{-11}	2.0×10^{-11}	1.3×10^{-11}	8.7×10^{-12}	7.4×10^{-12}
In-113m	1.66 h	F	0.040	1.0×10^{-10}	0.020	7.0×10^{-11}	3.2×10^{-11}	2.0×10^{-11}	1.2×10^{-11}	9.7×10^{-12}
		M	0.040	1.6×10^{-10}	0.020	1.1×10^{-10}	5.5×10^{-11}	3.6×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
In-114m	49.5 d	F	0.040	1.2×10^{-7}	0.020	7.7×10^{-8}	3.4×10^{-8}	1.9×10^{-8}	1.1×10^{-8}	9.3×10^{-9}
		M	0.040	4.8×10^{-8}	0.020	3.3×10^{-8}	1.6×10^{-8}	1.0×10^{-8}	7.8×10^{-9}	6.1×10^{-9}
In-115	5.10×10^{15} a	F	0.040	8.3×10^{-7}	0.020	7.8×10^{-7}	5.5×10^{-7}	5.0×10^{-7}	4.2×10^{-7}	3.9×10^{-7}
		M	0.040	3.0×10^{-7}	0.020	2.8×10^{-7}	2.1×10^{-7}	1.9×10^{-7}	1.7×10^{-7}	1.6×10^{-7}
In-115m	4.49 h	F	0.040	2.8×10^{-10}	0.020	1.9×10^{-10}	8.4×10^{-11}	5.1×10^{-11}	2.8×10^{-11}	2.4×10^{-11}
		M	0.040	4.7×10^{-10}	0.020	3.3×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	7.2×10^{-11}	5.9×10^{-11}
In-116m	0.902 h	F	0.040	2.5×10^{-10}	0.020	1.9×10^{-10}	9.2×10^{-11}	5.7×10^{-11}	3.4×10^{-11}	2.8×10^{-11}
		M	0.040	3.6×10^{-10}	0.020	2.7×10^{-10}	1.3×10^{-10}	8.5×10^{-11}	5.6×10^{-11}	4.5×10^{-11}
In-117	0.730 h	F	0.040	1.4×10^{-10}	0.020	9.7×10^{-11}	4.5×10^{-11}	2.8×10^{-11}	1.7×10^{-11}	1.5×10^{-11}
		M	0.040	2.3×10^{-10}	0.020	1.6×10^{-10}	7.5×10^{-11}	5.0×10^{-11}	3.5×10^{-11}	2.9×10^{-11}
In-117m	1.94 h	F	0.040	3.4×10^{-10}	0.020	2.3×10^{-10}	1.0×10^{-10}	6.2×10^{-11}	3.5×10^{-11}	2.9×10^{-11}
		M	0.040	6.0×10^{-10}	0.020	4.0×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	8.7×10^{-11}	7.2×10^{-11}
In-119m	0.300 h	F	0.040	1.2×10^{-10}	0.020	7.3×10^{-11}	3.1×10^{-11}	2.0×10^{-11}	1.2×10^{-11}	1.0×10^{-11}
		M	0.040	1.8×10^{-10}	0.020	1.1×10^{-10}	4.9×10^{-11}	3.2×10^{-11}	2.0×10^{-11}	1.7×10^{-11}

Tin										
Sn-110	4.00 h	F	0.040	1.0×10^{-9}	0.020	7.6×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.2×10^{-10}	9.9×10^{-11}
		M	0.040	1.5×10^{-9}	0.020	1.1×10^{-9}	5.1×10^{-10}	3.2×10^{-10}	1.9×10^{-10}	1.6×10^{-10}
Sn-111	0.588 h	F	0.040	7.7×10^{-11}	0.020	5.4×10^{-11}	2.6×10^{-11}	1.6×10^{-11}	9.4×10^{-12}	7.8×10^{-12}
		M	0.040	1.1×10^{-10}	0.020	8.0×10^{-11}	3.8×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	1.3×10^{-11}
Sn-113	115 d	F	0.040	5.1×10^{-9}	0.020	3.7×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.4×10^{-10}	5.4×10^{-10}
		M	0.040	1.3×10^{-8}	0.020	1.0×10^{-8}	5.8×10^{-9}	4.0×10^{-9}	3.2×10^{-9}	2.7×10^{-9}
Sn-117m	13.6 d	F	0.040	3.3×10^{-9}	0.020	2.2×10^{-9}	1.0×10^{-9}	6.1×10^{-10}	3.4×10^{-10}	2.8×10^{-10}
		M	0.040	1.0×10^{-8}	0.020	7.7×10^{-9}	4.6×10^{-9}	3.4×10^{-9}	3.1×10^{-9}	2.4×10^{-9}
Sn-119m	293 d	F	0.040	3.0×10^{-9}	0.020	2.2×10^{-9}	1.0×10^{-9}	6.0×10^{-10}	3.4×10^{-10}	2.8×10^{-10}
		M	0.040	1.0×10^{-8}	0.020	7.9×10^{-9}	4.7×10^{-9}	3.1×10^{-9}	2.6×10^{-9}	2.2×10^{-9}
Sn-121	1.13 d	F	0.040	7.7×10^{-10}	0.020	5.0×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	7.0×10^{-11}	6.0×10^{-11}
		M	0.040	1.5×10^{-9}	0.020	1.1×10^{-9}	5.1×10^{-10}	3.6×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
Sn-121m	55.0 a	F	0.040	6.9×10^{-9}	0.020	5.4×10^{-9}	2.8×10^{-9}	1.6×10^{-9}	9.4×10^{-10}	8.0×10^{-10}
		M	0.040	1.9×10^{-8}	0.020	1.5×10^{-8}	9.2×10^{-9}	6.4×10^{-9}	5.5×10^{-9}	4.5×10^{-9}
Sn-123	129 d	F	0.040	1.4×10^{-8}	0.020	9.9×10^{-9}	4.5×10^{-9}	2.6×10^{-9}	1.4×10^{-9}	1.2×10^{-9}
		M	0.040	4.0×10^{-8}	0.020	3.1×10^{-8}	1.8×10^{-8}	1.2×10^{-8}	9.5×10^{-9}	8.1×10^{-9}
Sn-123m	0.668 h	F	0.040	1.4×10^{-10}	0.020	8.9×10^{-11}	3.9×10^{-11}	2.5×10^{-11}	1.5×10^{-11}	1.3×10^{-11}
		M	0.040	2.3×10^{-10}	0.020	1.5×10^{-10}	7.0×10^{-11}	4.6×10^{-11}	3.2×10^{-11}	2.7×10^{-11}
Sn-125	9.64 d	F	0.040	1.2×10^{-8}	0.020	8.0×10^{-9}	3.5×10^{-9}	2.0×10^{-9}	1.1×10^{-9}	8.9×10^{-10}
		M	0.040	2.1×10^{-8}	0.020	1.5×10^{-8}	7.6×10^{-9}	5.0×10^{-9}	3.6×10^{-9}	3.1×10^{-9}
Sn-126	1.00×10^{5} a	F	0.040	7.3×10^{-8}	0.020	5.9×10^{-8}	3.2×10^{-8}	2.0×10^{-8}	1.3×10^{-8}	1.1×10^{-8}
		M	0.040	1.2×10^{-7}	0.020	1.0×10^{-7}	6.2×10^{-8}	4.1×10^{-8}	3.3×10^{-8}	2.8×10^{-8}
Sn-127	2.10 h	F	0.040	6.6×10^{-10}	0.020	4.7×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	7.9×10^{-11}	6.5×10^{-11}
		M	0.040	1.0×10^{-9}	0.020	7.4×10^{-10}	3.7×10^{-10}	2.4×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
Sn-128	0.985 h	F	0.040	5.1×10^{-10}	0.020	3.6×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	6.1×10^{-11}	5.0×10^{-11}
		M	0.040	8.0×10^{-10}	0.020	5.5×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	9.2×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Antimony										
Sb-115	0.530 h	F	0.200	8.1×10^{-11}	0.100	5.9×10^{-11}	2.8×10^{-11}	1.7×10^{-11}	1.0×10^{-11}	8.5×10^{-12}
		M	0.020	1.2×10^{-10}	0.010	8.3×10^{-11}	4.0×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	1.3×10^{-11}
		S	0.020	1.2×10^{-10}	0.010	8.6×10^{-11}	4.1×10^{-11}	2.6×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
Sb-116	0.263 h	F	0.200	8.4×10^{-11}	0.100	6.2×10^{-11}	3.0×10^{-11}	1.9×10^{-11}	1.1×10^{-11}	9.1×10^{-12}
		M	0.020	1.1×10^{-10}	0.010	8.2×10^{-11}	4.0×10^{-11}	2.5×10^{-11}	1.5×10^{-11}	1.3×10^{-11}
		S	0.020	1.2×10^{-10}	0.010	8.5×10^{-11}	4.1×10^{-11}	2.6×10^{-11}	1.6×10^{-11}	1.3×10^{-11}
Sb-116m	1.00 h	F	0.200	2.6×10^{-10}	0.100	2.1×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	4.0×10^{-11}	3.2×10^{-11}
		M	0.020	3.6×10^{-10}	0.010	2.8×10^{-10}	1.5×10^{-10}	9.1×10^{-11}	5.9×10^{-11}	4.7×10^{-11}
		S	0.020	3.7×10^{-10}	0.010	2.9×10^{-10}	1.5×10^{-10}	9.4×10^{-11}	6.1×10^{-11}	4.9×10^{-11}
Sb-117	2.80 h	F	0.200	7.7×10^{-11}	0.100	6.0×10^{-11}	2.9×10^{-11}	1.8×10^{-11}	1.0×10^{-11}	8.5×10^{-12}
		M	0.020	1.2×10^{-10}	0.010	9.1×10^{-11}	4.6×10^{-11}	3.0×10^{-11}	2.0×10^{-11}	1.6×10^{-11}
		S	0.020	1.3×10^{-10}	0.010	9.5×10^{-11}	4.8×10^{-11}	3.1×10^{-11}	2.2×10^{-11}	1.7×10^{-11}
Sb-118m	5.00 h	F	0.200	7.3×10^{-10}	0.100	6.2×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	9.3×10^{-11}
		M	0.020	9.3×10^{-10}	0.010	7.6×10^{-10}	4.0×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
		S	0.020	9.5×10^{-10}	0.010	7.8×10^{-10}	4.1×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Sb-119	1.59 d	F	0.020	2.7×10^{-10}	0.100	2.0×10^{-10}	9.4×10^{-11}	5.5×10^{-11}	2.9×10^{-11}	2.3×10^{-11}
		M	0.020	4.0×10^{-10}	0.010	2.8×10^{-10}	1.3×10^{-10}	7.9×10^{-11}	4.4×10^{-11}	3.5×10^{-11}
		S	0.020	4.1×10^{-10}	0.010	2.9×10^{-10}	1.4×10^{-10}	8.2×10^{-11}	4.5×10^{-11}	3.6×10^{-11}
Sb-120	5.76 h	F	0.200	4.1×10^{-9}	0.100	3.3×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	6.7×10^{-10}	5.5×10^{-10}
		M	0.020	6.3×10^{-9}	0.010	5.0×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.3×10^{-9}	1.0×10^{-9}
		S	0.020	6.6×10^{-9}	0.010	5.3×10^{-9}	2.9×10^{-9}	1.9×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Sb-120	0.265 h	F	0.200	4.6×10^{-11}	0.100	3.1×10^{-11}	1.4×10^{-11}	8.9×10^{-12}	5.4×10^{-12}	4.6×10^{-12}
		M	0.020	6.6×10^{-11}	0.010	4.4×10^{-11}	2.0×10^{-11}	1.3×10^{-11}	8.3×10^{-12}	7.0×10^{-12}
		S	0.020	6.8×10^{-11}	0.010	4.6×10^{-11}	2.1×10^{-11}	1.4×10^{-11}	8.7×10^{-12}	7.3×10^{-12}

Sb-122	2.70 d	F	0.200	4.2×10^{-9}	0.100	2.8×10^{-9}	1.4×10^{-9}	8.4×10^{-10}	4.4×10^{-10}	3.6×10^{-10}
		M	0.020	8.3×10^{-9}	0.010	5.7×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.3×10^{-9}	1.0×10^{-9}
		S	0.020	8.8×10^{-9}	0.010	6.1×10^{-9}	3.0×10^{-9}	2.0×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Sb-124	60.2 d	F	0.200	1.2×10^{-8}	0.100	8.8×10^{-9}	4.3×10^{-9}	2.6×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
		M	0.020	3.1×10^{-8}	0.010	2.4×10^{-8}	1.4×10^{-8}	9.6×10^{-9}	7.7×10^{-9}	6.4×10^{-9}
		S	0.020	3.9×10^{-8}	0.010	3.1×10^{-8}	1.8×10^{-8}	1.3×10^{-8}	1.0×10^{-8}	8.6×10^{-9}
Sb-124m	0.337 h	F	0.200	2.7×10^{-11}	0.100	1.9×10^{-11}	9.0×10^{-12}	5.6×10^{-12}	3.4×10^{-12}	2.8×10^{-12}
		M	0.020	4.3×10^{-11}	0.010	3.1×10^{-11}	1.5×10^{-11}	9.6×10^{-12}	6.5×10^{-12}	5.4×10^{-12}
		S	0.020	4.6×10^{-11}	0.010	3.3×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	7.2×10^{-12}	5.9×10^{-12}
Sb-125	2.77 a	F	0.200	8.7×10^{-9}	0.100	6.8×10^{-9}	3.7×10^{-9}	2.3×10^{-9}	1.5×10^{-9}	1.4×10^{-9}
		M	0.020	2.0×10^{-8}	0.010	1.6×10^{-8}	1.0×10^{-8}	6.8×10^{-9}	5.8×10^{-9}	4.8×10^{-9}
		S	0.020	4.2×10^{-8}	0.010	3.8×10^{-8}	2.4×10^{-8}	1.6×10^{-8}	1.4×10^{-8}	1.2×10^{-8}
Sb-126	12.4 d	F	0.200	8.8×10^{-9}	0.100	6.6×10^{-9}	3.3×10^{-9}	2.1×10^{-9}	1.2×10^{-9}	1.0×10^{-9}
		M	0.020	1.7×10^{-8}	0.010	1.3×10^{-8}	7.4×10^{-9}	5.1×10^{-9}	3.5×10^{-9}	2.8×10^{-9}
		S	0.020	1.9×10^{-8}	0.010	1.5×10^{-8}	8.2×10^{-9}	5.0×10^{-9}	4.0×10^{-9}	3.2×10^{-9}
Sb-126m	0.317 h	F	0.200	1.2×10^{-10}	0.100	8.2×10^{-11}	3.8×10^{-11}	2.4×10^{-11}	1.5×10^{-11}	1.2×10^{-11}
		M	0.020	1.7×10^{-10}	0.010	1.2×10^{-10}	5.5×10^{-11}	3.5×10^{-11}	2.3×10^{-11}	1.9×10^{-11}
		S	0.020	1.8×10^{-10}	0.010	1.2×10^{-10}	5.7×10^{-11}	3.7×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
Sb-127	3.85 d	F	0.200	5.1×10^{-9}	0.100	3.5×10^{-9}	1.6×10^{-9}	9.7×10^{-10}	5.2×10^{-10}	4.3×10^{-10}
		M	0.020	1.0×10^{-8}	0.010	7.3×10^{-9}	3.9×10^{-9}	2.7×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
		S	0.020	1.1×10^{-8}	0.010	7.9×10^{-9}	4.2×10^{-9}	3.0×10^{-9}	2.3×10^{-9}	1.9×10^{-9}
Sb-128	9.01 h	F	0.200	2.1×10^{-9}	0.100	1.7×10^{-9}	8.3×10^{-10}	5.1×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
		M	0.020	3.3×10^{-9}	0.010	2.5×10^{-9}	1.2×10^{-9}	7.9×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
		S	0.020	3.4×10^{-9}	0.010	2.6×10^{-9}	1.3×10^{-9}	8.3×10^{-10}	5.2×10^{-10}	4.2×10^{-10}
Sb-128	0.173 h	F	0.200	9.8×10^{-11}	0.100	6.9×10^{-11}	3.2×10^{-11}	2.0×10^{-11}	1.2×10^{-11}	1.0×10^{-11}
		M	0.020	1.3×10^{-10}	0.010	9.2×10^{-11}	4.3×10^{-11}	2.7×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		S	0.020	1.4×10^{-10}	0.010	9.4×10^{-11}	4.4×10^{-11}	2.8×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
Sb-129	4.32 h	F	0.200	1.1×10^{-9}	0.100	8.2×10^{-10}	3.8×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
		M	0.020	2.0×10^{-9}	0.010	1.4×10^{-9}	6.8×10^{-10}	4.4×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
		S	0.020	2.1×10^{-9}	0.010	1.5×10^{-9}	7.2×10^{-10}	4.6×10^{-10}	3.0×10^{-10}	2.5×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Sb-130	0.667 h	F	0.200	3.0×10^{-10}	0.100	2.2×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	4.0×10^{-11}	3.3×10^{-11}
		M	0.020	4.5×10^{-10}	0.010	3.2×10^{-10}	1.6×10^{-10}	9.8×10^{-11}	6.3×10^{-11}	5.1×10^{-11}
		S	0.020	4.6×10^{-10}	0.010	3.3×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	6.5×10^{-11}	5.3×10^{-11}
Sb-131	0.383 h	F	0.200	3.5×10^{-10}	0.100	2.8×10^{-10}	1.4×10^{-10}	7.7×10^{-11}	4.6×10^{-11}	3.5×10^{-11}
		M	0.020	3.9×10^{-10}	0.010	2.6×10^{-10}	1.3×10^{-10}	8.0×10^{-11}	5.3×10^{-11}	4.4×10^{-11}
		S	0.020	3.8×10^{-10}	0.010	2.6×10^{-10}	1.2×10^{-10}	7.9×10^{-11}	5.3×10^{-11}	4.4×10^{-11}
Tellurium										
Te-116	2.49 h	F	0.600	5.3×10^{-10}	0.300	4.2×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.2×10^{-11}	5.8×10^{-11}
		M	0.200	8.6×10^{-10}	0.100	6.4×10^{-10}	3.2×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
		S	0.020	9.1×10^{-10}	0.010	6.7×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Te-121	17.0 d	F	0.600	1.7×10^{-9}	0.300	1.4×10^{-9}	7.2×10^{-10}	4.6×10^{-10}	2.9×10^{-10}	2.4×10^{-11}
		M	0.200	2.3×10^{-9}	0.100	1.9×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	4.7×10^{-10}	3.8×10^{-10}
		S	0.020	2.4×10^{-9}	0.010	2.0×10^{-9}	1.1×10^{-9}	7.2×10^{-10}	5.1×10^{-10}	4.1×10^{-10}
Te-121m	154 d	F	0.600	1.4×10^{-8}	0.300	1.0×10^{-8}	5.3×10^{-9}	3.3×10^{-9}	2.1×10^{-9}	1.8×10^{-9}
		M	0.200	1.9×10^{-8}	0.100	1.5×10^{-8}	8.8×10^{-9}	6.1×10^{-9}	5.1×10^{-9}	4.2×10^{-9}
		S	0.020	2.3×10^{-8}	0.010	1.9×10^{-8}	1.2×10^{-8}	8.1×10^{-9}	6.9×10^{-9}	5.7×10^{-9}
Te-123	1.00×10^{13} a	F	0.600	1.1×10^{-8}	0.300	9.1×10^{-9}	6.2×10^{-9}	4.8×10^{-9}	4.0×10^{-9}	3.9×10^{-9}
		M	0.200	5.6×10^{-9}	0.100	4.4×10^{-9}	3.0×10^{-9}	2.3×10^{-9}	2.0×10^{-9}	1.9×10^{-9}
		S	0.020	5.3×10^{-9}	0.010	5.0×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	2.1×10^{-9}	2.0×10^{-9}
Te-123m	120 d	F	0.600	9.8×10^{-9}	0.300	6.8×10^{-9}	3.4×10^{-9}	1.9×10^{-9}	1.1×10^{-9}	9.5×10^{-10}
		M	0.200	1.8×10^{-8}	0.100	1.3×10^{-8}	8.0×10^{-9}	5.7×10^{-9}	5.0×10^{-9}	4.0×10^{-9}
		S	0.020	2.0×10^{-8}	0.010	1.6×10^{-8}	9.8×10^{-9}	7.1×10^{-9}	6.3×10^{-9}	5.1×10^{-9}
Te-125m	58.0 d	F	0.600	6.2×10^{-9}	0.300	4.2×10^{-9}	2.0×10^{-9}	1.1×10^{-9}	6.1×10^{-10}	5.1×10^{-10}
		M	0.200	1.5×10^{-8}	0.100	1.1×10^{-8}	6.6×10^{-9}	4.8×10^{-9}	4.3×10^{-9}	3.4×10^{-9}
		S	0.020	1.7×10^{-8}	0.010	1.3×10^{-8}	7.8×10^{-9}	5.8×10^{-9}	5.3×10^{-9}	4.2×10^{-9}

Te-127	9.35 h	F	0.600	4.3×10^{-10}	0.300	3.2×10^{-10}	1.4×10^{-10}	8.5×10^{-11}	4.5×10^{-11}	3.9×10^{-11}
		M	0.200	1.0×10^{-9}	0.100	7.3×10^{-10}	3.6×10^{-10}	2.4×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
		S	0.020	1.2×10^{-9}	0.010	7.9×10^{-10}	3.9×10^{-10}	2.6×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
Te-127m	109 d	F	0.600	2.1×10^{-8}	0.300	1.4×10^{-8}	6.5×10^{-9}	3.5×10^{-9}	2.0×10^{-9}	1.5×10^{-9}
		M	0.200	3.5×10^{-8}	0.100	2.6×10^{-8}	1.5×10^{-8}	1.1×10^{-8}	9.2×10^{-9}	7.4×10^{-9}
		S	0.020	4.1×10^{-8}	0.010	3.3×10^{-8}	2.0×10^{-8}	1.4×10^{-8}	1.2×10^{-8}	9.8×10^{-9}
Te-129	1.16 h	F	0.600	1.8×10^{-10}	0.300	1.2×10^{-10}	5.1×10^{-11}	3.2×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
		M	0.200	3.3×10^{-10}	0.100	2.2×10^{-10}	9.9×10^{-11}	6.5×10^{-11}	4.4×10^{-11}	3.7×10^{-11}
		S	0.020	3.5×10^{-10}	0.010	2.3×10^{-10}	1.0×10^{-10}	6.9×10^{-11}	4.7×10^{-11}	3.9×10^{-11}
Te-129m	33.6 h	F	0.600	2.0×10^{-8}	0.300	1.3×10^{-8}	5.8×10^{-9}	3.1×10^{-9}	1.7×10^{-9}	1.3×10^{-9}
		M	0.200	3.5×10^{-8}	0.100	2.6×10^{-8}	1.4×10^{-8}	9.8×10^{-9}	8.0×10^{-9}	6.6×10^{-9}
		S	0.020	3.8×10^{-8}	0.010	2.9×10^{-8}	1.7×10^{-8}	1.2×10^{-8}	9.6×10^{-9}	7.9×10^{-9}
Te-131	0.417 h	F	0.600	2.3×10^{-10}	0.300	2.0×10^{-10}	9.9×10^{-11}	5.3×10^{-11}	3.3×10^{-11}	2.3×10^{-11}
		M	0.200	2.6×10^{-10}	0.100	1.7×10^{-10}	8.1×10^{-11}	5.2×10^{-11}	3.5×10^{-11}	2.8×10^{-11}
		S	0.020	2.4×10^{-10}	0.010	1.6×10^{-10}	7.4×10^{-11}	4.9×10^{-11}	3.3×10^{-11}	2.8×10^{-11}
Te-131m	1.25 d	F	0.600	8.7×10^{-9}	0.300	7.6×10^{-9}	3.9×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	8.6×10^{-10}
		M	0.200	7.9×10^{-9}	0.100	5.8×10^{-9}	3.0×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	9.4×10^{-10}
		S	0.020	7.0×10^{-9}	0.010	5.1×10^{-9}	2.6×10^{-9}	1.8×10^{-9}	1.1×10^{-9}	9.1×10^{-10}
Te-132	3.26 d	F	0.600	2.2×10^{-8}	0.300	1.8×10^{-8}	8.5×10^{-9}	4.2×10^{-9}	2.6×10^{-9}	1.8×10^{-9}
		M	0.200	1.6×10^{-8}	0.100	1.3×10^{-8}	6.4×10^{-9}	4.0×10^{-9}	2.6×10^{-9}	2.0×10^{-9}
		S	0.020	1.5×10^{-8}	0.010	1.1×10^{-8}	5.8×10^{-9}	3.8×10^{-9}	2.5×10^{-9}	2.0×10^{-9}
Te-133	0.207 h	F	0.600	2.4×10^{-10}	0.300	2.1×10^{-10}	9.6×10^{-11}	4.6×10^{-11}	2.8×10^{-11}	1.9×10^{-11}
		M	0.200	2.0×10^{-10}	0.100	1.3×10^{-10}	6.1×10^{-11}	3.8×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
		S	0.020	1.7×10^{-10}	0.010	1.2×10^{-10}	5.4×10^{-11}	3.5×10^{-11}	2.2×10^{-11}	1.9×10^{-11}
Te-133m	0.923 h	F	0.600	1.0×10^{-9}	0.300	8.9×10^{-10}	4.1×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	8.1×10^{-11}
		M	0.200	8.5×10^{-10}	0.100	5.8×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.7×10^{-11}
		S	0.020	7.4×10^{-10}	0.010	5.1×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	8.4×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Te-134	0.696 h	F	0.600	4.7×10^{-10}	0.300	3.7×10^{-10}	1.8×10^{-10}	1.0×10^{-10}	6.0×10^{-11}	4.7×10^{-11}
		M	0.200	5.5×10^{-10}	0.100	3.9×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	8.1×10^{-11}	6.6×10^{-11}
		S	0.020	5.6×10^{-10}	0.010	4.0×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	8.4×10^{-11}	6.8×10^{-11}
Iodine										
I-120	1.35 h	F	1.000	1.3×10^{-9}	1.000	1.0×10^{-9}	4.8×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	1.0×10^{-10}
		M	0.200	1.1×10^{-9}	0.100	7.3×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
		S	0.020	1.0×10^{-9}	0.010	6.9×10^{-10}	3.2×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	1.0×10^{-10}
I-120m	0.883 h	F	1.000	8.6×10^{-10}	1.000	6.9×10^{-10}	3.3×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	8.2×10^{-11}
		M	0.200	8.2×10^{-10}	0.100	5.9×10^{-10}	2.9×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	8.7×10^{-11}
		S	0.020	8.2×10^{-10}	0.010	5.8×10^{-10}	2.8×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	8.8×10^{-11}
I-121	2.12 h	F	1.000	2.3×10^{-10}	1.000	2.1×10^{-10}	1.1×10^{-10}	6.0×10^{-11}	3.8×10^{-11}	2.7×10^{-11}
		M	0.200	2.1×10^{-10}	0.100	1.5×10^{-10}	7.8×10^{-11}	4.9×10^{-11}	3.2×10^{-11}	2.5×10^{-11}
		S	0.020	1.9×10^{-10}	0.010	1.4×10^{-10}	7.0×10^{-11}	4.5×10^{-11}	3.0×10^{-11}	2.4×10^{-11}
I-123	13.2 h	F	1.000	8.7×10^{-10}	1.100	7.9×10^{-10}	3.8×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	7.4×10^{-11}
		M	0.200	5.3×10^{-10}	0.100	3.9×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	8.2×10^{-11}	6.4×10^{-11}
		S	0.020	4.3×10^{-10}	0.010	3.2×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	7.6×10^{-11}	6.0×10^{-11}
I-124	4.18 d	F	1.000	4.7×10^{-8}	1.000	4.5×10^{-8}	2.2×10^{-8}	1.1×10^{-8}	6.7×10^{-9}	4.4×10^{-9}
		M	0.200	1.4×10^{-8}	0.100	9.3×10^{-9}	4.6×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.2×10^{-9}
		S	0.020	6.2×10^{-9}	0.010	4.4×10^{-9}	2.2×10^{-9}	1.4×10^{-9}	9.4×10^{-10}	7.7×10^{-10}
I-125	60.1 d	F	1.000	2.0×10^{-8}	1.000	2.3×10^{-8}	1.5×10^{-8}	1.1×10^{-8}	7.2×10^{-9}	5.1×10^{-9}
		M	0.200	6.9×10^{-9}	0.100	5.6×10^{-9}	3.6×10^{-9}	2.6×10^{-9}	1.8×10^{-9}	1.4×10^{-9}
		S	0.020	2.4×10^{-9}	0.010	1.8×10^{-9}	1.0×10^{-9}	6.7×10^{-10}	4.8×10^{-10}	3.8×10^{-10}
I-126	13.0 d	F	1.000	8.1×10^{-8}	1.000	8.3×10^{-8}	4.5×10^{-8}	2.4×10^{-8}	1.5×10^{-8}	9.8×10^{-9}
		M	0.200	2.4×10^{-8}	0.100	1.7×10^{-8}	9.5×10^{-9}	5.5×10^{-9}	3.8×10^{-9}	2.7×10^{-9}
		S	0.020	8.3×10^{-9}	0.010	5.9×10^{-9}	3.3×10^{-9}	2.2×10^{-9}	1.8×10^{-9}	1.4×10^{-9}

I-128	0.416 h	F	1.000	1.5×10^{-10}	1.000	1.1×10^{-10}	4.7×10^{-11}	2.7×10^{-11}	1.6×10^{-11}	1.3×10^{-11}
		M	0.200	1.9×10^{-10}	0.100	1.2×10^{-10}	5.3×10^{-11}	3.4×10^{-11}	2.2×10^{-11}	1.9×10^{-11}
		S	0.020	1.9×10^{-10}	0.010	1.2×10^{-10}	5.4×10^{-11}	3.5×10^{-11}	2.3×10^{-11}	2.0×10^{-11}
I-129	1.57×10^{7} a	F	1.000	7.2×10^{-8}	1.000	8.6×10^{-8}	6.1×10^{-8}	6.7×10^{-8}	4.6×10^{-8}	3.6×10^{-8}
		M	0.200	3.6×10^{-8}	0.100	3.3×10^{-8}	2.4×10^{-8}	2.4×10^{-8}	1.9×10^{-8}	1.5×10^{-8}
		S	0.020	2.9×10^{-8}	0.010	2.6×10^{-8}	1.8×10^{-8}	1.3×10^{-8}	1.1×10^{-8}	9.8×10^{-9}
I-130	12.4 h	F	1.000	8.2×10^{-9}	1.000	7.4×10^{-9}	3.5×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.7×10^{-10}
		M	0.200	4.3×10^{-9}	0.100	3.1×10^{-9}	1.5×10^{-9}	9.2×10^{-10}	5.8×10^{-10}	4.5×10^{-10}
		S	0.020	3.3×10^{-9}	0.010	2.4×10^{-9}	1.2×10^{-9}	7.9×10^{-10}	5.1×10^{-10}	4.1×10^{-10}
I-131	8.04 d	F	1.000	7.2×10^{-8}	1.000	7.2×10^{-8}	3.7×10^{-8}	1.9×10^{-8}	1.1×10^{-8}	7.4×10^{-9}
		M	0.200	2.2×10^{-8}	0.100	1.5×10^{-8}	8.2×10^{-9}	4.7×10^{-9}	3.4×10^{-9}	2.4×10^{-9}
		S	0.020	8.8×10^{-9}	0.010	6.2×10^{-9}	3.5×10^{-9}	2.4×10^{-9}	2.0×10^{-9}	1.6×10^{-9}
I-132	2.30 h	F	1.000	1.1×10^{-9}	1.000	9.6×10^{-10}	4.5×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	9.4×10^{-11}
		M	0.200	9.9×10^{-10}	0.100	7.3×10^{-10}	3.6×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
		S	0.020	9.3×10^{-10}	0.010	6.8×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
I-132m	1.39 h	F	1.000	9.6×10^{-10}	1.000	8.4×10^{-10}	4.0×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	7.9×10^{-11}
		M	0.200	7.2×10^{-10}	0.100	5.3×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.7×10^{-11}
		S	0.020	6.6×10^{-10}	0.010	4.8×10^{-10}	2.4×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.5×10^{-11}
I-133	20.8 h	F	1.000	1.9×10^{-8}	1.000	1.8×10^{-8}	8.3×10^{-9}	3.8×10^{-9}	2.2×10^{-9}	1.5×10^{-9}
		M	0.200	6.6×10^{-9}	0.100	4.4×10^{-9}	2.1×10^{-9}	1.2×10^{-9}	7.4×10^{-10}	5.5×10^{-10}
		S	0.020	3.8×10^{-9}	0.010	2.9×10^{-9}	1.4×10^{-9}	9.0×10^{-10}	5.3×10^{-10}	4.3×10^{-10}
I-134	0.876 h	F	1.000	4.6×10^{-10}	1.000	3.7×10^{-10}	1.8×10^{-10}	9.7×10^{-11}	5.9×10^{-11}	4.5×10^{-11}
		M	0.200	4.8×10^{-10}	0.100	3.4×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	6.7×10^{-11}	5.4×10^{-11}
		S	0.020	4.8×10^{-10}	0.010	3.4×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	6.8×10^{-11}	5.5×10^{-11}
I-135	6.61 h	F	1.000	4.1×10^{-9}	1.000	3.7×10^{-9}	1.7×10^{-9}	7.9×10^{-10}	4.8×10^{-10}	3.2×10^{-10}
		M	0.200	2.2×10^{-9}	0.100	1.6×10^{-9}	7.8×10^{-10}	4.7×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
		S	0.020	1.8×10^{-9}	0.010	1.3×10^{-9}	6.5×10^{-10}	4.2×10^{-10}	2.7×10^{-10}	2.2×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Cesium										
Cs-125	0.750 h	F	1.000	1.2×10^{-10}	1.000	8.3×10^{-11}	3.9×10^{-11}	2.4×10^{-11}	1.4×10^{-11}	1.2×10^{-11}
		M	0.200	2.0×10^{-10}	0.100	1.4×10^{-10}	6.5×10^{-11}	4.2×10^{-11}	2.7×10^{-11}	2.2×10^{-11}
		S	0.020	2.1×10^{-10}	0.010	1.4×10^{-10}	6.8×10^{-11}	4.4×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
Cs-127	6.25 h	F	1.000	1.6×10^{-10}	1.000	1.3×10^{-10}	6.9×10^{-11}	4.2×10^{-11}	2.5×10^{-11}	2.0×10^{-11}
		M	0.200	2.8×10^{-10}	0.100	2.2×10^{-10}	1.1×10^{-10}	7.3×10^{-11}	4.6×10^{-11}	3.6×10^{-11}
		S	0.020	3.0×10^{-10}	0.010	2.3×10^{-10}	1.2×10^{-10}	7.6×10^{-11}	4.8×10^{-11}	3.8×10^{-11}
Cs-129	1.34 d	F	1.000	3.4×10^{-10}	1.000	2.8×10^{-10}	1.4×10^{-10}	8.7×10^{-11}	5.2×10^{-11}	4.2×10^{-11}
		M	0.200	5.7×10^{-10}	0.100	4.6×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	9.1×10^{-11}	7.3×10^{-11}
		S	0.020	6.3×10^{-10}	0.010	4.9×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	9.7×10^{-11}	7.7×10^{-11}
Cs-130	0.498 h	F	1.000	8.3×10^{-11}	1.000	5.6×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	9.4×10^{-12}	7.8×10^{-12}
		M	0.200	1.3×10^{-10}	0.100	8.7×10^{-11}	4.0×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	1.4×10^{-11}
		S	0.020	1.4×10^{-10}	0.010	9.0×10^{-11}	4.1×10^{-11}	2.6×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
Cs-131	9.69 d	F	1.000	2.4×10^{-10}	1.000	1.7×10^{-10}	8.4×10^{-11}	5.3×10^{-11}	3.2×10^{-11}	2.7×10^{-11}
		M	0.200	3.5×10^{-10}	0.100	2.6×10^{-10}	1.4×10^{-10}	8.5×10^{-11}	5.5×10^{-11}	4.4×10^{-11}
		S	0.020	3.8×10^{-10}	0.010	2.8×10^{-10}	1.4×10^{-10}	9.1×10^{-11}	5.9×10^{-11}	4.7×10^{-11}
Cs-132	6.48 d	F	1.000	1.5×10^{-9}	1.000	1.2×10^{-9}	6.4×10^{-10}	4.1×10^{-10}	2.7×10^{-10}	2.3×10^{-10}
		M	0.200	1.9×10^{-9}	0.100	1.5×10^{-9}	8.4×10^{-10}	5.4×10^{-10}	3.7×10^{-10}	2.9×10^{-10}
		S	0.020	2.0×10^{-9}	0.010	1.6×10^{-9}	8.7×10^{-10}	5.6×10^{-10}	3.8×10^{-10}	3.0×10^{-10}
Cs-134	2.06 a	F	1.000	1.1×10^{-8}	1.000	7.3×10^{-9}	5.2×10^{-9}	5.3×10^{-9}	6.3×10^{-9}	6.6×10^{-9}
		M	0.200	3.2×10^{-8}	0.100	2.6×10^{-8}	1.6×10^{-8}	1.2×10^{-8}	1.1×10^{-8}	9.1×10^{-9}
		S	0.020	7.0×10^{-8}	0.010	6.3×10^{-8}	4.1×10^{-8}	2.8×10^{-8}	2.3×10^{-8}	2.0×10^{-8}
Cs-134m	2.90 h	F	1.000	1.3×10^{-10}	1.000	8.6×10^{-11}	3.8×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	1.4×10^{-11}
		M	0.200	3.3×10^{-10}	0.100	2.3×10^{-10}	1.2×10^{-10}	8.3×10^{-11}	6.6×10^{-11}	5.4×10^{-11}
		S	0.020	3.6×10^{-10}	0.010	2.5×10^{-10}	1.3×10^{-10}	9.2×10^{-11}	7.4×10^{-11}	6.0×10^{-11}

Cs-135	2.30 x 10^6 a	F	1.000	1.7 x 10^{-9}	1.000	9.9 x 10^{-10}	6.2 x 10^{-10}	6.1 x 10^{-10}	6.8 x 10^{-10}	6.9 x 10^{-10}
		M	0.200	1.2 x 10^{-8}	0.100	9.3 x 10^{-9}	5.7 x 10^{-9}	4.1 x 10^{-9}	3.8 x 10^{-9}	3.1 x 10^{-9}
		S	0.020	2.7 x 10^{-8}	0.010	2.4 x 10^{-8}	1.6 x 10^{-8}	1.1 x 10^{-8}	9.5 x 10^{-9}	8.6 x 10^{-9}
Cs-135m	0.883 h	F	1.000	9.2 x 10^{-11}	1.000	7.8 x 10^{-11}	4.1 x 10^{-11}	2.4 x 10^{-11}	1.5 x 10^{-11}	1.2 x 10^{-11}
		M	0.200	1.2 x 10^{-10}	0.100	9.9 x 10^{-11}	5.2 x 10^{-11}	3.2 x 10^{-11}	1.9 x 10^{-11}	1.5 x 10^{-11}
		S	0.020	1.2 x 10^{-10}	0.010	1.0 x 10^{-10}	5.3 x 10^{-11}	3.3 x 10^{-11}	2.0 x 10^{-11}	1.6 x 10^{-11}
Cs-136	13.1 d	F	1.000	7.3 x 10^{-9}	1.000	5.2 x 10^{-9}	2.9 x 10^{-9}	2.0 x 10^{-9}	1.4 x 10^{-9}	1.2 x 10^{-9}
		M	0.200	1.3 x 10^{-8}	0.100	1.0 x 10^{-8}	6.0 x 10^{-9}	3.7 x 10^{-9}	3.1 x 10^{-9}	2.5 x 10^{-9}
		S	0.020	1.5 x 10^{-8}	0.010	1.1 x 10^{-8}	5.7 x 10^{-9}	4.1 x 10^{-9}	3.5 x 10^{-9}	2.8 x 10^{-9}
Cs-137	30.0 a	F	1.000	8.8 x 10^{-9}	1.000	5.4 x 10^{-9}	3.6 x 10^{-9}	3.7 x 10^{-9}	4.4 x 10^{-9}	4.6 x 10^{-9}
		M	0.200	3.6 x 10^{-8}	0.100	2.9 x 10^{-8}	1.8 x 10^{-8}	1.3 x 10^{-8}	1.1 x 10^{-8}	9.7 x 10^{-9}
		S	0.020	1.1 x 10^{-7}	0.010	1.0 x 10^{-7}	7.0 x 10^{-8}	4.8 x 10^{-8}	4.2 x 10^{-8}	3.9 x 10^{-8}
Cs-138	0.536 h	F	1.000	2.6 x 10^{-10}	1.000	1.8 x 10^{-10}	8.1 x 10^{-11}	5.0 x 10^{-11}	2.9 x 10^{-11}	2.4 x 10^{-11}
		M	0.200	4.0 x 10^{-10}	0.100	2.7 x 10^{-10}	1.3 x 10^{-10}	7.8 x 10^{-11}	4.9 x 10^{-11}	4.1 x 10^{-11}
		S	0.020	4.2 x 10^{-10}	0.010	2.8 x 10^{-10}	1.3 x 10^{-10}	8.2 x 10^{-11}	5.1 x 10^{-11}	4.3 x 10^{-11}
Barium[a]										
Ba-126	1.61 h	F	0.600	6.7 x 10^{-10}	0.200	5.2 x 10^{-10}	2.4 x 10^{-10}	1.4 x 10^{-10}	6.9 x 10^{-11}	7.4 x 10^{-11}
		M	0.200	1.0 x 10^{-9}	0.100	7.0 x 10^{-10}	3.2 x 10^{-10}	2.0 x 10^{-10}	1.2 x 10^{-10}	1.0 x 10^{-10}
		S	0.020	1.1 x 10^{-9}	0.010	7.2 x 10^{-10}	3.3 x 10^{-10}	2.1 x 10^{-10}	1.3 x 10^{-10}	1.1 x 10^{-10}
Ba-128	2.43 d	F	0.600	5.9 x 10^{-9}	0.200	5.4 x 10^{-9}	2.5 x 10^{-9}	1.4 x 10^{-9}	7.4 x 10^{-10}	7.6 x 10^{-10}
		M	0.200	1.1 x 10^{-8}	0.100	7.8 x 10^{-9}	3.7 x 10^{-9}	2.4 x 10^{-9}	1.5 x 10^{-9}	1.3 x 10^{-9}
		S	0.020	1.2 x 10^{-8}	0.010	8.3 x 10^{-9}	4.0 x 10^{-9}	2.6 x 10^{-9}	1.6 x 10^{-9}	1.4 x 10^{-9}
Ba-131	11.8 d	F	0.600	2.1 x 10^{-9}	0.200	1.4 x 10^{-9}	7.1 x 10^{-10}	4.7 x 10^{-10}	3.1 x 10^{-10}	2.2 x 10^{-10}
		M	0.200	3.7 x 10^{-9}	0.100	3.1 x 10^{-9}	1.6 x 10^{-9}	1.1 x 10^{-9}	9.7 x 10^{-10}	7.6 x 10^{-10}
		S	0.020	4.0 x 10^{-9}	0.010	3.0 x 10^{-9}	1.8 x 10^{-9}	1.3 x 10^{-9}	1.1 x 10^{-9}	8.7 x 10^{-10}
Ba-131m	0.243 h	F	0.600	2.7 x 10^{-11}	0.200	2.1 x 10^{-11}	1.0 x 10^{-11}	6.7 x 10^{-12}	4.7 x 10^{-12}	4.0 x 10^{-12}
		M	0.200	4.8 x 10^{-11}	0.100	3.3 x 10^{-11}	1.7 x 10^{-11}	1.2 x 10^{-11}	9.0 x 10^{-12}	7.4 x 10^{-12}
		S	0.020	5.0 x 10^{-11}	0.010	3.5 x 10^{-11}	1.8 x 10^{-11}	1.2 x 10^{-11}	9.5 x 10^{-12}	7.8 x 10^{-12}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Ba-133	10.7 a	F	0.600	1.1×10^{-8}	0.200	4.5×10^{-9}	2.6×10^{-9}	3.7×10^{-9}	6.0×10^{-9}	1.5×10^{-9}
		M	0.200	1.5×10^{-8}	0.100	1.0×10^{-8}	6.4×10^{-9}	5.1×10^{-9}	5.5×10^{-9}	3.1×10^{-9}
		S	0.020	3.2×10^{-8}	0.010	2.9×10^{-8}	2.0×10^{-8}	1.3×10^{-8}	1.1×10^{-8}	1.0×10^{-8}
Ba-133m	1.62 d	F	0.600	1.4×10^{-9}	0.200	1.1×10^{-9}	4.9×10^{-10}	3.1×10^{-10}	1.5×10^{-10}	1.8×10^{-10}
		M	0.200	3.0×10^{-9}	0.100	2.2×10^{-9}	1.0×10^{-9}	6.9×10^{-10}	5.2×10^{-10}	4.2×10^{-10}
		S	0.020	3.1×10^{-9}	0.010	2.4×10^{-9}	1.1×10^{-9}	7.6×10^{-10}	5.8×10^{-10}	4.6×10^{-10}
Ba-135m	1.20 d	F	0.600	1.1×10^{-9}	0.200	1.0×10^{-9}	4.6×10^{-10}	2.5×10^{-10}	1.2×10^{-10}	1.4×10^{-10}
		M	0.200	2.4×10^{-9}	0.100	1.8×10^{-9}	8.9×10^{-10}	5.4×10^{-10}	4.1×10^{-10}	3.3×10^{-10}
		S	0.020	2.7×10^{-9}	0.010	1.9×10^{-9}	8.6×10^{-10}	5.9×10^{-10}	4.5×10^{-10}	3.6×10^{-10}
Ba-139	1.38 h	F	0.600	3.3×10^{-10}	0.200	2.4×10^{-10}	1.1×10^{-10}	6.0×10^{-11}	3.1×10^{-11}	3.4×10^{-11}
		M	0.200	5.4×10^{-10}	0.100	3.5×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	6.6×10^{-11}	5.6×10^{-11}
		S	0.020	5.7×10^{-10}	0.010	3.6×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	7.0×10^{-11}	5.9×10^{-11}
Ba-140	12.7 d	F	0.600	1.4×10^{-8}	0.200	7.8×10^{-9}	3.6×10^{-9}	2.4×10^{-9}	1.6×10^{-9}	1.0×10^{-9}
		M	0.200	2.7×10^{-8}	0.100	2.0×10^{-8}	1.1×10^{-8}	7.6×10^{-9}	6.2×10^{-9}	5.1×10^{-9}
		S	0.020	2.9×10^{-8}	0.010	2.2×10^{-8}	1.2×10^{-8}	8.6×10^{-9}	7.1×10^{-9}	5.8×10^{-9}
Ba-141	0.305 h	F	0.600	1.9×10^{-10}	0.200	1.4×10^{-10}	6.4×10^{-11}	3.8×10^{-11}	2.1×10^{-11}	2.1×10^{-11}
		M	0.200	3.0×10^{-10}	0.100	2.0×10^{-10}	9.3×10^{-11}	5.9×10^{-11}	3.8×10^{-11}	3.2×10^{-11}
		S	0.020	3.2×10^{-10}	0.010	2.1×10^{-10}	9.7×10^{-11}	6.2×10^{-11}	4.0×10^{-11}	3.4×10^{-11}
Ba-142	0.177 h	F	0.600	1.3×10^{-10}	0.200	9.6×10^{-11}	4.5×10^{-11}	2.7×10^{-11}	1.6×10^{-11}	1.5×10^{-11}
		M	0.200	1.8×10^{-10}	0.100	1.3×10^{-10}	6.1×10^{-11}	3.9×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
		S	0.020	1.9×10^{-10}	0.010	1.3×10^{-10}	6.2×10^{-11}	4.0×10^{-11}	2.6×10^{-11}	2.2×10^{-11}
Lanthanum										
La-131	0.983 h	F	0.005	1.2×10^{-10}	5.0×10^{-4}	8.7×10^{-11}	4.2×10^{-11}	2.6×10^{-11}	1.5×10^{-11}	1.3×10^{-11}
		M	0.005	1.8×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.4×10^{-11}	4.1×10^{-11}	2.8×10^{-11}	2.3×10^{-11}

La-132	4.80 h	F	0.005	1.0×10^{-9}	5.0×10^{-4}	7.7×10^{-10}	3.7×10^{-10}	2.2×10^{-10}	1.2×10^{-10}	1.0×10^{-10}
		M	0.005	1.5×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	5.4×10^{-10}	3.4×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
La-135	19.5 h	F	0.005	1.0×10^{-9}	5.0×10^{-4}	7.7×10^{-11}	3.8×10^{-11}	2.3×10^{-11}	1.3×10^{-11}	1.0×10^{-11}
		M	0.005	1.3×10^{-10}	5.0×10^{-4}	1.0×10^{-10}	4.9×10^{-11}	3.0×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
La-137	6.00×10^{4} a	F	0.005	2.5×10^{-8}	5.0×10^{-4}	2.3×10^{-8}	1.5×10^{-8}	1.1×10^{-8}	8.9×10^{-9}	8.7×10^{-9}
		M	0.005	8.6×10^{-9}	5.0×10^{-4}	8.1×10^{-9}	5.6×10^{-9}	4.0×10^{-9}	3.6×10^{-9}	3.6×10^{-9}
La-138	1.35×10^{11} a	F	0.005	3.7×10^{-7}	5.0×10^{-4}	3.5×10^{-7}	2.4×10^{-7}	1.8×10^{-7}	1.6×10^{-7}	1.5×10^{-7}
		M	0.005	1.3×10^{-7}	5.0×10^{-4}	1.2×10^{-7}	9.1×10^{-8}	6.8×10^{-8}	6.4×10^{-8}	6.4×10^{-8}
La-140	1.68 d	F	0.005	5.8×10^{-9}	5.0×10^{-4}	4.2×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	6.9×10^{-10}	5.7×10^{-10}
		M	0.005	8.8×10^{-9}	5.0×10^{-4}	6.3×10^{-9}	3.1×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
La-141	3.93 h	F	0.005	8.6×10^{-10}	5.0×10^{-4}	5.5×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	7.5×10^{-11}	6.3×10^{-11}
		M	0.005	1.4×10^{-9}	5.0×10^{-4}	9.3×10^{-10}	4.3×10^{-10}	2.8×10^{-10}	1.8×10^{-10}	1.5×10^{-10}
La-142	1.54 h	F	0.005	5.3×10^{-10}	5.0×10^{-4}	3.8×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	6.3×10^{-11}	5.2×10^{-11}
		M	0.005	8.1×10^{-10}	5.0×10^{-4}	5.7×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.9×10^{-11}
La-143	0.237 h	F	0.005	1.4×10^{-10}	5.0×10^{-4}	8.6×10^{-11}	3.7×10^{-11}	2.3×10^{-11}	1.4×10^{-11}	1.2×10^{-11}
		M	0.005	2.1×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.0×10^{-11}	3.9×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
Cerium										
Ce-134	3.00 d	F	0.005	7.6×10^{-9}	5.0×10^{-4}	5.3×10^{-9}	2.3×10^{-9}	1.4×10^{-9}	7.7×10^{-10}	5.7×10^{-10}
		M	0.005	1.1×10^{-8}	5.0×10^{-4}	7.6×10^{-9}	3.7×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	1.3×10^{-9}
		S	0.005	1.2×10^{-8}	5.0×10^{-4}	8.0×10^{-9}	3.8×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Ce-135	17.6 h	F	0.005	2.3×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	8.5×10^{-10}	5.3×10^{-10}	3.0×10^{-10}	2.4×10^{-10}
		M	0.005	3.6×10^{-9}	5.0×10^{-4}	2.7×10^{-9}	1.4×10^{-9}	8.9×10^{-10}	5.9×10^{-10}	4.8×10^{-10}
		S	0.005	3.7×10^{-9}	5.0×10^{-4}	2.8×10^{-9}	1.4×10^{-9}	9.4×10^{-10}	6.3×10^{-10}	5.0×10^{-10}
Ce-137	9.00 h	F	0.005	7.5×10^{-11}	5.0×10^{-4}	5.6×10^{-11}	2.7×10^{-11}	1.6×10^{-11}	8.7×10^{-12}	7.0×10^{-12}
		M	0.005	1.1×10^{-10}	5.0×10^{-4}	7.6×10^{-11}	3.6×10^{-11}	2.2×10^{-11}	1.2×10^{-11}	9.8×10^{-12}
		S	0.005	1.1×10^{-10}	5.0×10^{-4}	7.8×10^{-11}	3.7×10^{-11}	2.3×10^{-11}	1.3×10^{-11}	1.0×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Ce-137m	1.43 d	F	0.005	1.6×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	4.6×10^{-10}	2.8×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
		M	0.005	3.1×10^{-9}	5.0×10^{-4}	2.2×10^{-9}	1.1×10^{-9}	6.7×10^{-10}	5.1×10^{-10}	4.1×10^{-10}
		S	0.005	3.3×10^{-9}	5.0×10^{-4}	2.3×10^{-9}	1.0×10^{-9}	7.3×10^{-10}	5.6×10^{-10}	4.4×10^{-10}
Ce-139	138 d	F	0.005	1.1×10^{-8}	5.0×10^{-4}	8.5×10^{-9}	4.5×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.5×10^{-9}
		M	0.005	7.5×10^{-9}	5.0×10^{-4}	6.1×10^{-9}	3.6×10^{-9}	2.5×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
		S	0.005	7.8×10^{-9}	5.0×10^{-4}	6.3×10^{-9}	3.9×10^{-9}	2.7×10^{-9}	2.4×10^{-9}	1.9×10^{-9}
Ce-141	32.5 d	F	0.005	1.1×10^{-8}	5.0×10^{-4}	7.3×10^{-9}	3.5×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	9.3×10^{-10}
		M	0.005	1.4×10^{-8}	5.0×10^{-4}	1.1×10^{-8}	6.3×10^{-9}	4.6×10^{-9}	4.1×10^{-9}	3.2×10^{-9}
		S	0.005	1.6×10^{-8}	5.0×10^{-4}	1.2×10^{-8}	7.1×10^{-9}	5.3×10^{-9}	4.8×10^{-9}	3.8×10^{-9}
Ce-143	1.38 d	F	0.005	3.6×10^{-9}	5.0×10^{-4}	2.3×10^{-9}	1.0×10^{-9}	6.2×10^{-10}	3.3×10^{-10}	2.7×10^{-10}
		M	0.005	5.6×10^{-9}	5.0×10^{-4}	3.9×10^{-9}	1.9×10^{-9}	1.3×10^{-9}	9.3×10^{-10}	7.5×10^{-10}
		S	0.005	5.9×10^{-9}	5.0×10^{-4}	4.1×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	1.0×10^{-9}	8.3×10^{-10}
Ce-144	284 d	F	0.005	3.6×10^{-7}	5.0×10^{-4}	2.7×10^{-7}	1.4×10^{-7}	7.8×10^{-8}	4.8×10^{-8}	4.0×10^{-8}
		M	0.005	1.9×10^{-7}	5.0×10^{-4}	1.6×10^{-7}	8.8×10^{-8}	5.5×10^{-8}	4.1×10^{-8}	3.6×10^{-8}
		S	0.005	2.1×10^{-7}	5.0×10^{-4}	1.8×10^{-7}	1.1×10^{-7}	7.3×10^{-8}	5.8×10^{-8}	5.3×10^{-8}
Praseodymium										
Pr-136	0.218 h	M	0.005	1.3×10^{-10}	5.0×10^{-4}	8.8×10^{-11}	4.2×10^{-11}	2.6×10^{-11}	1.6×10^{-11}	1.3×10^{-11}
		S	0.005	1.3×10^{-10}	5.0×10^{-4}	9.0×10^{-11}	4.3×10^{-11}	2.7×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
Pr-137	1.28 h	M	0.005	1.8×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.1×10^{-11}	3.9×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
		S	0.005	1.9×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.4×10^{-11}	4.0×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
Pr-138m	2.10 h	M	0.005	5.9×10^{-10}	5.0×10^{-4}	4.5×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	9.0×10^{-11}	7.2×10^{-11}
		S	0.005	6.0×10^{-10}	5.0×10^{-4}	4.7×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	9.3×10^{-11}	7.4×10^{-11}
Pr-139	4.51 h	M	0.005	1.5×10^{-10}	5.0×10^{-4}	1.1×10^{-10}	5.5×10^{-11}	3.5×10^{-11}	2.3×10^{-11}	1.8×10^{-11}
		S	0.005	1.6×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	5.7×10^{-11}	3.7×10^{-11}	2.4×10^{-11}	2.0×10^{-11}

Pr-142	19.1 h	M	0.005	5.3×10^{-9}	5.0×10^{-4}	3.5×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.2×10^{-10}	5.2×10^{-10}
		S	0.005	5.5×10^{-9}	5.0×10^{-4}	3.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.5×10^{-10}
Pr-142m	0.243 h	M	0.005	6.7×10^{-11}	5.0×10^{-4}	4.5×10^{-11}	2.0×10^{-11}	1.3×10^{-11}	7.9×10^{-12}	6.6×10^{-12}
		S	0.005	7.0×10^{-11}	5.0×10^{-4}	4.7×10^{-11}	2.2×10^{-11}	1.4×10^{-11}	8.4×10^{-12}	7.0×10^{-12}
Pr-143	13.6 d	M	0.005	1.2×10^{-8}	5.0×10^{-4}	8.4×10^{-9}	4.6×10^{-9}	3.2×10^{-9}	2.7×10^{-9}	2.2×10^{-9}
		S	0.005	1.3×10^{-8}	5.0×10^{-4}	9.2×10^{-9}	5.1×10^{-9}	3.6×10^{-9}	3.0×10^{-9}	2.4×10^{-9}
Pr-144	0.288 h	M	0.005	1.9×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	5.0×10^{-11}	3.2×10^{-11}	2.1×10^{-11}	1.8×10^{-11}
		S	0.005	1.9×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	5.2×10^{-11}	3.4×10^{-11}	2.1×10^{-11}	1.8×10^{-11}
Pr-145	5.98 h	M	0.005	1.6×10^{-9}	5.0×10^{-4}	1.0×10^{-9}	4.7×10^{-10}	3.0×10^{-10}	1.9×10^{-10}	1.6×10^{-10}
		S	0.005	1.6×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	4.9×10^{-10}	3.2×10^{-10}	2.0×10^{-10}	1.7×10^{-10}
Pr-147	0.227 h	M	0.005	1.5×10^{-10}	5.0×10^{-4}	1.0×10^{-10}	4.8×10^{-11}	3.1×10^{-11}	2.1×10^{-11}	1.8×10^{-11}
		S	0.005	1.6×10^{-10}	5.0×10^{-4}	1.1×10^{-10}	5.0×10^{-11}	3.3×10^{-11}	2.2×10^{-11}	1.8×10^{-11}
Neodymium										
Nd-136	0.844 h	M	0.005	4.6×10^{-10}	5.0×10^{-4}	3.2×10^{-10}	1.6×10^{-10}	9.8×10^{-11}	6.3×10^{-11}	5.1×10^{-11}
		S	0.005	4.8×10^{-10}	5.0×10^{-4}	3.3×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	6.6×10^{-11}	5.4×10^{-11}
Nd-138	5.04 d	M	0.005	2.3×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	7.7×10^{-10}	4.8×10^{-10}	2.8×10^{-10}	2.3×10^{-10}
		S	0.005	2.4×10^{-9}	5.0×10^{-4}	1.8×10^{-9}	8.0×10^{-10}	5.0×10^{-10}	3.0×10^{-10}	2.5×10^{-10}
Nd-139	0.495 h	M	0.005	9.0×10^{-11}	5.0×10^{-4}	6.2×10^{-11}	3.0×10^{-11}	1.9×10^{-11}	1.2×10^{-11}	9.9×10^{-12}
		S	0.005	9.4×10^{-11}	5.0×10^{-4}	6.4×10^{-11}	3.1×10^{-11}	2.0×10^{-11}	1.3×10^{-11}	1.0×10^{-11}
Nd-139m	5.50 h	M	0.005	1.1×10^{-9}	5.0×10^{-4}	8.8×10^{-10}	4.5×10^{-10}	2.9×10^{-10}	1.8×10^{-10}	1.5×10^{-10}
		S	0.005	1.2×10^{-9}	5.0×10^{-4}	9.1×10^{-10}	4.6×10^{-10}	3.0×10^{-10}	1.9×10^{-10}	1.5×10^{-10}
Nd-141	2.49 h	M	0.005	4.1×10^{-11}	5.0×10^{-4}	3.1×10^{-11}	1.5×10^{-11}	9.6×10^{-12}	6.0×10^{-12}	4.8×10^{-12}
		S	0.005	4.3×10^{-11}	5.0×10^{-4}	3.2×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	6.2×10^{-12}	5.0×10^{-12}
Nd-147	11.0 d	M	0.005	1.1×10^{-8}	5.0×10^{-4}	8.0×10^{-9}	4.5×10^{-9}	3.2×10^{-9}	2.6×10^{-9}	2.1×10^{-9}
		S	0.005	1.2×10^{-8}	5.0×10^{-4}	8.6×10^{-9}	4.9×10^{-9}	3.5×10^{-9}	3.0×10^{-9}	2.4×10^{-9}
Nd-149	1.73 h	M	0.005	6.8×10^{-10}	5.0×10^{-4}	4.6×10^{-10}	2.2×10^{-10}	1.5×10^{-10}	1.0×10^{-10}	8.4×10^{-11}
		S	0.005	7.1×10^{-10}	5.0×10^{-4}	4.8×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	1.1×10^{-10}	8.9×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Nd-151	0.207 h	M	0.005	1.5×10^{-10}	5.0×10^{-4}	9.9×10^{-11}	4.6×10^{-11}	3.0×10^{-11}	2.0×10^{-11}	1.7×10^{-11}
		S	0.005	1.5×10^{-10}	5.0×10^{-4}	1.0×10^{-10}	4.8×10^{-11}	3.1×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
Promethium										
Pm-141	0.348 h	M	0.005	1.4×10^{-10}	5.0×10^{-4}	9.4×10^{-11}	4.3×10^{-11}	2.7×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		S	0.005	1.5×10^{-10}	5.0×10^{-4}	9.7×10^{-11}	4.4×10^{-11}	2.8×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
Pm-143	265 d	M	0.005	6.2×10^{-9}	5.0×10^{-4}	5.4×10^{-9}	3.3×10^{-9}	2.2×10^{-9}	1.7×10^{-9}	1.5×10^{-9}
		S	0.005	5.5×10^{-9}	5.0×10^{-4}	4.8×10^{-9}	3.1×10^{-9}	2.1×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
Pm-144	363 d	M	0.005	3.1×10^{-8}	5.0×10^{-4}	2.8×10^{-8}	1.8×10^{-8}	1.2×10^{-8}	9.3×10^{-9}	8.2×10^{-9}
		S	0.005	2.6×10^{-8}	5.0×10^{-4}	2.4×10^{-8}	1.6×10^{-8}	1.1×10^{-8}	8.9×10^{-9}	7.5×10^{-9}
Pm-145	17.7 a	M	0.005	1.1×10^{-8}	5.0×10^{-4}	9.8×10^{-9}	6.4×10^{-9}	4.3×10^{-9}	3.7×10^{-9}	3.6×10^{-9}
		S	0.005	7.1×10^{-9}	5.0×10^{-4}	6.5×10^{-9}	4.3×10^{-9}	2.9×10^{-9}	2.4×10^{-9}	2.3×10^{-9}
Pm-146	5.53 a	M	0.005	6.4×10^{-8}	5.0×10^{-4}	5.9×10^{-8}	3.9×10^{-8}	2.6×10^{-8}	2.2×10^{-8}	2.1×10^{-8}
		S	0.005	5.3×10^{-8}	5.0×10^{-4}	4.9×10^{-8}	3.3×10^{-8}	2.2×10^{-8}	1.9×10^{-8}	1.7×10^{-8}
Pm-147	2.62 a	M	0.005	2.1×10^{-8}	5.0×10^{-4}	1.8×10^{-8}	1.1×10^{-8}	7.0×10^{-9}	5.7×10^{-9}	5.0×10^{-9}
		S	0.005	1.9×10^{-8}	5.0×10^{-4}	1.6×10^{-8}	1.0×10^{-8}	6.8×10^{-9}	5.8×10^{-9}	4.9×10^{-9}
Pm-148	5.37 d	M	0.005	1.5×10^{-8}	5.0×10^{-4}	1.0×10^{-8}	5.2×10^{-9}	3.4×10^{-9}	2.4×10^{-9}	2.0×10^{-9}
		S	0.005	1.5×10^{-8}	5.0×10^{-4}	1.1×10^{-8}	5.5×10^{-9}	3.7×10^{-9}	2.6×10^{-9}	2.2×10^{-9}
Pm-148m	41.3 d	M	0.005	2.4×10^{-8}	5.0×10^{-4}	1.9×10^{-8}	1.1×10^{-8}	7.7×10^{-9}	6.3×10^{-9}	5.1×10^{-9}
		S	0.005	2.5×10^{-8}	5.0×10^{-4}	2.0×10^{-8}	1.2×10^{-8}	8.3×10^{-9}	7.1×10^{-9}	5.7×10^{-9}
Pm-149	2.21 d	M	0.005	5.0×10^{-9}	5.0×10^{-4}	3.5×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	8.3×10^{-10}	6.7×10^{-10}
		S	0.005	5.3×10^{-9}	5.0×10^{-4}	3.6×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	9.0×10^{-10}	7.3×10^{-10}
Pm-150	2.68 h	M	0.005	1.2×10^{-9}	5.0×10^{-4}	7.9×10^{-10}	3.8×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
		S	0.005	1.2×10^{-9}	5.0×10^{-4}	8.2×10^{-10}	3.9×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
Pm-151	1.18 d	M	0.005	3.3×10^{-9}	5.0×10^{-4}	2.5×10^{-9}	1.2×10^{-9}	8.3×10^{-10}	5.3×10^{-10}	4.3×10^{-10}
		S	0.005	3.4×10^{-9}	5.0×10^{-4}	2.6×10^{-9}	1.3×10^{-9}	7.9×10^{-10}	5.7×10^{-10}	4.6×10^{-10}

Samarium										
Sm-141	0.170 h	M	0.005	1.5×10^{-10}	5.0×10^{-4}	1.0×10^{-10}	4.7×10^{-11}	2.9×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
Sm-141m	0.377 h	M	0.005	3.0×10^{-10}	5.0×10^{-4}	2.1×10^{-10}	9.7×10^{-11}	6.1×10^{-11}	3.9×10^{-11}	3.2×10^{-11}
Sm-142	1.21 h	M	0.005	7.5×10^{-10}	5.0×10^{-4}	4.8×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	8.5×10^{-11}	7.1×10^{-11}
Sm-145	340 d	M	0.005	8.1×10^{-9}	5.0×10^{-4}	6.8×10^{-9}	4.0×10^{-9}	2.5×10^{-9}	1.9×10^{-9}	1.6×10^{-9}
Sm-146	1.03×0^{8} a	M	0.005	2.7×10^{-5}	5.0×10^{-4}	2.6×10^{-5}	1.7×10^{-5}	1.2×10^{-5}	1.1×10^{-5}	1.1×10^{-5}
Sm-147	1.06×10^{11} a	M	0.005	2.5×10^{-5}	5.0×10^{-4}	2.3×10^{-5}	1.6×10^{-5}	1.1×10^{-5}	9.6×10^{-6}	9.6×10^{-6}
Sm-151	90.0 a	M	0.005	1.1×10^{-8}	5.0×10^{-4}	1.0×10^{-8}	6.7×10^{-9}	4.5×10^{-9}	4.0×10^{-9}	4.0×10^{-9}
Sm-153	1.95 d	M	0.005	4.2×10^{-9}	5.0×10^{-4}	2.9×10^{-9}	1.5×10^{-9}	1.0×10^{-9}	7.9×10^{-10}	6.3×10^{-10}
Sm-155	0.368 h	M	0.005	1.5×10^{-10}	5.0×10^{-4}	9.9×10^{-11}	4.4×10^{-11}	2.9×10^{-11}	2.0×10^{-11}	1.7×10^{-11}
Sm-156	9.40 h	M	0.005	1.6×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	5.8×10^{-10}	3.5×10^{-10}	2.7×10^{-10}	2.2×10^{-10}
Europium										
Eu-145	5.94 d	M	0.005	3.6×10^{-9}	5.0×10^{-4}	2.9×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	5.5×10^{-10}
Eu-146	4.61 d	M	0.005	5.5×10^{-9}	5.0×10^{-4}	4.4×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	1.0×10^{-9}	8.0×10^{-10}
Eu-147	24.0 d	M	0.005	4.9×10^{-9}	5.0×10^{-4}	3.7×10^{-9}	2.2×10^{-9}	1.6×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Eu-148	54.5 d	M	0.005	1.4×10^{-8}	5.0×10^{-4}	1.2×10^{-8}	6.8×10^{-9}	4.6×10^{-9}	3.2×10^{-9}	2.6×10^{-9}
Eu-149	93.1 d	M	0.005	1.6×10^{-9}	5.0×10^{-4}	1.3×10^{-9}	7.3×10^{-10}	4.7×10^{-10}	3.5×10^{-10}	2.9×10^{-9}
Eu-150	34.2 a	M	0.005	1.1×10^{-7}	5.0×10^{-4}	1.1×10^{-7}	7.8×10^{-8}	5.7×10^{-8}	5.3×10^{-8}	5.3×10^{-8}
Eu-150	12.6 h	M	0.005	1.6×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	5.2×10^{-10}	3.4×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
Eu-152	13.3 a	M	0.005	1.1×10^{-7}	5.0×10^{-4}	1.0×10^{-7}	7.0×10^{-8}	4.9×10^{-8}	4.3×10^{-8}	4.2×10^{-8}
Eu-152m	9.32 h	M	0.005	1.9×10^{-9}	5.0×10^{-4}	1.3×10^{-9}	6.6×10^{-10}	4.2×10^{-10}	2.4×10^{-10}	2.2×10^{-10}
Eu-154	8.80 a	M	0.005	1.6×10^{-7}	5.0×10^{-4}	1.5×10^{-7}	9.7×10^{-8}	6.5×10^{-8}	5.6×10^{-8}	5.3×10^{-8}
Eu-155	4.96 a	M	0.005	2.6×10^{-8}	5.0×10^{-4}	2.3×10^{-8}	1.4×10^{-8}	9.2×10^{-9}	7.6×10^{-9}	6.9×10^{-9}
Eu-156	15.2 d	M	0.005	1.9×10^{-8}	5.0×10^{-4}	1.4×10^{-8}	7.7×10^{-9}	5.3×10^{-9}	4.2×10^{-9}	3.4×10^{-9}
Eu-157	15.1 h	M	0.005	2.5×10^{-9}	5.0×10^{-4}	1.9×10^{-9}	8.9×10^{-10}	5.9×10^{-10}	3.5×10^{-10}	2.8×10^{-10}
Eu-158	0.765 h	M	0.005	4.3×10^{-10}	5.0×10^{-4}	2.9×10^{-10}	1.3×10^{-10}	8.5×10^{-11}	5.6×10^{-11}	4.7×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Gadolinium										
Gd-145	0.382 h	F	0.005	1.3×10^{-10}	5.0×10^{-4}	9.6×10^{-11}	4.7×10^{-11}	2.9×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		M	0.005	1.8×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.2×10^{-11}	3.9×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
Gd-146	48.3 d	F	0.005	2.9×10^{-8}	5.0×10^{-4}	2.3×10^{-8}	1.2×10^{-8}	7.8×10^{-9}	5.1×10^{-9}	4.4×10^{-9}
		M	0.005	2.8×10^{-8}	5.0×10^{-4}	2.2×10^{-8}	1.3×10^{-8}	9.3×10^{-9}	7.9×10^{-9}	6.4×10^{-9}
Gd-147	1.59 d	F	0.005	2.1×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	8.4×10^{-10}	5.3×10^{-10}	3.1×10^{-10}	2.6×10^{-10}
		M	0.005	2.8×10^{-9}	5.0×10^{-4}	2.2×10^{-9}	1.1×10^{-9}	7.5×10^{-10}	5.1×10^{-10}	4.0×10^{-10}
Gd-148	93.0 a	F	0.005	8.3×10^{-5}	5.0×10^{-4}	7.6×10^{-5}	4.7×10^{-5}	3.2×10^{-5}	2.6×10^{-5}	2.6×10^{-5}
		M	0.005	3.2×10^{-5}	5.0×10^{-4}	2.9×10^{-5}	1.9×10^{-5}	1.3×10^{-5}	1.2×10^{-5}	1.1×10^{-5}
Gd-149	9.40 d	F	0.005	2.6×10^{-9}	5.0×10^{-4}	2.0×10^{-9}	8.0×10^{-10}	5.1×10^{-10}	3.1×10^{-10}	2.6×10^{-10}
		M	0.005	3.6×10^{-9}	5.0×10^{-4}	3.0×10^{-9}	1.5×10^{-9}	1.1×10^{-9}	9.2×10^{-10}	7.3×10^{-10}
Gd-151	120 d	F	0.005	6.3×10^{-9}	5.0×10^{-4}	4.9×10^{-9}	2.5×10^{-9}	1.5×10^{-9}	9.2×10^{-10}	7.8×10^{-10}
		M	0.005	4.5×10^{-9}	5.0×10^{-4}	3.5×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	1.0×10^{-9}	8.6×10^{-10}
Gd-152	1.08×10^{14} a	F	0.005	5.9×10^{-5}	5.0×10^{-4}	5.4×10^{-5}	3.4×10^{-5}	2.4×10^{-5}	1.9×10^{-5}	1.9×10^{-5}
		M	0.005	2.1×10^{-5}	5.0×10^{-4}	1.9×10^{-5}	1.3×10^{-5}	8.9×10^{-6}	7.9×10^{-6}	8.0×10^{-6}
Gd-153	242 d	F	0.005	1.5×10^{-8}	5.0×10^{-4}	1.2×10^{-8}	6.5×10^{-9}	3.9×10^{-9}	2.4×10^{-9}	2.1×10^{-9}
		M	0.005	9.9×10^{-9}	5.0×10^{-4}	7.9×10^{-9}	4.8×10^{-9}	3.1×10^{-9}	2.5×10^{-9}	2.1×10^{-9}
Gd-159	18.6 h	F	0.005	1.2×10^{-9}	5.0×10^{-4}	8.9×10^{-10}	3.8×10^{-10}	2.3×10^{-10}	1.2×10^{-10}	1.0×10^{-10}
		M	0.005	2.2×10^{-9}	5.0×10^{-4}	1.5×10^{-9}	7.3×10^{-10}	4.9×10^{-10}	3.4×10^{-10}	2.7×10^{-10}
Terbium										
Tb-147	1.65 h	M	0.005	6.7×10^{-10}	5.0×10^{-4}	4.8×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	9.3×10^{-11}	7.6×10^{-11}
Tb-149	4.15 h	M	0.005	2.1×10^{-8}	5.0×10^{-4}	1.5×10^{-8}	9.6×10^{-9}	6.6×10^{-9}	5.8×10^{-9}	4.9×10^{-9}
Tb-150	3.27 h	M	0.005	1.0×10^{-9}	5.0×10^{-4}	7.4×10^{-10}	3.5×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
Tb-151	17.6 h	M	0.005	1.6×10^{-9}	5.0×10^{-4}	1.2×10^{-9}	6.3×10^{-10}	4.2×10^{-10}	2.8×10^{-10}	2.3×10^{-10}

Tb-153	2.34 d	M	0.005	1.4×10^{-9}	5.0×10^{-4}	1.0×10^{-9}	5.4×10^{-10}	3.6×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
Tb-154	21.4 h	M	0.005	2.7×10^{-9}	5.0×10^{-4}	2.1×10^{-9}	1.1×10^{-9}	7.1×10^{-10}	4.5×10^{-10}	3.6×10^{-10}
Tb-155	5.32 d	M	0.005	1.4×10^{-9}	5.0×10^{-4}	1.0×10^{-9}	5.6×10^{-10}	3.4×10^{-10}	2.7×10^{-10}	2.2×10^{-10}
Tb-156	5.34 d	M	0.005	7.0×10^{-9}	5.0×10^{-4}	5.4×10^{-9}	3.0×10^{-9}	2.0×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Tb-156m	1.02 d	M	0.005	1.1×10^{-9}	5.0×10^{-4}	9.4×10^{-10}	4.7×10^{-7}	3.3×10^{-10}	2.7×10^{-10}	2.1×10^{-10}
Tb-156m	5.00 h	M	0.005	6.2×10^{-10}	5.0×10^{-4}	4.5×10^{-10}	2.4×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	9.6×10^{-11}
Tb-157	1.50×10^{2} a	M	0.005	3.2×10^{-9}	5.0×10^{-4}	3.0×10^{-9}	2.0×10^{-9}	1.4×10^{-9}	1.2×10^{-9}	1.2×10^{-9}
Tb-158	1.50×10^{2} a	M	0.005	1.1×10^{-7}	5.0×10^{-4}	1.0×10^{-7}	7.0×10^{-8}	5.1×10^{-8}	4.7×10^{-8}	4.6×10^{-8}
Tb-160	72.3 d	M	0.005	3.2×10^{-8}	5.0×10^{-4}	2.5×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	8.6×10^{-9}	7.0×10^{-9}
Tb-161	6.91 d	M	0.005	6.6×10^{-9}	5.0×10^{-4}	4.7×10^{-9}	2.6×10^{-9}	1.9×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Dysprosium										
Dy-155	10.0 h	M	0.005	5.6×10^{-10}	5.0×10^{-4}	4.4×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	9.6×10^{-11}	7.7×10^{-11}
Dy-157	8.10 h	M	0.005	2.4×10^{-10}	5.0×10^{-4}	1.9×10^{-10}	9.9×10^{-11}	6.2×10^{-11}	3.8×10^{-11}	3.0×10^{-11}
Dy-159	144 d	M	0.005	2.1×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	9.6×10^{-10}	6.0×10^{-10}	4.4×10^{-10}	3.7×10^{-10}
Dy-165	2.33 h	M	0.005	5.2×10^{-10}	5.0×10^{-4}	3.4×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	7.2×10^{-11}	6.0×10^{-11}
Dy-166	3.40 d	M	0.005	1.2×10^{-8}	5.0×10^{-4}	8.3×10^{-9}	4.4×10^{-9}	3.0×10^{-9}	2.3×10^{-9}	1.9×10^{-9}
Holmium										
Ho-155	0.800 h	M	0.005	1.7×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	5.8×10^{-11}	3.7×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
Ho-157	0.210 h	M	0.005	3.4×10^{-11}	5.0×10^{-4}	2.5×10^{-11}	1.3×10^{-11}	8.0×10^{-12}	5.1×10^{-12}	4.2×10^{-12}
Ho-159	0.550 h	M	0.005	4.6×10^{-11}	5.0×10^{-4}	3.3×10^{-11}	1.7×10^{-11}	1.1×10^{-11}	7.5×10^{-12}	6.1×10^{-12}
Ho-161	2.50 h	M	0.005	5.7×10^{-11}	5.0×10^{-4}	4.0×10^{-11}	2.0×10^{-11}	1.2×10^{-11}	7.5×10^{-12}	6.0×10^{-12}
Ho-162	0.250 h	M	0.005	2.1×10^{-11}	5.0×10^{-4}	1.5×10^{-11}	7.2×10^{-12}	4.8×10^{-12}	3.4×10^{-12}	2.8×10^{-12}
Ho-162m	1.13 h	M	0.005	1.5×10^{-10}	5.0×10^{-4}	1.1×10^{-10}	5.8×10^{-11}	3.8×10^{-11}	2.6×10^{-11}	2.1×10^{-11}
Ho-164	0.483 h	M	0.005	6.8×10^{-11}	5.0×10^{-4}	4.5×10^{-11}	2.1×10^{-11}	1.4×10^{-11}	9.9×10^{-12}	8.4×10^{-12}
Ho-164m	0.625 h	M	0.005	9.1×10^{-11}	5.0×10^{-4}	5.9×10^{-11}	3.0×10^{-11}	2.0×10^{-11}	1.3×10^{-11}	1.2×10^{-11}
Ho-166	1.12 d	M	0.005	6.0×10^{-9}	5.0×10^{-4}	4.0×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	7.9×10^{-10}	6.5×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Ho-166m	1.20 x 10^3 a	M	0.005	2.6 x 10^{-7}	5.0 x 10^{-4}	2.5 x 10^{-7}	1.8 x 10^{-7}	1.3 x 10^{-7}	1.2 x 10^{-7}	1.2 x 10^{-7}
Ho-167	3.10 h	M	0.005	5.2 x 10^{-10}	5.0 x 10^{-4}	3.6 x 10^{-10}	1.8 x 10^{-10}	1.2 x 10^{-10}	8.7 x 10^{-11}	7.1 x 10^{-11}
Erbium										
Er-161	3.24 h	M	0.005	3.8 x 10^{-10}	5.0 x 10^{-4}	2.9 x 10^{-10}	1.5 x 10^{-10}	9.5 x 10^{-11}	6.0 x 10^{-11}	4.8 x 10^{-11}
Er-165	10.4 h	M	0.005	7.2 x 10^{-11}	5.0 x 10^{-4}	5.3 x 10^{-11}	2.6 x 10^{-11}	1.6 x 10^{-11}	9.6 x 10^{-12}	7.9 x 10^{-12}
Er-169	9.30 d	M	0.005	4.7 x 10^{-9}	5.0 x 10^{-4}	3.5 x 10^{-9}	2.0 x 10^{-9}	1.5 x 10^{-9}	1.3 x 10^{-9}	1.0 x 10^{-9}
Er-171	7.52 h	M	0.005	1.8 x 10^{-9}	5.0 x 10^{-4}	1.2 x 10^{-9}	5.9 x 10^{-10}	3.9 x 10^{-10}	2.7 x 10^{-10}	2.2 x 10^{-10}
Er-172	2.05 d	M	0.005	6.6 x 10^{-9}	5.0 x 10^{-4}	4.7 x 10^{-9}	2.5 x 10^{-9}	1.7 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Thulium										
Tm-162	0.362 h	M	0.005	1.3 x 10^{-10}	5.0 x 10^{-4}	9.6 x 10^{-11}	4.7 x 10^{-11}	3.0 x 10^{-11}	1.9 x 10^{-11}	1.6 x 10^{-11}
Tm-166	7.70 h	M	0.005	1.3 x 10^{-9}	5.0 x 10^{-4}	9.9 x 10^{-10}	5.2 x 10^{-10}	3.3 x 10^{-10}	2.2 x 10^{-10}	1.7 x 10^{-10}
Tm-167	9.24 d	M	0.005	5.6 x 10^{-9}	5.0 x 10^{-4}	4.1 x 10^{-9}	2.3 x 10^{-9}	1.7 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Tm-170	129 d	M	0.005	3.6 x 10^{-8}	5.0 x 10^{-4}	2.8 x 10^{-8}	1.6 x 10^{-8}	1.1 x 10^{-8}	8.5 x 10^{-9}	7.0 x 10^{-9}
Tm-171	1.92 a	M	0.005	6.8 x 10^{-9}	5.0 x 10^{-4}	5.7 x 10^{-9}	3.4 x 10^{-9}	2.0 x 10^{-9}	1.6 x 10^{-9}	1.4 x 10^{-9}
Tm-172	2.65 d	M	0.005	8.4 x 10^{-9}	5.0 x 10^{-4}	5.8 x 10^{-9}	2.9 x 10^{-9}	1.9 x 10^{-9}	1.4 x 10^{-9}	1.1 x 10^{-9}
Tm-173	8.24 h	M	0.005	1.5 x 10^{-9}	5.0 x 10^{-4}	1.0 x 10^{-9}	5.0 x 10^{-10}	3.3 x 10^{-10}	2.2 x 10^{-10}	1.8 x 10^{-10}
Tm-175	0.253 h	M	0.005	1.6 x 10^{-10}	5.0 x 10^{-4}	1.1 x 10^{-10}	5.0 x 10^{-11}	3.3 x 10^{-11}	2.2 x 10^{-11}	1.8 x 10^{-11}
Ytterbium										
Yb-162	0.315 h	M	0.005	1.1 x 10^{-10}	5.0 x 10^{-4}	7.9 x 10^{-11}	3.9 x 10^{-11}	2.5 x 10^{-11}	1.6 x 10^{-11}	1.3 x 10^{-11}
		S	0.005	1.2 x 10^{-10}	5.0 x 10^{-4}	8.2 x 10^{-11}	4.0 x 10^{-11}	2.6 x 10^{-11}	1.7 x 10^{-11}	1.4 x 10^{-11}
Yb-166	2.36 d	M	0.005	4.7 x 10^{-9}	5.0 x 10^{-4}	3.5 x 10^{-9}	1.9 x 10^{-9}	1.3 x 10^{-9}	9.0 x 10^{-10}	7.2 x 10^{-10}
		S	0.005	4.9 x 10^{-9}	5.0 x 10^{-4}	3.7 x 10^{-9}	2.0 x 10^{-9}	1.3 x 10^{-9}	9.6 x 10^{-10}	7.7 x 10^{-10}
Yb-167	0.292 h	M	0.005	4.4 x 10^{-11}	5.0 x 10^{-4}	3.1 x 10^{-11}	1.6 x 10^{-11}	1.1 x 10^{-11}	7.9 x 10^{-12}	6.5 x 10^{-12}
		S	0.005	4.6 x 10^{-11}	5.0 x 10^{-4}	3.2 x 10^{-11}	1.7 x 10^{-11}	1.1 x 10^{-11}	8.4 x 10^{-12}	6.9 x 10^{-12}

Yb-169	32.0 d	M	0.005	1.2×10^{-8}	5.0×10^{-4}	8.7×10^{-9}	5.1×10^{-9}	3.7×10^{-9}	3.2×10^{-9}	2.5×10^{-9}
		S	0.005	1.3×10^{-8}	5.0×10^{-4}	9.8×10^{-9}	5.9×10^{-9}	4.2×10^{-9}	3.7×10^{-9}	3.0×10^{-9}
Yb-175	4.19 d	M	0.005	3.5×10^{-9}	5.0×10^{-4}	2.5×10^{-9}	1.4×10^{-9}	9.8×10^{-10}	8.3×10^{-10}	6.5×10^{-10}
		S	0.005	3.7×10^{-9}	5.0×10^{-4}	2.7×10^{-9}	1.5×10^{-9}	1.1×10^{-9}	9.2×10^{-10}	7.3×10^{-10}
Yb-177	1.90 h	M	0.005	5.0×10^{-10}	5.0×10^{-4}	3.3×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	7.8×10^{-11}	6.4×10^{-11}
		S	0.005	5.3×10^{-10}	5.0×10^{-4}	3.5×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	8.4×10^{-11}	6.9×10^{-11}
Yb-178	1.23 h	M	0.005	5.9×10^{-10}	5.0×10^{-4}	3.9×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	8.5×10^{-11}	7.0×10^{-11}
		S	0.005	6.2×10^{-10}	5.0×10^{-4}	4.1×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	9.1×10^{-11}	7.5×10^{-11}
Lutetium										
Lu-169	1.42 d	M	0.005	2.3×10^{-9}	5.0×10^{-4}	1.8×10^{-9}	9.5×10^{-10}	6.3×10^{-10}	4.4×10^{-10}	3.5×10^{-10}
		S	0.005	2.4×10^{-9}	5.0×10^{-4}	1.9×10^{-9}	1.0×10^{-9}	6.7×10^{-10}	4.8×10^{-10}	3.8×10^{-10}
Lu-170	2.00 d	M	0.005	4.3×10^{-9}	5.0×10^{-4}	3.4×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	7.8×10^{-10}	6.3×10^{-10}
		S	0.005	4.5×10^{-9}	5.0×10^{-4}	3.5×10^{-9}	1.8×10^{-9}	1.2×10^{-9}	8.2×10^{-10}	6.6×10^{-10}
Lu-171	8.22 d	M	0.005	5.0×10^{-9}	5.0×10^{-4}	3.7×10^{-9}	2.1×10^{-9}	1.2×10^{-9}	9.8×10^{-10}	8.0×10^{-10}
		S	0.005	4.7×10^{-9}	5.0×10^{-4}	3.9×10^{-9}	2.0×10^{-9}	1.4×10^{-9}	1.1×10^{-9}	8.8×10^{-9}
Lu-172	6.70 d	M	0.005	8.7×10^{-9}	5.0×10^{-4}	6.7×10^{-9}	3.8×10^{-9}	2.6×10^{-9}	1.8×10^{-9}	1.4×10^{-9}
		S	0.005	9.3×10^{-9}	5.0×10^{-4}	7.1×10^{-9}	4.0×10^{-9}	2.8×10^{-9}	2.0×10^{-9}	1.6×10^{-9}
Lu-173	1.37 a	M	0.005	1.0×10^{-8}	5.0×10^{-4}	8.5×10^{-9}	5.1×10^{-9}	3.2×10^{-9}	2.5×10^{-9}	2.2×10^{-9}
		S	0.005	1.0×10^{-8}	5.0×10^{-4}	8.7×10^{-9}	5.4×10^{-9}	3.6×10^{-9}	2.9×10^{-9}	2.4×10^{-9}
Lu-174	3.31 a	M	0.005	1.7×10^{-8}	5.0×10^{-4}	1.5×10^{-8}	9.1×10^{-9}	5.8×10^{-9}	4.7×10^{-9}	4.2×10^{-9}
		S	0.005	1.6×10^{-8}	5.0×10^{-4}	1.4×10^{-8}	8.9×10^{-9}	5.9×10^{-9}	4.9×10^{-9}	4.2×10^{-9}
Lu-174m	142 d	M	0.005	1.9×10^{-8}	5.0×10^{-4}	1.4×10^{-8}	8.6×10^{-9}	5.4×10^{-9}	4.3×10^{-9}	3.7×10^{-9}
		S	0.005	2.0×10^{-8}	5.0×10^{-4}	1.5×10^{-8}	9.2×10^{-9}	6.1×10^{-9}	5.0×10^{-9}	4.2×10^{-9}
Lu-176	3.60×10^{10} a	M	0.005	1.8×10^{-7}	5.0×10^{-4}	1.7×10^{-7}	1.1×10^{-7}	7.8×10^{-8}	7.1×10^{-8}	7.0×10^{-8}
		S	0.005	1.5×10^{-7}	5.0×10^{-4}	1.4×10^{-7}	9.4×10^{-8}	6.5×10^{-8}	5.9×10^{-8}	5.6×10^{-8}
Lu-176m	3.68 h	M	0.005	8.9×10^{-10}	5.0×10^{-4}	5.9×10^{-10}	2.8×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	1.1×10^{-10}
		S	0.005	9.3×10^{-10}	5.0×10^{-4}	6.2×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	1.2×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Lu-177	6.71 d	M	0.005	5.3×10^{-9}	5.0×10^{-4}	3.8×10^{-9}	2.2×10^{-9}	1.6×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
		S	0.005	5.7×10^{-9}	5.0×10^{-4}	4.1×10^{-9}	2.4×10^{-9}	1.7×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Lu-177m	161 d	M	0.005	5.8×10^{-9}	5.0×10^{-4}	4.6×10^{-8}	2.8×10^{-8}	1.9×10^{-8}	1.6×10^{-8}	1.3×10^{-8}
		S	0.005	6.5×10^{-8}	5.0×10^{-4}	5.3×10^{-8}	3.2×10^{-8}	2.3×10^{-8}	2.0×10^{-8}	1.6×10^{-8}
Lu-178	0.473 h	M	0.005	2.3×10^{-10}	5.0×10^{-4}	1.5×10^{-10}	6.6×10^{-11}	4.3×10^{-11}	2.9×10^{-11}	2.4×10^{-11}
		S	0.005	2.4×10^{-10}	5.0×10^{-4}	1.5×10^{-10}	6.9×10^{-11}	4.5×10^{-11}	3.0×10^{-11}	2.6×10^{-11}
Lu-178m	0.378 h	M	0.005	2.6×10^{-10}	5.0×10^{-4}	1.8×10^{-10}	8.3×10^{-11}	5.6×10^{-11}	3.8×10^{-11}	3.2×10^{-11}
		S	0.005	2.7×10^{-10}	5.0×10^{-4}	1.9×10^{-10}	8.7×10^{-11}	5.8×10^{-11}	4.0×10^{-11}	3.3×10^{-11}
Lu-179	4.59h	M	0.005	9.9×10^{-10}	5.0×10^{-4}	6.5×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	1.1×10^{-10}
		S	0.005	1.0×10^{-9}	5.0×10^{-4}	6.8×10^{-10}	3.2×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	1.2×10^{-10}
Hafnium										
Hf-170	16.0 h	F	0.020	1.4×10^{-9}	0.002	1.1×10^{-9}	5.4×10^{-10}	3.4×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
		M	0.020	2.2×10^{-9}	0.002	1.7×10^{-9}	8.7×10^{-10}	5.8×10^{-10}	3.9×10^{-10}	3.2×10^{-10}
Hf-172	1.87 a	F	0.020	1.5×10^{-7}	0.002	1.3×10^{-7}	7.8×10^{-8}	4.9×10^{-8}	3.5×10^{-8}	3.2×10^{-8}
		M	0.020	8.1×10^{-8}	0.002	6.9×10^{-8}	4.3×10^{-8}	2.8×10^{-8}	2.3×10^{-8}	2.0×10^{-8}
Hf-173	24.0 h	F	0.020	6.6×10^{-10}	0.002	5.0×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	8.9×10^{-11}	7.4×10^{-11}
		M	0.020	1.1×10^{-9}	0.002	8.2×10^{-10}	4.3×10^{-10}	2.9×10^{-10}	2.0×10^{-10}	1.6×10^{-10}
Hf-175	70.0 d	F	0.020	5.4×10^{-9}	0.002	4.0×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	8.5×10^{-10}	7.2×10^{-10}
		M	0.020	5.8×10^{-9}	0.002	4.5×10^{-9}	2.6×10^{-9}	1.8×10^{-9}	1.4×10^{-9}	1.2×10^{-9}
Hf-177m	0.856 h	F	0.020	3.9×10^{-10}	0.002	2.8×10^{-10}	1.3×10^{-10}	8.5×10^{-11}	5.2×10^{-11}	4.4×10^{-11}
		M	0.020	6.5×10^{-10}	0.002	4.7×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	1.1×10^{-10}	9.0×10^{-11}
Hf-178m	31.0 a	F	0.020	6.2×10^{-7}	0.002	5.8×10^{-7}	4.0×10^{-7}	3.1×10^{-7}	2.7×10^{-7}	2.6×10^{-7}
		M	0.020	2.6×10^{-7}	0.002	2.4×10^{-7}	1.7×10^{-7}	1.3×10^{-7}	1.2×10^{-7}	1.2×10^{-7}
Hf-179m	25.1 d	F	0.020	9.7×10^{-9}	0.002	6.8×10^{-9}	3.4×10^{-9}	2.1×10^{-9}	1.2×10^{-9}	1.1×10^{-9}
		M	0.020	1.7×10^{-8}	0.002	1.3×10^{-8}	7.6×10^{-9}	5.5×10^{-9}	4.8×10^{-9}	3.8×10^{-9}

Hf-180m	5.50 h	F	0.020	5.4×10^{-10}	0.002	4.1×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	7.2×10^{-11}	5.9×10^{-11}
		M	0.020	9.1×10^{-10}	0.002	6.8×10^{-10}	3.6×10^{-10}	2.4×10^{-10}	1.7×10^{-10}	1.3×10^{-10}
Hf-181	42.4 d	F	0.020	1.3×10^{-8}	0.002	9.6×10^{-9}	4.8×10^{-9}	2.8×10^{-9}	1.7×10^{-9}	1.4×10^{-9}
		M	0.020	2.2×10^{-8}	0.002	1.7×10^{-8}	9.9×10^{-9}	7.1×10^{-9}	6.3×10^{-9}	5.0×10^{-9}
Hf-182	9.00×10^{6} a	F	0.020	6.5×10^{-7}	0.002	6.2×10^{-7}	4.4×10^{-7}	3.6×10^{-7}	3.1×10^{-7}	3.1×10^{-7}
		M	0.020	2.4×10^{-7}	0.002	2.3×10^{-7}	1.7×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}
Hf-182m	1.02 h	F	0.020	1.9×10^{-10}	0.002	1.4×10^{-10}	6.6×10^{-11}	4.2×10^{-11}	2.6×10^{-11}	2.1×10^{-11}
		M	0.020	3.2×10^{-10}	0.002	2.3×10^{-10}	1.2×10^{-10}	7.8×10^{-11}	5.6×10^{-11}	4.6×10^{-11}
Hf-183	1.07 h	F	0.020	2.5×10^{-10}	0.002	1.7×10^{-10}	7.9×10^{-11}	4.9×10^{-11}	2.8×10^{-11}	2.4×10^{-11}
		M	0.020	4.4×10^{-10}	0.002	3.0×10^{-10}	1.5×10^{-10}	9.8×10^{-11}	7.0×10^{-11}	5.7×10^{-11}
Hf-184	4.12 h	F	0.020	1.4×10^{-9}	0.002	9.6×10^{-10}	4.3×10^{-10}	2.7×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
		M	0.020	2.6×10^{-9}	0.002	1.8×10^{-9}	8.9×10^{-10}	5.9×10^{-10}	4.0×10^{-10}	3.3×10^{-10}
Tantalum										
Ta-172	0.613 h	M	0.010	2.8×10^{-10}	0.001	1.9×10^{-10}	9.3×10^{-11}	6.0×10^{-11}	4.0×10^{-11}	3.3×10^{-11}
		S	0.010	2.9×10^{-10}	0.001	2.0×10^{-10}	9.8×10^{-11}	6.3×10^{-11}	4.2×10^{-11}	3.5×10^{-11}
Ta-173	3.65 h	M	0.010	8.8×10^{-10}	0.001	6.2×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
		S	0.010	9.2×10^{-10}	0.001	6.5×10^{-10}	3.2×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
Ta-174	1.20 h	M	0.010	3.2×10^{-10}	0.001	2.2×10^{-10}	1.1×10^{-10}	7.1×10^{-11}	5.0×10^{-11}	4.1×10^{-11}
		S	0.010	3.4×10^{-10}	0.001	2.3×10^{-10}	1.1×10^{-10}	7.5×10^{-11}	5.3×10^{-11}	4.3×10^{-11}
Ta-175	10.5 h	M	0.010	9.1×10^{-10}	0.001	7.0×10^{-10}	3.7×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
		S	0.010	9.5×10^{-10}	0.001	7.3×10^{-10}	3.8×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
Ta-176	8.08 h	M	0.010	1.4×10^{-9}	0.001	1.1×10^{-9}	5.7×10^{-10}	3.7×10^{-10}	2.4×10^{-10}	1.9×10^{-10}
		S	0.010	1.4×10^{-9}	0.001	1.1×10^{-9}	5.9×10^{-10}	3.8×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
Ta-177	2.36 d	M	0.010	6.5×10^{-10}	0.001	4.7×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	1.2×10^{-10}	9.6×10^{-11}
		S	0.010	6.9×10^{-10}	0.001	5.0×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
Ta-178	2.20 h	M	0.010	4.4×10^{-10}	0.001	3.3×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.0×10^{-11}	6.5×10^{-11}
		S	0.010	4.6×10^{-10}	0.001	3.4×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	8.5×10^{-11}	6.8×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Ta-179	1.82 a	M	0.010	1.2×10^{-9}	0.001	9.6×10^{-10}	5.5×10^{-10}	3.5×10^{-10}	2.6×10^{-10}	2.2×10^{-10}
		S	0.010	2.4×10^{-9}	0.001	2.1×10^{-9}	1.3×10^{-9}	8.3×10^{-10}	6.4×10^{-10}	5.6×10^{-10}
Ta-180	1.00×10^{13} a	M	0.010	2.7×10^{-8}	0.001	2.2×10^{-8}	1.3×10^{-8}	9.2×10^{-9}	7.9×10^{-9}	6.4×10^{-9}
		S	0.010	7.0×10^{-8}	0.001	6.5×10^{-8}	4.5×10^{-8}	3.1×10^{-8}	2.8×10^{-8}	2.6×10^{-8}
Ta-180m	8.10 h	M	0.010	3.1×10^{-10}	0.001	2.2×10^{-10}	1.1×10^{-10}	7.4×10^{-11}	4.8×10^{-11}	4.4×10^{-11}
		S	0.010	3.3×10^{-10}	0.001	2.3×10^{-10}	1.2×10^{-10}	7.9×10^{-11}	5.2×10^{-11}	4.2×10^{-11}
Ta-182	115 d	M	0.010	3.2×10^{-8}	0.001	2.6×10^{-8}	1.5×10^{-8}	1.1×10^{-8}	9.5×10^{-9}	7.6×10^{-9}
		S	0.010	4.2×10^{-8}	0.001	3.4×10^{-8}	2.1×10^{-8}	1.5×10^{-8}	1.3×10^{-8}	1.0×10^{-8}
Ta-182m	0.264 h	M	0.010	1.6×10^{-10}	0.001	1.1×10^{-10}	4.9×10^{-11}	3.4×10^{-11}	2.4×10^{-11}	2.0×10^{-11}
		S	0.010	1.6×10^{-10}	0.001	1.1×10^{-10}	5.2×10^{-11}	3.6×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
Ta-183	5.10 d	M	0.010	1.0×10^{-8}	0.001	7.4×10^{-9}	4.1×10^{-9}	2.9×10^{-9}	2.4×10^{-9}	1.9×10^{-9}
		S	0.010	1.1×10^{-8}	0.001	8.0×10^{-9}	4.5×10^{-9}	3.2×10^{-9}	2.7×10^{-9}	2.1×10^{-9}
Ta-184	8.70 h	M	0.010	3.2×10^{-9}	0.001	2.3×10^{-9}	1.1×10^{-9}	7.5×10^{-10}	5.0×10^{-10}	4.1×10^{-10}
		S	0.010	3.4×10^{-9}	0.001	2.4×10^{-9}	1.2×10^{-9}	7.9×10^{-10}	5.4×10^{-10}	4.3×10^{-10}
Ta-185	0.816 h	M	0.010	3.8×10^{-10}	0.001	2.5×10^{-10}	1.2×10^{-10}	7.7×10^{-11}	5.4×10^{-11}	4.5×10^{-11}
		S	0.010	4.0×10^{-10}	0.001	2.6×10^{-10}	1.2×10^{-10}	8.2×10^{-11}	5.7×10^{-11}	4.8×10^{-11}
Ta-186	0.175 h	M	0.010	1.6×10^{-10}	0.001	1.1×10^{-10}	4.8×10^{-11}	3.1×10^{-11}	2.0×10^{-11}	1.7×10^{-11}
		S	0.010	1.6×10^{-10}	0.001	1.1×10^{-10}	5.0×10^{-11}	3.2×10^{-11}	2.1×10^{-11}	1.8×10^{-11}
Tungsten										
W-176	2.30 h	F	0.600	3.3×10^{-10}	0.300	2.7×10^{-10}	1.4×10^{-10}	8.6×10^{-11}	5.0×10^{-11}	4.1×10^{-11}
W-177	2.25 h	F	0.600	2.0×10^{-10}	0.300	1.6×10^{-10}	8.2×10^{-11}	5.1×10^{-11}	3.0×10^{-11}	2.4×10^{-11}
W-178	21.7 d	F	0.600	7.2×10^{-10}	0.300	5.4×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	8.7×10^{-11}	7.2×10^{-11}
W-179	0.625 h	F	0.600	9.3×10^{-12}	0.300	6.8×10^{-12}	3.3×10^{-12}	2.0×10^{-12}	1.2×10^{-12}	9.2×10^{-13}
W-181	121 d	F	0.600	2.5×10^{-10}	0.300	1.9×10^{-10}	9.2×10^{-11}	5.7×10^{-11}	3.2×10^{-11}	2.7×10^{-11}

W-185	75.1d	F	0.600	1.4×10^{-9}	0.300	1.0×10^{-9}	4.4×10^{-10}	2.7×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
W-187	23.9 h	F	0.600	2.0×10^{-9}	0.300	1.5×10^{-9}	7.0×10^{-10}	4.3×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
W-188	69.4 d	F	0.600	7.1×10^{-9}	0.300	5.0×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	6.8×10^{-10}	5.7×10^{-10}
Rhenium										
Re-177	0.233 h	F	1.000	9.4×10^{-11}	0.800	6.7×10^{-11}	3.2×10^{-11}	1.9×10^{-11}	1.2×10^{-11}	9.7×10^{-12}
		M	1.000	1.1×10^{-10}	0.800	7.9×10^{-11}	3.9×10^{-11}	2.5×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
Re-178	0.220 h	F	1.000	9.9×10^{-11}	0.800	6.8×10^{-11}	3.1×10^{-11}	1.9×10^{-11}	1.2×10^{-11}	1.0×10^{-11}
		M	1.000	1.3×10^{-10}	0.800	8.5×10^{-11}	3.9×10^{-11}	2.6×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
Re-181	20.0 h	F	1.000	2.0×10^{-9}	0.800	1.4×10^{-9}	6.7×10^{-10}	3.8×10^{-10}	2.3×10^{-10}	1.8×10^{-10}
		M	1.000	2.1×10^{-9}	0.800	1.5×10^{-9}	7.4×10^{-10}	4.6×10^{-10}	3.1×10^{-10}	2.5×10^{-10}
Re-182	2.67 d	F	1.000	6.5×10^{-9}	0.800	4.7×10^{-9}	2.2×10^{-9}	1.3×10^{-9}	8.0×10^{-10}	6.4×10^{-10}
		M	1.000	8.7×10^{-9}	0.800	6.3×10^{-9}	3.4×10^{-9}	2.2×10^{-9}	1.5×10^{-9}	1.2×10^{-9}
Re-182	12.7 h	F	1.000	1.3×10^{-9}	0.800	1.0×10^{-9}	4.9×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
		M	1.000	1.4×10^{-9}	0.800	1.1×10^{-9}	5.7×10^{-10}	3.6×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
Re-184	38.0 d	F	1.000	4.1×10^{-9}	0.800	2.9×10^{-9}	1.4×10^{-9}	8.6×10^{-10}	5.4×10^{-10}	4.4×10^{-10}
		M	1.000	9.1×10^{-9}	0.800	6.8×10^{-9}	4.0×10^{-9}	2.8×10^{-9}	2.4×10^{-9}	1.9×10^{-9}
Re-184m	165 d	F	1.000	6.6×10^{-9}	0.800	4.6×10^{-9}	2.0×10^{-9}	1.2×10^{-9}	7.3×10^{-10}	5.9×10^{-10}
		M	1.000	2.9×10^{-8}	0.800	2.2×10^{-8}	1.3×10^{-8}	9.3×10^{-9}	8.1×10^{-9}	6.5×10^{-9}
Re-186	3.78 d	F	1.000	7.3×10^{-9}	0.800	4.7×10^{-9}	2.0×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.2×10^{-10}
		M	1.000	8.7×10^{-9}	0.800	5.7×10^{-9}	2.8×10^{-9}	1.8×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
Re-186m	2.00×10^{5} a	F	1.000	1.2×10^{-8}	0.800	7.0×10^{-9}	2.9×10^{-9}	1.7×10^{-9}	1.0×10^{-9}	8.3×10^{-10}
		M	1.000	5.9×10^{-8}	0.800	4.6×10^{-8}	2.7×10^{-8}	1.8×10^{-8}	1.4×10^{-8}	1.2×10^{-8}
Re-187	5.00×10^{10} a	F	1.000	2.6×10^{-11}	0.800	1.6×10^{-11}	6.8×10^{-12}	3.8×10^{-12}	2.3×10^{-12}	1.8×10^{-12}
		M	1.000	5.7×10^{-11}	0.800	4.1×10^{-11}	2.0×10^{-11}	1.2×10^{-11}	7.5×10^{-12}	6.3×10^{-12}
Re-188	17.0 h	F	1.000	6.5×10^{-9}	0.800	4.4×10^{-9}	1.9×10^{-9}	1.0×10^{-9}	6.1×10^{-10}	4.6×10^{-10}
		M	1.000	6.0×10^{-9}	0.800	4.0×10^{-9}	1.8×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	5.4×10^{-10}
Re-188m	0.310 h	F	1.000	1.4×10^{-10}	0.800	9.1×10^{-11}	4.0×10^{-11}	2.1×10^{-11}	1.3×10^{-11}	1.0×10^{-11}
		M	1.000	1.3×10^{-10}	0.800	8.6×10^{-11}	4.0×10^{-11}	2.7×10^{-11}	1.6×10^{-11}	1.3×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Re-189	1.01 d	F	1.000	3.7×10^{-9}	0.800	2.5×10^{-9}	1.1×10^{-9}	5.8×10^{-10}	3.5×10^{-10}	2.7×10^{-10}
		M	1.000	3.9×10^{-9}	0.800	2.6×10^{-9}	1.2×10^{-9}	7.6×10^{-10}	5.5×10^{-10}	4.3×10^{-10}
Osmium										
Os-180	0.366 h	F	0.020	7.1×10^{-11}	0.010	5.3×10^{-11}	2.6×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	8.2×10^{-12}
		M	0.020	1.1×10^{-10}	0.010	7.9×10^{-11}	3.9×10^{-11}	2.5×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		S	0.020	1.1×10^{-10}	0.010	8.2×10^{-11}	4.1×10^{-11}	2.6×10^{-11}	1.8×10^{-11}	1.5×10^{-11}
Os-181	1.75 h	F	0.020	3.0×10^{-10}	0.010	2.3×10^{-10}	1.1×10^{-10}	7.0×10^{-11}	4.1×10^{-11}	3.3×10^{-11}
		M	0.020	4.5×10^{-10}	0.010	3.4×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	7.6×10^{-11}	6.2×10^{-11}
		S	0.020	4.7×10^{-10}	0.010	3.6×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	8.1×10^{-11}	6.5×10^{-11}
Os-182	22.0 h	F	0.020	1.6×10^{-9}	0.010	1.2×10^{-9}	6.0×10^{-10}	3.7×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
		M	0.020	2.5×10^{-9}	0.010	1.9×10^{-9}	1.0×10^{-9}	6.6×10^{-10}	4.5×10^{-10}	3.6×10^{-10}
		S	0.020	2.6×10^{-9}	0.010	2.0×10^{-9}	1.0×10^{-9}	6.9×10^{-10}	4.8×10^{-10}	3.8×10^{-10}
Os-185	94.0 d	F	0.020	7.2×10^{-9}	0.010	5.8×10^{-9}	3.1×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	1.1×10^{-9}
		M	0.020	6.6×10^{-9}	0.010	5.4×10^{-9}	2.9×10^{-9}	2.0×10^{-9}	1.5×10^{-9}	1.3×10^{-9}
		S	0.020	7.0×10^{-9}	0.010	5.8×10^{-9}	3.6×10^{-9}	2.4×10^{-9}	1.9×10^{-9}	1.6×10^{-9}
Os-189 m	6.00 h	F	0.020	3.8×10^{-11}	0.010	2.8×10^{-11}	1.2×10^{-11}	7.0×10^{-12}	3.5×10^{-12}	2.5×10^{-12}
		M	0.020	6.5×10^{-11}	0.010	4.1×10^{-11}	1.8×10^{-11}	1.1×10^{-11}	6.0×10^{-12}	5.0×10^{-12}
		S	0.020	6.8×10^{-11}	0.010	4.3×10^{-11}	1.9×10^{-11}	1.2×10^{-11}	6.3×10^{-12}	5.3×10^{-12}
Os-191	15.4 d	F	0.020	2.8×10^{-9}	0.010	1.9×10^{-9}	8.5×10^{-10}	5.3×10^{-10}	3.0×10^{-10}	2.5×10^{-10}
		M	0.020	8.0×10^{-9}	0.010	5.8×10^{-9}	3.4×10^{-9}	2.4×10^{-9}	2.0×10^{-9}	1.7×10^{-9}
		S	0.020	9.0×10^{-9}	0.010	6.5×10^{-9}	3.9×10^{-9}	2.7×10^{-9}	2.3×10^{-9}	1.9×10^{-9}
Os-191m	13.0 h	F	0.020	3.0×10^{-10}	0.010	2.0×10^{-10}	8.8×10^{-11}	5.4×10^{-11}	2.9×10^{-11}	2.4×10^{-11}
		M	0.020	7.8×10^{-10}	0.010	5.4×10^{-10}	3.1×10^{-10}	2.1×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
		S	0.020	8.5×10^{-10}	0.010	6.0×10^{-10}	3.4×10^{-10}	2.4×10^{-10}	2.0×10^{-10}	1.6×10^{-10}

Os-193	1.25 d	F	0.020	1.9×10^{-9}	0.010	1.2×10^{-9}	5.2×10^{-10}	3.2×10^{-10}	1.8×10^{-10}	1.6×10^{-10}
		M	0.020	3.8×10^{-9}	0.010	2.6×10^{-9}	1.3×10^{-9}	8.4×10^{-10}	5.9×10^{-10}	4.8×10^{-10}
		S	0.020	4.0×10^{-9}	0.010	2.7×10^{-9}	1.3×10^{-9}	9.0×10^{-10}	6.4×10^{-10}	5.2×10^{-10}
Os-194	6.00 a	F	0.020	8.7×10^{-8}	0.010	6.8×10^{-8}	3.4×10^{-8}	2.1×10^{-8}	1.3×10^{-8}	1.1×10^{-8}
		M	0.020	9.9×10^{-8}	0.010	8.3×10^{-8}	4.8×10^{-8}	3.1×10^{-8}	2.4×10^{-8}	2.1×10^{-8}
		S	0.020	2.6×10^{-7}	0.010	2.4×10^{-7}	1.6×10^{-7}	1.1×10^{-7}	8.8×10^{-8}	8.5×10^{-8}
Iridium										
Ir-182	0.250 h	F	0.020	1.4×10^{-10}	0.010	9.8×10^{-11}	4.5×10^{-11}	2.8×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
		M	0.020	2.1×10^{-10}	0.010	1.4×10^{-10}	6.7×10^{-11}	4.3×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
		S	0.020	2.2×10^{-10}	0.010	1.5×10^{-10}	6.9×10^{-11}	4.4×10^{-11}	2.9×10^{-11}	2.4×10^{-11}
Ir-184	3.02 h	F	0.020	5.7×10^{-10}	0.010	4.4×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.6×10^{-11}	6.2×10^{-11}
		M	0.020	8.6×10^{-10}	0.010	6.4×10^{-10}	3.2×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
		S	0.020	8.9×10^{-10}	0.010	6.6×10^{-10}	3.4×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
Ir-185	14.0 h	F	0.020	8.0×10^{-10}	0.010	6.1×10^{-10}	2.9×10^{-10}	1.8×10^{-10}	1.0×10^{-10}	8.2×10^{-11}
		M	0.020	1.3×10^{-9}	0.010	9.7×10^{-10}	4.9×10^{-10}	3.2×10^{-10}	2.2×10^{-10}	1.8×10^{-10}
		S	0.020	1.4×10^{-9}	0.010	1.0×10^{-9}	5.2×10^{-10}	3.4×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
Ir-186	15.8 h	F	0.020	1.5×10^{-9}	0.010	1.2×10^{-9}	5.9×10^{-10}	3.6×10^{-10}	2.1×10^{-10}	1.7×10^{-10}
		M	0.020	2.2×10^{-9}	0.010	1.7×10^{-9}	8.8×10^{-10}	5.8×10^{-10}	3.8×10^{-10}	3.1×10^{-10}
		S	0.020	2.3×10^{-9}	0.010	1.8×10^{-9}	9.2×10^{-10}	6.0×10^{-10}	4.0×10^{-10}	3.2×10^{-10}
Ir-186	1.75 h	F	0.020	2.1×10^{-10}	0.010	1.6×10^{-10}	7.7×10^{-11}	4.8×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
		M	0.020	3.3×10^{-10}	0.010	2.4×10^{-10}	1.2×10^{-10}	7.7×10^{-11}	5.1×10^{-11}	4.2×10^{-11}
		S	0.020	3.4×10^{-10}	0.010	2.5×10^{-10}	1.2×10^{-10}	8.1×10^{-11}	5.4×10^{-11}	4.4×10^{-11}
Ir-187	10.5 h	F	0.020	3.6×10^{-10}	0.010	2.8×10^{-10}	1.4×10^{-10}	8.2×10^{-11}	4.6×10^{-11}	3.7×10^{-11}
		M	0.020	5.8×10^{-10}	0.010	4.3×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	9.2×10^{-11}	7.4×10^{-11}
		S	0.020	6.0×10^{-10}	0.010	4.5×10^{-10}	2.3×10^{-10}	1.5×10^{-10}	9.7×10^{-11}	7.9×10^{-11}
Ir-188	1.73 d	F	0.020	2.0×10^{-9}	0.010	1.6×10^{-9}	8.0×10^{-10}	5.0×10^{-10}	2.9×10^{-10}	2.4×10^{-10}
		M	0.020	2.7×10^{-9}	0.010	2.1×10^{-9}	1.1×10^{-9}	7.5×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
		S	0.020	2.8×10^{-9}	0.010	2.2×10^{-9}	1.2×10^{-9}	7.8×10^{-10}	5.2×10^{-10}	4.2×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Ir-189	13.3 d	F	0.020	1.2×10^{-9}	0.010	8.2×10^{-10}	3.8×10^{-10}	2.4×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
		M	0.020	2.7×10^{-9}	0.010	1.9×10^{-9}	1.1×10^{-9}	7.7×10^{-10}	6.4×10^{-10}	5.2×10^{-10}
		S	0.020	3.0×10^{-9}	0.010	2.2×10^{-9}	1.3×10^{-9}	8.7×10^{-10}	7.3×10^{-10}	6.0×10^{-10}
Ir-190	12.1 d	F	0.020	6.2×10^{-9}	0.010	4.7×10^{-9}	2.4×10^{-9}	1.5×10^{-9}	9.1×10^{-10}	7.7×10^{-10}
		M	0.020	1.1×10^{-8}	0.010	8.6×10^{-9}	4.4×10^{-9}	3.1×10^{-9}	2.7×10^{-9}	2.1×10^{-9}
		S	0.020	1.1×10^{-8}	0.010	9.4×10^{-9}	4.8×10^{-9}	3.5×10^{-9}	3.0×10^{-9}	2.4×10^{-9}
Ir-190m	3.10 h	F	0.020	4.2×10^{-10}	0.010	3.4×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	6.0×10^{-11}	4.9×10^{-11}
		M	0.020	6.0×10^{-10}	0.010	4.7×10^{-10}	2.4×10^{-10}	1.5×10^{-10}	9.9×10^{-11}	7.9×10^{-11}
		S	0.020	6.2×10^{-10}	0.010	4.8×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	8.3×10^{-11}
Ir-190m	1.20 h	F	0.020	3.2×10^{-11}	0.010	2.4×10^{-11}	1.2×10^{-11}	7.2×10^{-12}	4.3×10^{-12}	3.6×10^{-12}
		M	0.020	5.7×10^{-11}	0.010	4.2×10^{-11}	2.0×10^{-11}	1.4×10^{-11}	1.2×10^{-11}	9.3×10^{-12}
		S	0.020	5.5×10^{-11}	0.010	4.5×10^{-11}	2.2×10^{-11}	1.6×10^{-11}	1.3×10^{-11}	1.0×10^{-11}
Ir-192	74.0 d	F	0.020	1.5×10^{-8}	0.010	1.1×10^{-8}	5.7×10^{-9}	3.3×10^{-9}	2.1×10^{-9}	1.8×10^{-9}
		M	0.020	2.3×10^{-8}	0.010	1.8×10^{-8}	1.1×10^{-8}	7.6×10^{-9}	6.4×10^{-9}	5.2×10^{-9}
		S	0.020	2.8×10^{-8}	0.010	2.2×10^{-8}	1.3×10^{-8}	9.5×10^{-9}	8.1×10^{-9}	6.6×10^{-9}
Ir-192m	2.41×10^{2} a	F	0.020	2.7×10^{-8}	0.010	2.3×10^{-8}	1.4×10^{-8}	8.2×10^{-9}	5.4×10^{-9}	4.8×10^{-9}
		M	0.020	2.3×10^{-8}	0.010	2.1×10^{-8}	1.3×10^{-8}	8.4×10^{-9}	6.6×10^{-9}	5.8×10^{-9}
		S	0.020	9.2×10^{-8}	0.010	9.1×10^{-8}	6.5×10^{-8}	4.5×10^{-8}	4.0×10^{-8}	3.9×10^{-8}
Ir-193m	11.9 d	F	0.020	1.2×10^{-9}	0.010	8.4×10^{-10}	3.7×10^{-10}	2.2×10^{-10}	1.2×10^{-10}	1.0×10^{-10}
		M	0.020	4.8×10^{-9}	0.010	3.5×10^{-9}	2.1×10^{-9}	1.5×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
		S	0.020	5.4×10^{-9}	0.010	4.0×10^{-9}	2.4×10^{-9}	1.8×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Ir-194	19.1 h	F	0.020	2.9×10^{-9}	0.010	1.9×10^{-9}	8.1×10^{-10}	4.9×10^{-10}	2.5×10^{-10}	2.1×10^{-10}
		M	0.020	5.3×10^{-9}	0.010	3.5×10^{-9}	1.6×10^{-9}	1.0×10^{-9}	6.3×10^{-10}	5.2×10^{-10}
		S	0.020	5.5×10^{-9}	0.010	3.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	6.7×10^{-10}	5.6×10^{-10}

Ir-194m	171 d	F	0.020	3.4×10^{-8}	0.010	2.7×10^{-8}	1.4×10^{-8}	9.5×10^{-9}	6.2×10^{-9}	5.4×10^{-9}
		M	0.020	3.9×10^{-8}	0.010	3.2×10^{-8}	1.9×10^{-8}	1.3×10^{-8}	1.1×10^{-8}	9.0×10^{-9}
		S	0.020	5.0×10^{-8}	0.010	4.2×10^{-8}	2.6×10^{-8}	1.8×10^{-8}	1.5×10^{-8}	1.3×10^{-8}
Ir-195	2.50 h	F	0.020	2.9×10^{-10}	0.010	1.9×10^{-10}	8.1×10^{-11}	5.1×10^{-11}	2.9×10^{-11}	2.4×10^{-11}
		M	0.020	5.4×10^{-10}	0.010	3.6×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.1×10^{-11}	6.7×10^{-11}
		S	0.020	5.7×10^{-10}	0.010	3.8×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	8.7×10^{-11}	7.1×10^{-11}
Ir-195m	3.80 h	F	0.020	6.9×10^{-10}	0.010	4.8×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.2×10^{-11}	6.0×10^{-11}
		M	0.020	1.2×10^{-9}	0.010	8.6×10^{-10}	4.2×10^{-10}	2.7×10^{-10}	1.9×10^{-10}	1.6×10^{-10}
		S	0.020	1.3×10^{-9}	0.010	9.0×10^{-10}	4.4×10^{-10}	2.9×10^{-10}	2.0×10^{-10}	1.7×10^{-10}
Platinum										
Pt-186	2.00 h	F	0.020	3.0×10^{-10}	0.010	2.4×10^{-10}	1.2×10^{-10}	7.2×10^{-11}	4.1×10^{-11}	3.3×10^{-11}
Pt-188	10.2 d	F	0.020	3.6×10^{-9}	0.010	2.7×10^{-9}	1.3×10^{-9}	8.4×10^{-10}	5.0×10^{-10}	4.2×10^{-10}
Pt-189	10.9 h	F	0.020	3.8×10^{-10}	0.010	2.9×10^{-10}	1.4×10^{-10}	8.4×10^{-11}	4.7×10^{-11}	3.8×10^{-11}
Pt-191	2.80 d	F	0.020	1.1×10^{-9}	0.010	7.9×10^{-10}	3.7×10^{-10}	2.3×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
Pt-193	50.0 a	F	0.020	2.2×10^{-10}	0.010	1.6×10^{-10}	7.2×10^{-11}	4.3×10^{-11}	2.5×10^{-11}	2.1×10^{-11}
Pt-193m	4.33 d	F	0.020	1.6×10^{-9}	0.010	1.0×10^{-9}	4.5×10^{-10}	2.7×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
Pt-195m	4.02 d	F	0.020	2.2×10^{-9}	0.010	1.5×10^{-9}	6.4×10^{-10}	3.9×10^{-10}	2.1×10^{-10}	1.8×10^{-10}
Pt-197	18.3 h	F	0.020	1.1×10^{-9}	0.010	7.3×10^{-10}	3.1×10^{-10}	1.9×10^{-10}	1.0×10^{-10}	8.5×10^{-11}
Pt-197m	1.57 h	F	0.020	2.8×10^{-10}	0.010	1.8×10^{-10}	7.9×10^{-11}	4.9×10^{-11}	2.8×10^{-11}	2.4×10^{-11}
Pt-199	0.513 h	F	0.020	1.3×10^{-10}	0.010	8.3×10^{-11}	3.6×10^{-11}	2.3×10^{-11}	1.4×10^{-11}	1.2×10^{-11}
Pt-200	12.5 h	F	0.020	2.6×10^{-9}	0.010	1.7×10^{-9}	7.2×10^{-10}	5.1×10^{-10}	2.6×10^{-10}	2.2×10^{-10}
Gold										
Au-193	17.6 h	F	0.200	3.7×10^{-10}	0.100	2.8×10^{-10}	1.3×10^{-10}	7.9×10^{-11}	4.3×10^{-11}	3.6×10^{-11}
		M	0.200	7.5×10^{-10}	0.100	5.6×10^{-10}	2.8×10^{-10}	1.9×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
		S	0.200	7.9×10^{-10}	0.100	5.9×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Au-194	1.65 d	F	0.200	1.2×10^{-9}	0.100	9.6×10^{-10}	4.9×10^{-10}	3.0×10^{-10}	1.8×10^{-10}	1.4×10^{-10}
		M	0.200	1.7×10^{-9}	0.100	1.4×10^{-9}	7.1×10^{-10}	4.6×10^{-10}	2.9×10^{-10}	2.3×10^{-10}
		S	0.200	1.7×10^{-9}	0.100	1.4×10^{-9}	7.3×10^{-10}	4.7×10^{-10}	3.0×10^{-10}	2.4×10^{-10}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Au-195	183 d	F	0.200	7.2×10^{-10}	0.100	5.3×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	8.1×10^{-11}	6.6×10^{-11}
		M	0.200	5.2×10^{-9}	0.100	4.1×10^{-9}	2.4×10^{-9}	1.6×10^{-9}	1.4×10^{-9}	1.1×10^{-9}
		S	0.200	8.1×10^{-9}	0.100	6.6×10^{-9}	3.9×10^{-9}	2.6×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
Au-198	2.69 d	F	0.200	2.4×10^{-9}	0.100	1.7×10^{-9}	7.6×10^{-10}	4.7×10^{-10}	2.5×10^{-10}	2.1×10^{-10}
		M	0.200	5.0×10^{-9}	0.100	4.1×10^{-9}	1.9×10^{-9}	1.3×10^{-9}	9.7×10^{-10}	7.8×10^{-10}
		S	0.200	5.4×10^{-9}	0.100	4.4×10^{-9}	2.0×10^{-9}	1.4×10^{-9}	1.1×10^{-9}	8.6×10^{-10}
Au-198m	2.30 d	F	0.200	3.3×10^{-9}	0.100	2.4×10^{-9}	1.1×10^{-9}	6.9×10^{-10}	3.7×10^{-10}	3.2×10^{-10}
		M	0.200	8.7×10^{-9}	0.100	6.5×10^{-9}	3.6×10^{-9}	2.6×10^{-9}	2.2×10^{-9}	1.8×10^{-9}
		S	0.200	9.5×10^{-9}	0.100	7.1×10^{-9}	4.0×10^{-9}	2.9×10^{-9}	2.5×10^{-9}	2.0×10^{-9}
Au-199	3.14 d	F	0.200	1.1×10^{-9}	0.100	7.9×10^{-10}	3.5×10^{-10}	2.2×10^{-10}	1.1×10^{-10}	9.8×10^{-11}
		M	0.200	3.4×10^{-9}	0.100	2.5×10^{-9}	1.4×10^{-9}	1.0×10^{-9}	9.0×10^{-10}	7.1×10^{-10}
		S	0.200	3.8×10^{-9}	0.100	2.8×10^{-9}	1.6×10^{-9}	1.2×10^{-9}	1.0×10^{-9}	7.9×10^{-10}
Au-200	0.807 h	F	0.200	1.9×10^{-10}	0.100	1.2×10^{-10}	5.2×10^{-11}	3.2×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
		M	0.200	3.2×10^{-10}	0.100	2.1×10^{-10}	9.3×10^{-11}	6.0×10^{-11}	4.0×10^{-11}	3.3×10^{-11}
		S	0.200	3.4×10^{-10}	0.100	2.1×10^{-10}	9.8×10^{-11}	6.3×10^{-11}	4.2×10^{-11}	3.5×10^{-11}
Au-200m	18.7 h	F	0.200	2.7×10^{-9}	0.100	2.1×10^{-9}	1.0×10^{-9}	6.4×10^{-10}	3.6×10^{-10}	2.9×10^{-10}
		M	0.200	4.8×10^{-9}	0.100	3.7×10^{-9}	1.9×10^{-9}	1.2×10^{-9}	8.4×10^{-10}	6.8×10^{-10}
		S	0.200	5.1×10^{-9}	0.100	3.9×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	8.9×10^{-10}	7.2×10^{-10}
Au-201	0.440 h	F	0.200	9.0×10^{-11}	0.100	5.7×10^{-11}	2.5×10^{-11}	1.6×10^{-11}	1.0×10^{-11}	8.7×10^{-12}
		M	0.200	1.5×10^{-10}	0.100	9.6×10^{-11}	4.3×10^{-11}	2.9×10^{-11}	2.0×10^{-11}	1.7×10^{-11}
		S	0.200	1.5×10^{-10}	0.100	1.0×10^{-10}	4.5×10^{-11}	3.0×10^{-11}	2.1×10^{-11}	1.7×10^{-11}
Mercury										
Hg-193 (organic)	3.50 h	F	0.800	2.2×10^{-10}	0.400	1.8×10^{-10}	8.2×10^{-11}	5.0×10^{-11}	2.9×10^{-11}	2.4×10^{-11}

Hg-193	3.50 h	F	0.040	2.7×10^{-10}	0.020	2.0×10^{-10}	8.9×10^{-11}	5.5×10^{-11}	3.1×10^{-11}	2.6×10^{-11}
(inorganic)		M	0.040	5.3×10^{-10}	0.020	3.8×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	9.2×10^{-11}	7.5×10^{-11}
Hg-193m	11.1 h	F	0.800	8.4×10^{-10}	0.400	7.6×10^{-10}	3.7×10^{-10}	2.2×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
(organic)										
Hg-193m	11.1 h	F	0.040	1.1×10^{-9}	0.020	8.5×10^{-10}	4.1×10^{-10}	2.5×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
(inorganic)		M	0.040	1.9×10^{-9}	0.020	1.4×10^{-9}	7.2×10^{-10}	4.7×10^{-10}	3.2×10^{-10}	2.6×10^{-10}
Hg-194	2.60×10^{2} a	F	0.800	4.9×10^{-8}	0.400	3.7×10^{-8}	2.4×10^{-8}	1.9×10^{-8}	1.5×10^{-8}	1.4×10^{-8}
(organic)										
Hg-194	2.60×10^{2} a	F	0.040	3.2×10^{-8}	0.020	2.9×10^{-8}	2.0×10^{-8}	1.6×10^{-8}	1.4×10^{-8}	1.3×10^{-8}
(inorganic)		M	0.040	2.1×10^{-8}	0.020	1.9×10^{-8}	1.3×10^{-8}	1.0×10^{-8}	8.9×10^{-9}	8.3×10^{-9}
Hg-195	9.90 h	F	0.800	2.0×10^{-10}	0.400	1.8×10^{-10}	8.5×10^{-11}	5.1×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
(organic)										
Hg-195	9.90 h	F	0.040	2.7×10^{-10}	0.020	2.0×10^{-10}	9.5×10^{-11}	5.7×10^{-11}	3.1×10^{-11}	2.5×10^{-11}
(inorganic)		M	0.040	5.3×10^{-10}	0.020	3.9×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	9.0×10^{-11}	7.3×10^{-11}
Hg-195m	1.73 d	F	0.800	1.1×10^{-9}	0.400	9.7×10^{-10}	4.4×10^{-10}	2.7×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
(organic)										
Hg-195m	1.73 d	F	0.040	1.6×10^{-9}	0.020	1.1×10^{-9}	5.1×10^{-10}	3.1×10^{-10}	1.7×10^{-10}	1.4×10^{-10}
(inorganic)		M	0.040	3.7×10^{-9}	0.020	2.6×10^{-9}	1.4×10^{-9}	8.5×10^{-10}	6.7×10^{-10}	5.3×10^{-10}
Hg-197	2.67 d	F	0.800	4.7×10^{-10}	0.400	4.0×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	5.8×10^{-11}	4.7×10^{-11}
(organic)										
Hg-197	2.67 d	F	0.040	6.8×10^{-10}	0.020	4.7×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	6.8×10^{-11}	5.6×10^{-11}
(inorganic)		M	0.040	1.7×10^{-9}	0.020	1.2×10^{-9}	6.6×10^{-10}	4.6×10^{-10}	3.8×10^{-10}	3.0×10^{-10}
Hg-197m	23.8 h	F	0.800	9.3×10^{-10}	0.400	7.8×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.1×10^{-10}	9.6×10^{-11}
(organic)										
Hg-197m	23.8 h	F	0.040	1.4×10^{-9}	0.020	9.3×10^{-10}	4.0×10^{-10}	2.5×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
(inorganic)		M	0.040	3.5×10^{-9}	0.020	2.5×10^{-9}	1.1×10^{-9}	8.2×10^{-10}	6.7×10^{-10}	5.3×10^{-10}
Hg-199m	0.710 h	F	0.800	1.4×10^{-10}	0.400	9.6×10^{-11}	4.2×10^{-11}	2.7×10^{-11}	1.7×10^{-11}	1.5×10^{-11}
(organic)										

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Hg-199m	0.710 h	F	0.040	1.4×10^{-10}	0.020	9.6×10^{-11}	4.2×10^{-11}	2.7×10^{-11}	1.7×10^{-11}	1.5×10^{-11}
(inorganic)		M	0.040	2.5×10^{-10}	0.020	1.7×10^{-10}	7.9×10^{-11}	5.4×10^{-11}	3.8×10^{-11}	3.2×10^{-11}
Hg-203	46.6 d	F	0.800	5.7×10^{-9}	0.400	3.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	6.6×10^{-10}	5.6×10^{-10}
(organic)										
Hg-203	46.6 d	F	0.040	4.2×10^{-9}	0.020	2.9×10^{-9}	1.4×10^{-9}	9.0×10^{-10}	5.5×10^{-10}	4.6×10^{-10}
(inorganic)		M	0.040	1.0×10^{-8}	0.020	7.9×10^{-9}	4.7×10^{-9}	3.4×10^{-9}	3.0×10^{-9}	2.4×10^{-9}
Thallium										
T1-194	0.550 h	F	1.000	3.6×10^{-11}	1.000	3.0×10^{-11}	1.5×10^{-11}	9.2×10^{-12}	5.5×10^{-12}	4.4×10^{-12}
T1-194m	0.546 h	F	1.000	1.7×10^{-10}	1.000	1.2×10^{-10}	6.1×10^{-11}	3.8×10^{-11}	2.3×10^{-11}	1.9×10^{-11}
T1-195	1.16 h	F	1.000	1.3×10^{-10}	1.000	1.0×10^{-10}	5.3×10^{-11}	3.2×10^{-11}	1.9×10^{-11}	1.5×10^{-11}
T1-197	2.84 h	F	1.000	1.3×10^{-10}	1.000	9.7×10^{-10}	4.7×10^{-11}	2.9×10^{-11}	1.7×10^{-11}	1.4×10^{-11}
T1-198	5.30 h	F	1.000	4.7×10^{-10}	1.000	4.0×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.5×10^{-11}	6.0×10^{-11}
T1 198m	1.87 h	F	1.000	3.2×10^{-10}	1.000	2.5×10^{-10}	1.2×10^{-10}	7.5×10^{-11}	4.5×10^{-11}	3.7×10^{-11}
T1-199	7.42 h	F	1.000	1.7×10^{-10}	1.000	1.3×10^{-10}	6.4×10^{-11}	3.9×10^{-11}	2.3×10^{-11}	1.9×10^{-11}
T1-200	1.09 d	F	1.000	1.0×10^{-9}	1.000	8.7×10^{-10}	4.6×10^{-10}	2.8×10^{-10}	1.6×10^{-10}	1.3×10^{-10}
T1 -201	3.04 d	F	1.000	4.5×10^{-10}	1.000	3.3×10^{-10}	1.5×10^{-10}	9.4×10^{-11}	5.4×10^{-11}	4.4×10^{-11}
T1-202	12.2 d	F	1.000	1.5×10^{-9}	1.000	1.2×10^{-9}	5.9×10^{-10}	3.8×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
T1-204	3.78 a	F	1.000	5.0×10^{-9}	1.000	3.3×10^{-9}	1.5×10^{-9}	8.8×10^{-10}	4.7×10^{-10}	3.9×10^{-10}
Lead[a]										
Pb-195m	0.263 h	F	0.600	1.3×10^{-10}	0.200	1.0×10^{-10}	4.9×10^{-11}	3.1×10^{-11}	1.9×10^{-11}	1.6×10^{-11}
		M	0.200	2.0×10^{-10}	0.100	1.5×10^{-10}	7.1×10^{-11}	4.6×10^{-11}	3.1×10^{-11}	2.5×10^{-11}
		S	0.020	2.1×10^{-10}	0.010	1.5×10^{-10}	7.4×10^{-11}	4.8×10^{-11}	3.2×10^{-11}	2.7×10^{-11}

Pb-198	2.40 h	F	0.600	3.4×10^{-10}	0.200	2.9×10^{-10}	1.5×10^{-10}	8.9×10^{-11}	5.2×10^{-11}	4.3×10^{-11}
		M	0.200	5.0×10^{-10}	0.100	4.0×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	8.3×10^{-11}	6.6×10^{-11}
		S	0.020	5.4×10^{-10}	0.010	4.2×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	8.7×10^{-11}	7.0×10^{-11}
Pb-199	1.50 h	F	0.600	1.9×10^{-10}	0.200	1.6×10^{-10}	8.2×10^{-11}	4.9×10^{-11}	2.9×10^{-11}	2.3×10^{-11}
		M	0.200	2.8×10^{-10}	0.100	2.2×10^{-10}	1.1×10^{-10}	7.1×10^{-11}	4.5×10^{-11}	3.6×10^{-11}
		S	0.020	2.9×10^{-10}	0.010	2.3×10^{-10}	1.2×10^{-10}	7.4×10^{-11}	4.7×10^{-11}	3.7×10^{-11}
Pb-200	21.5 h	F	0.600	1.1×10^{-9}	0.200	9.3×10^{-10}	4.6×10^{-10}	2.8×10^{-10}	1.6×10^{-10}	1.4×10^{-10}
		M	0.200	2.2×10^{-9}	0.100	1.7×10^{-9}	8.6×10^{-10}	5.7×10^{-10}	4.1×10^{-10}	3.3×10^{-10}
		S	0.020	2.4×10^{-9}	0.010	1.8×10^{-9}	9.2×10^{-10}	6.2×10^{-10}	4.4×10^{-10}	3.5×10^{-10}
Pb-201	9.40 h	F	0.600	4.8×10^{-10}	0.200	4.1×10^{-10}	2.0×10^{-10}	1.2×10^{-10}	7.1×10^{-11}	6.0×10^{-11}
		M	0.200	8.0×10^{-10}	0.100	6.4×10^{-10}	3.3×10^{-10}	2.1×10^{-10}	1.4×10^{-10}	1.1×10^{-10}
		S	0.020	8.8×10^{-10}	0.010	6.7×10^{-10}	3.5×10^{-10}	2.2×10^{-10}	1.5×10^{-10}	1.2×10^{-10}
Pb-202	3.00×10^{5} a	F	0.600	1.9×10^{-8}	0.200	1.3×10^{-8}	8.9×10^{-9}	1.3×10^{-8}	1.8×10^{-8}	1.1×10^{-8}
		M	0.200	1.2×10^{-8}	0.100	8.9×10^{-9}	6.2×10^{-9}	6.7×10^{-9}	8.7×10^{-9}	6.3×10^{-9}
		S	0.020	2.8×10^{-8}	0.010	2.8×10^{-8}	2.0×10^{-8}	1.4×10^{-8}	1.3×10^{-8}	1.2×10^{-8}
Pb-202m	3.62 h	F	0.600	4.7×10^{-10}	0.200	4.0×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.5×10^{-11}	6.2×10^{-11}
		M	0.200	6.9×10^{-10}	0.100	5.6×10^{-10}	2.9×10^{-10}	1.9×10^{-10}	1.2×10^{-10}	9.5×10^{-11}
		S	0.020	7.3×10^{-10}	0.010	5.8×10^{-10}	3.0×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	1.0×10^{-10}
Pb-203	2.17 d	F	0.600	7.2×10^{-10}	0.200	5.8×10^{-10}	2.8×10^{-10}	1.7×10^{-10}	9.9×10^{-11}	8.5×10^{-11}
		M	0.200	1.3×10^{-9}	0.100	1.0×10^{-9}	5.4×10^{-10}	3.6×10^{-10}	2.5×10^{-10}	2.0×10^{-10}
		S	0.020	1.5×10^{-9}	0.010	1.1×10^{-9}	5.8×10^{-10}	3.8×10^{-10}	2.8×10^{-10}	2.2×10^{-10}
Pb-205	1.43×10^{7} a	F	0.600	1.1×10^{-9}	0.200	6.9×10^{-10}	4.0×10^{-10}	4.1×10^{-10}	4.3×10^{-10}	3.3×10^{-10}
		M	0.200	1.1×10^{-9}	0.100	7.7×10^{-10}	4.3×10^{-10}	3.2×10^{-10}	2.9×10^{-10}	2.5×10^{-10}
		S	0.020	2.9×10^{-9}	0.010	2.7×10^{-9}	1.7×10^{-9}	1.1×10^{-9}	9.2×10^{-10}	8.5×10^{-10}
Pb-209	3.25 h	F	0.600	1.8×10^{-10}	0.200	1.2×10^{-10}	5.3×10^{-11}	3.4×10^{-11}	1.9×10^{-11}	1.7×10^{-11}
		M	0.200	4.0×10^{-10}	0.100	2.7×10^{-10}	1.3×10^{-10}	9.2×10^{-11}	6.9×10^{-11}	5.6×10^{-11}
		S	0.020	4.4×10^{-10}	0.010	2.9×10^{-10}	1.4×10^{-10}	9.9×10^{-11}	7.5×10^{-11}	6.1×10^{-11}

Notes: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.
[a] The f_1 value for lead for 1 to 15 years old for Type F is 0.4

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Pb-210	22.3 a	F	0.600	4.7×10^{-6}	0.200	2.9×10^{-6}	1.5×10^{-6}	1.4×10^{-6}	1.3×10^{-6}	9.0×10^{-7}
		M	0.200	5.0×10^{-6}	0.100	3.7×10^{-6}	2.2×10^{-6}	1.5×10^{-6}	1.3×10^{-6}	1.1×10^{-6}
		S	0.020	1.8×10^{-5}	0.010	1.8×10^{-5}	1.1×10^{-5}	7.2×10^{-6}	5.9×10^{-6}	5.6×10^{-6}
Pb-211	0.601 h	F	0.600	2.5×10^{-8}	0.200	1.7×10^{-8}	8.7×10^{-9}	6.1×10^{-9}	4.6×10^{-9}	3.9×10^{-9}
		M	0.200	6.2×10^{-8}	0.100	4.5×10^{-8}	2.5×10^{-8}	1.9×10^{-8}	1.4×10^{-8}	1.1×10^{-8}
		S	0.020	6.6×10^{-8}	0.010	4.8×10^{-8}	2.7×10^{-8}	2.0×10^{-8}	1.5×10^{-8}	1.2×10^{-8}
Pb-212	10.6 h	F	0.600	1.9×10^{-7}	0.200	1.2×10^{-7}	5.4×10^{-8}	3.5×10^{-8}	2.0×10^{-8}	1.8×10^{-8}
		M	0.200	6.2×10^{-7}	0.100	4.6×10^{-7}	3.0×10^{-7}	2.2×10^{-7}	2.2×10^{-7}	1.7×10^{-7}
		S	0.020	6.7×10^{-7}	0.010	5.0×10^{-7}	3.3×10^{-7}	2.5×10^{-7}	2.4×10^{-7}	1.9×10^{-7}
Pb-214	0.447 h	F	0.600	2.2×10^{-8}	0.200	1.5×10^{-8}	6.9×10^{-9}	4.8×10^{-9}	3.3×10^{-9}	2.8×10^{-9}
		M	0.200	6.4×10^{-8}	0.100	4.6×10^{-8}	2.6×10^{-8}	1.9×10^{-8}	1.4×10^{-8}	1.4×10^{-8}
		S	0.020	6.9×10^{-8}	0.010	5.0×10^{-8}	2.8×10^{-8}	2.1×10^{-8}	1.5×10^{-8}	1.5×10^{-8}
Bismuth										
Bi-200	0.606 h	F	0.100	1.9×10^{-10}	0.050	1.5×10^{-10}	7.4×10^{-11}	4.5×10^{-11}	2.7×10^{-11}	2.2×10^{-11}
		M	0.100	2.5×10^{-10}	0.050	1.9×10^{-10}	9.9×10^{-11}	6.3×10^{-11}	4.1×10^{-11}	3.3×10^{-11}
Bi-201	1.80 h	F	0.100	4.0×10^{-10}	0.050	3.1×10^{-10}	1.5×10^{-10}	9.3×10^{-11}	5.4×10^{-11}	4.4×10^{-11}
		M	0.100	5.5×10^{-10}	0.050	4.1×10^{-10}	2.0×10^{-10}	1.3×10^{-10}	8.3×10^{-11}	6.6×10^{-11}
Bi-202	1.67 h	F	0.100	3.4×10^{-10}	0.050	2.8×10^{-10}	1.5×10^{-10}	9.0×10^{-11}	5.3×10^{-11}	4.3×10^{-11}
		M	0.100	4.2×10^{-10}	0.050	3.4×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	6.9×10^{-11}	5.5×10^{-11}
Bi-203	11.8 h	F	0.100	1.5×10^{-9}	0.050	1.2×10^{-9}	6.4×10^{-10}	4.0×10^{-10}	2.3×10^{-10}	1.9×10^{-10}
		M	0.100	2.0×10^{-9}	0.050	1.6×10^{-9}	8.2×10^{-10}	5.3×10^{-10}	3.3×10^{-10}	2.6×10^{-10}
Bi-205	15.3 d	F	0.100	3.0×10^{-9}	0.050	2.4×10^{-9}	1.3×10^{-9}	8.0×10^{-10}	4.7×10^{-10}	3.8×10^{-10}
		M	0.100	5.5×10^{-9}	0.050	4.4×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	1.2×10^{-9}	9.3×10^{-10}
Bi-206	6.24 d	F	0.100	6.1×10^{-9}	0.050	4.8×10^{-9}	2.5×10^{-9}	1.6×10^{-9}	9.1×10^{-10}	7.4×10^{-10}
		M	0.100	1.0×10^{-8}	0.050	8.0×10^{-9}	4.4×10^{-9}	2.9×10^{-9}	2.1×10^{-9}	1.7×10^{-9}

Bi-207	38.0 a	F	0.100	4.3×10^{-9}	0.050	3.3×10^{-9}	1.7×10^{-9}	1.0×10^{-9}	6.0×10^{-10}	4.9×10^{-10}
		M	0.100	2.3×10^{-8}	0.050	2.0×10^{-8}	1.2×10^{-8}	8.2×10^{-9}	6.5×10^{-9}	5.6×10^{-9}
Bi-210	5.01 d	F	0.100	1.1×10^{-8}	0.050	6.9×10^{-9}	3.2×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
		M	0.100	3.9×10^{-7}	0.050	3.0×10^{-7}	1.9×10^{-7}	1.3×10^{-7}	1.1×10^{-7}	9.3×10^{-8}
Bi-210m	3.00×10^{6} a	F	0.100	4.1×10^{-7}	0.050	2.6×10^{-7}	1.3×10^{-7}	8.3×10^{-8}	5.6×10^{-8}	4.6×10^{-8}
		M	0.100	1.5×10^{-5}	0.050	1.1×10^{-5}	7.0×10^{-6}	4.8×10^{-6}	4.1×10^{-6}	3.4×10^{-6}
Bi-212	1.01 h	F	0.100	6.5×10^{-8}	0.050	4.5×10^{-8}	2.1×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	9.1×10^{-9}
		M	0.100	1.6×10^{-7}	0.050	1.1×10^{-7}	6.0×10^{-8}	4.4×10^{-8}	3.8×10^{-8}	3.1×10^{-8}
Bi-213	0.761 h	F	0.100	7.7×10^{-8}	0.050	5.3×10^{-8}	2.5×10^{-8}	1.7×10^{-8}	1.2×10^{-8}	1.0×10^{-8}
		M	0.100	1.6×10^{-7}	0.050	1.2×10^{-7}	6.0×10^{-8}	4.4×10^{-8}	3.6×10^{-8}	3.0×10^{-8}
Bi-214	0.332 h	F	0.100	5.0×10^{-8}	0.050	3.5×10^{-8}	1.6×10^{-8}	1.1×10^{-8}	8.2×10^{-9}	7.1×10^{-9}
		M	0.100	8.7×10^{-8}	0.050	6.1×10^{-8}	3.1×10^{-8}	2.2×10^{-8}	1.7×10^{-8}	1.4×10^{-8}
Polonium										
Po-203	0.612 h	F	0.200	1.9×10^{-10}	0.100	1.5×10^{-10}	7.7×10^{-11}	4.7×10^{-11}	2.8×10^{-11}	2.3×10^{-11}
		M	0.200	2.7×10^{-10}	0.100	2.1×10^{-10}	1.1×10^{-10}	6.7×10^{-11}	4.3×10^{-11}	3.5×10^{-11}
		S	0.020	2.8×10^{-10}	0.010	2.2×10^{-10}	1.1×10^{-10}	7.0×10^{-11}	4.5×10^{-11}	3.6×10^{-11}
Po-205	1.80 h	F	0.200	2.6×10^{-10}	0.100	2.1×10^{-10}	1.1×10^{-10}	6.6×10^{-11}	4.1×10^{-11}	3.3×10^{-11}
		M	0.200	4.0×10^{-10}	0.100	3.1×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.1×10^{-11}	6.5×10^{-11}
		S	0.020	4.2×10^{-10}	0.010	3.2×10^{-10}	1.8×10^{-10}	1.2×10^{-10}	8.5×10^{-11}	6.9×10^{-11}
Po-207	5.83 h	F	0.200	4.8×10^{-10}	0.100	4.0×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	7.3×10^{-11}	5.8×10^{-11}
		M	0.200	6.2×10^{-10}	0.100	5.1×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	9.9×10^{-11}	7.8×10^{-11}
		S	0.020	6.6×10^{-10}	0.010	5.3×10^{-10}	2.7×10^{-10}	1.7×10^{-10}	1.0×10^{-10}	8.2×10^{-11}
Po-210	138 d	F	0.200	7.4×10^{-6}	0.100	4.8×10^{-6}	2.2×10^{-6}	1.3×10^{-6}	7.7×10^{-7}	6.1×10^{-7}
		M	0.200	1.5×10^{-5}	0.100	1.1×10^{-5}	6.7×10^{-6}	4.6×10^{-6}	4.0×10^{-6}	3.3×10^{-6}
		S	0.020	1.8×10^{-5}	0.010	1.4×10^{-5}	8.6×10^{-6}	5.9×10^{-6}	5.1×10^{-6}	4.3×10^{-6}
Astatine										
At-207	1.80 h	F	1.000	2.4×10^{-9}	1.000	1.7×10^{-9}	8.9×10^{-10}	5.9×10^{-10}	4.0×10^{-10}	3.3×10^{-10}
		M	1.000	9.2×10^{-9}	1.000	6.7×10^{-9}	4.3×10^{-9}	3.1×10^{-9}	2.9×10^{-9}	2.3×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
At-211	7.21 h	F	1.000	1.4×10^{-7}	1.000	9.7×10^{-8}	4.3×10^{-8}	2.8×10^{-8}	1.7×10^{-8}	1.6×10^{-8}
		M	1.000	5.2×10^{-7}	1.000	3.7×10^{-7}	1.9×10^{-7}	1.4×10^{-7}	1.3×10^{-7}	1.1×10^{-7}
Francium										
Fr-222	0.240 h	F	1.000	9.1×10^{-8}	1.000	6.3×10^{-8}	3.0×10^{-8}	2.1×10^{-8}	1.6×10^{-8}	1.4×10^{-8}
Fr-223	0.363 h	F	1.000	1.1×10^{-8}	1.000	7.3×10^{-9}	3.2×10^{-9}	1.9×10^{-9}	1.0×10^{-9}	8.9×10^{-10}
Radium[a]										
Ra-223	11.4 d	F	0.600	3.0×10^{-6}	0.200	1.0×10^{-6}	4.9×10^{-7}	4.0×10^{-7}	3.3×10^{-7}	1.2×10^{-7}
		M	0.200	2.8×10^{-5}	0.100	2.1×10^{-5}	1.3×10^{-5}	9.9×10^{-6}	9.4×10^{-6}	7.4×10^{-6}
		S	0.020	3.2×10^{-5}	0.010	2.4×10^{-5}	1.5×10^{-5}	1.1×10^{-5}	1.1×10^{-5}	8.7×10^{-6}
Ra-224	3.66 d	F	0.600	1.5×10^{-6}	0.200	6.0×10^{-7}	2.9×10^{-7}	2.2×10^{-7}	1.7×10^{-7}	7.5×10^{-8}
		M	0.200	1.1×10^{-5}	0.100	8.2×10^{-6}	5.3×10^{-6}	3.9×10^{-6}	3.7×10^{-6}	3.0×10^{-6}
		S	0.020	1.2×10^{-5}	0.010	9.2×10^{-6}	5.9×10^{-6}	4.4×10^{-6}	4.2×10^{-6}	3.4×10^{-6}
Ra-225	14.8 d	F	0.600	4.0×10^{-6}	0.200	1.2×10^{-6}	5.6×10^{-7}	4.6×10^{-7}	3.8×10^{-7}	1.3×10^{-7}
		M	0.200	2.4×10^{-5}	0.100	1.8×10^{-5}	1.1×10^{-5}	8.4×10^{-6}	7.9×10^{-6}	6.3×10^{-6}
		S	0.020	2.8×10^{-5}	0.010	2.2×10^{-5}	1.4×10^{-5}	1.0×10^{-5}	9.8×10^{-6}	7.7×10^{-6}
Ra-226	1.60×10^{3} a	F	0.600	2.6×10^{-6}	0.200	9.4×10^{-7}	5.5×10^{-7}	7.2×10^{-7}	1.3×10^{-6}	3.6×10^{-7}
		M	0.200	1.5×10^{-5}	0.100	1.1×10^{-5}	7.0×10^{-6}	4.9×10^{-6}	4.5×10^{-6}	3.5×10^{-6}
		S	0.020	3.4×10^{-5}	0.010	2.9×10^{-5}	1.9×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	9.5×10^{-6}
Ra-227	0.703 h	F	0.600	1.5×10^{-9}	0.200	1.2×10^{-9}	7.8×10^{-10}	6.1×10^{-10}	5.3×10^{-10}	4.6×10^{-10}
		M	0.200	8.0×10^{-10}	0.100	6.7×10^{-10}	4.4×10^{-10}	3.2×10^{-10}	2.9×10^{-10}	2.8×10^{-10}
		S	0.020	1.0×10^{-9}	0.010	8.5×10^{-10}	4.4×10^{-10}	2.9×10^{-10}	2.4×10^{-10}	2.2×10^{-10}
Ra-228	5.75 a	F	0.600	1.7×10^{-5}	0.200	5.7×10^{-6}	3.1×10^{-6}	3.6×10^{-6}	4.6×10^{-6}	9.0×10^{-7}
		M	0.200	1.5×10^{-5}	0.100	1.0×10^{-5}	6.3×10^{-6}	4.6×10^{-6}	4.4×10^{-6}	2.6×10^{-6}
		S	0.020	4.9×10^{-5}	0.010	4.8×10^{-5}	3.2×10^{-5}	2.0×10^{-5}	1.6×10^{-5}	1.6×10^{-5}

Notes: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.
[a] The f_1 value for radium for 1 to 15 years old for Type F is 0.3

Actinium										
Ac-224	2.90 h	F	0.005	1.3×10^{-7}	5.0×10^{-4}	8.9×10^{-8}	4.7×10^{-8}	3.1×10^{-8}	1.4×10^{-8}	1.1×10^{-8}
		M	0.005	4.2×10^{-7}	5.0×10^{-4}	3.2×10^{-7}	2.0×10^{-7}	1.5×10^{-7}	1.4×10^{-7}	1.1×10^{-7}
		S	0.005	4.6×10^{-7}	5.0×10^{-4}	3.5×10^{-7}	2.2×10^{-7}	1.7×10^{-7}	1.6×10^{-7}	1.3×10^{-7}
Ac-225	10.0 d	F	0.005	1.1×10^{-5}	5.0×10^{-4}	7.7×10^{-6}	4.0×10^{-6}	2.6×10^{-6}	1.1×10^{-6}	8.8×10^{-7}
		M	0.005	2.8×10^{-5}	5.0×10^{-4}	2.1×10^{-5}	1.3×10^{-5}	1.0×10^{-5}	9.3×10^{-6}	7.4×10^{-6}
		S	0.005	3.1×10^{-5}	5.0×10^{-4}	2.3×10^{-5}	1.5×10^{-5}	1.1×10^{-5}	1.1×10^{-5}	8.5×10^{-6}
Ac-226	1.21 d	F	0.005	1.5×10^{-6}	5.0×10^{-4}	1.1×10^{-6}	4.0×10^{-7}	2.6×10^{-7}	1.2×10^{-7}	9.6×10^{-8}
		M	0.005	4.3×10^{-6}	5.0×10^{-4}	3.2×10^{-6}	2.1×10^{-6}	1.5×10^{-6}	1.5×10^{-6}	1.2×10^{-6}
		S	0.005	4.7×10^{-6}	5.0×10^{-4}	3.5×10^{-6}	2.3×10^{-6}	1.7×10^{-6}	1.6×10^{-6}	1.3×10^{-6}
Ac-227	21.8 a	F	0.005	1.7×10^{-3}	5.0×10^{-4}	1.6×10^{-3}	1.0×10^{-3}	7.2×10^{-4}	5.6×10^{-4}	5.5×10^{-4}
		M	0.005	5.7×10^{-4}	5.0×10^{-4}	5.5×10^{-4}	3.9×10^{-4}	2.6×10^{-4}	2.3×10^{-4}	2.2×10^{-4}
		S	0.005	2.2×10^{-4}	5.0×10^{-4}	2.0×10^{-4}	1.3×10^{-4}	8.7×10^{-5}	7.6×10^{-5}	7.2×10^{-5}
Ac-228	6.13 h	F	0.005	1.8×10^{-7}	5.0×10^{-4}	1.6×10^{-7}	9.7×10^{-8}	5.7×10^{-8}	2.9×10^{-8}	2.5×10^{-8}
		M	0.005	8.4×10^{-8}	5.0×10^{-4}	7.3×10^{-8}	4.7×10^{-8}	2.9×10^{-8}	2.0×10^{-8}	1.7×10^{-8}
		S	0.005	6.4×10^{-8}	5.0×10^{-4}	5.3×10^{-8}	3.3×10^{-8}	2.2×10^{-8}	1.9×10^{-8}	1.6×10^{-8}
Thorium										
Th-226	0.515 h	F	0.005	1.4×10^{-7}	5.0×10^{-4}	1.0×10^{-7}	4.8×10^{-8}	3.4×10^{-8}	2.5×10^{-8}	2.2×10^{-8}
		M	0.005	3.0×10^{-7}	5.0×10^{-4}	2.1×10^{-7}	1.1×10^{-7}	8.3×10^{-8}	7.0×10^{-8}	5.8×10^{-8}
		S	0.005	3.1×10^{-7}	5.0×10^{-4}	2.2×10^{-7}	1.2×10^{-7}	8.8×10^{-8}	7.5×10^{-8}	6.1×10^{-8}
Th-227	18.7 d	F	0.005	8.4×10^{-6}	5.0×10^{-4}	5.2×10^{-6}	2.6×10^{-6}	1.6×10^{-6}	1.0×10^{-6}	6.7×10^{-7}
		M	0.005	3.2×10^{-5}	5.0×10^{-4}	2.5×10^{-5}	1.6×10^{-5}	1.1×10^{-5}	1.1×10^{-5}	8.5×10^{-6}
		S	0.005	3.9×10^{-5}	5.0×10^{-4}	3.0×10^{-5}	1.9×10^{-5}	1.4×10^{-5}	1.3×10^{-5}	1.0×10^{-5}
Th-228	1.91 a	F	0.005	1.8×10^{-4}	5.0×10^{-4}	1.5×10^{-4}	8.3×10^{-5}	5.2×10^{-5}	3.6×10^{-5}	2.9×10^{-5}
		M	0.005	1.3×10^{-4}	5.0×10^{-4}	1.1×10^{-4}	6.8×10^{-5}	4.6×10^{-5}	3.9×10^{-5}	3.2×10^{-5}
		S	0.005	1.6×10^{-4}	5.0×10^{-4}	1.3×10^{-4}	8.2×10^{-5}	5.5×10^{-5}	4.7×10^{-5}	4.0×10^{-5}
Th-229	7.34×10^{3} a	F	0.005	5.4×10^{-4}	5.0×10^{-4}	5.1×10^{-4}	3.6×10^{-4}	2.9×10^{-4}	2.4×10^{-4}	2.4×10^{-4}
		M	0.005	2.3×10^{-4}	5.0×10^{-4}	2.1×10^{-4}	1.6×10^{-4}	1.2×10^{-4}	1.1×10^{-4}	1.1×10^{-4}
		S	0.005	2.1×10^{-4}	5.0×10^{-4}	1.9×10^{-4}	1.3×10^{-4}	8.7×10^{-5}	7.6×10^{-5}	7.1×10^{-5}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Th-230	7.70 x 10^4 a	F	0.005	2.1 x 10^{-4}	5.0 x 10^{-4}	2.0 x 10^{-4}	1.4 x 10^{-4}	1.1 x 10^{-4}	9.9 x 10^{-5}	1.0 x 10^{-4}
		M	0.005	7.7 x 10^{-5}	5.0 x 10^{-4}	7.4 x 10^{-5}	5.5 x 10^{-5}	4.3 x 10^{-5}	4.2 x 10^{-5}	4.3 x 10^{-5}
		S	0.005	4.0 x 10^{-5}	5.0 x 10^{-4}	3.5 x 10^{-5}	2.4 x 10^{-5}	1.6 x 10^{-5}	1.5 x 10^{-5}	1.4 x 10^{-5}
Th-231	1.06 d	F	0.005	1.1 x 10^{-9}	5.0 x 10^{-4}	7.2 x 10^{-10}	2.6 x 10^{-10}	1.6 x 10^{-10}	9.2 x 10^{-11}	7.8 x 10^{-11}
		M	0.005	2.2 x 10^{-9}	5.0 x 10^{-4}	1.6 x 10^{-9}	8.0 x 10^{-10}	4.8 x 10^{-10}	3.8 x 10^{-10}	3.1 x 10^{-10}
		S	0.005	2.4 x 10^{-9}	5.0 x 10^{-4}	1.7 x 10^{-9}	7.6 x 10^{-10}	5.2 x 10^{-10}	4.1 x 10^{-10}	3.3 x 10^{-10}
Th-232	1.40 x 10^{10} a	F	0.005	2.3 x 10^{-4}	5.0 x 10^{-4}	2.2 x 10^{-4}	1.6 x 10^{-4}	1.3 x 10^{-4}	1.2 x 10^{-4}	1.1 x 10^{-4}
		M	0.005	8.3 x 10^{-5}	5.0 x 10^{-4}	8.1 x 10^{-5}	6.3 x 10^{-5}	5.0 x 10^{-5}	4.7 x 10^{-5}	4.5 x 10^{-5}
		S	0.005	5.4 x 10^{-5}	5.0 x 10^{-4}	5.0 x 10^{-5}	3.7 x 10^{-5}	2.6 x 10^{-5}	2.5 x 10^{-5}	2.5 x 10^{-5}
Th-234	24.1 d	F	0.005	4.0 x 10^{-8}	5.0 x 10^{-4}	2.5 x 10^{-8}	1.1 x 10^{-8}	6.1 x 10^{-9}	3.5 x 10^{-9}	2.5 x 10^{-9}
		M	0.005	3.9 x 10^{-8}	5.0 x 10^{-4}	2.9 x 10^{-8}	1.5 x 10^{-8}	1.0 x 10^{-8}	7.9 x 10^{-9}	6.6 x 10^{-9}
		S	0.005	4.1 x 10^{-8}	5.0 x 10^{-4}	3.1 x 10^{-8}	1.7 x 10^{-8}	1.1 x 10^{-8}	9.1 x 10^{-9}	7.7 x 10^{-9}
Protactinium										
Pa-227	0.638 h	M	0.005	3.6 x 10^{-7}	5.0 x 10^{-4}	2.6 x 10^{-7}	1.4 x 10^{-7}	1.0 x 10^{-7}	9.0 x 10^{-8}	7.4 x 10^{-8}
		S	0.005	3.8 x 10^{-7}	5.0 x 10^{-4}	2.8 x 10^{-7}	1.5 x 10^{-7}	1.1 x 10^{-7}	8.1 x 10^{-8}	8.0 x 10^{-8}
Pa-228	22.0 h	M	0.005	2.6 x 10^{-7}	5.0 x 10^{-4}	2.1 x 10^{-7}	1.3 x 10^{-7}	8.8 x 10^{-8}	7.7 x 10^{-8}	6.4 x 10^{-8}
		S	0.005	2.9 x 10^{-7}	5.0 x 10^{-4}	2.4 x 10^{-7}	1.5 x 10^{-7}	1.0 x 10^{-7}	9.1 x 10^{-8}	7.5 x 10^{-8}
Pa-230	17.4 d	M	0.005	2.4 x 10^{-6}	5.0 x 10^{-4}	1.8 x 10^{-6}	1.1 x 10^{-6}	8.3 x 10^{-7}	7.6 x 10^{-7}	6.1 x 10^{-7}
		S	0.005	2.9 x 10^{-6}	5.0 x 10^{-4}	2.2 x 10^{-6}	1.4 x 10^{-6}	1.0 x 10^{-6}	9.6 x 10^{-7}	7.6 x 10^{-7}
Pa-231	3.27 x 10^4 a	M	0.005	2.2 x 10^{-4}	5.0 x 10^{-4}	2.3 x 10^{-4}	1.9 x 10^{-4}	1.5 x 10^{-4}	1.5 x 10^{-4}	1.4 x 10^{-4}
		S	0.005	7.4 x 10^{-5}	5.0 x 10^{-4}	6.9 x 10^{-5}	5.2 x 10^{-5}	3.9 x 10^{-5}	3.6 x 10^{-5}	3.4 x 10^{-5}
Pa-232	1.31 d	M	0.005	1.9 x 10^{-8}	5.0 x 10^{-4}	1.8 x 10^{-8}	1.4 x 10^{-8}	1.1 x 10^{-8}	1.0 x 10^{-8}	1.0 x 10^{-8}
		S	0.005	1.0 x 10^{-8}	5.0 x 10^{-4}	8.7 x 10^{-9}	5.9 x 10^{-9}	4.1 x 10^{-9}	3.7 x 10^{-9}	3.5 x 10^{-9}

Pa-233	27.0 d	M	0.005	1.5×10^{-8}	5.0×10^{-4}	1.1×10^{-8}	6.5×10^{-9}	4.7×10^{-9}	4.1×10^{-9}	3.3×10^{-9}
		S	0.005	1.7×10^{-8}	5.0×10^{-4}	1.3×10^{-8}	7.5×10^{-9}	5.5×10^{-9}	4.9×10^{-9}	3.9×10^{-9}
Pa-234	6.70 h	M	0.005	2.8×10^{-9}	5.0×10^{-4}	2.0×10^{-9}	1.0×10^{-9}	6.8×10^{-10}	4.7×10^{-10}	3.8×10^{-10}
		S	0.005	2.9×10^{-9}	5.0×10^{-4}	2.1×10^{-9}	1.1×10^{-9}	7.1×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
Uranium										
U-230	20.8 d	F	0.040	3.2×10^{-6}	0.020	1.5×10^{-6}	7.2×10^{-7}	5.4×10^{-7}	4.1×10^{-7}	3.8×10^{-7}
		M	0.040	4.9×10^{-5}	0.020	3.7×10^{-5}	2.4×10^{-5}	1.8×10^{-5}	1.7×10^{-5}	1.3×10^{-5}
		S	0.020	5.8×10^{-5}	0.002	4.4×10^{-5}	2.8×10^{-5}	2.1×10^{-5}	2.0×10^{-5}	1.6×10^{-5}
U-231	4.20 d	F	0.040	8.9×10^{-10}	0.020	6.2×10^{-10}	3.1×10^{-10}	1.4×10^{-10}	1.0×10^{-10}	6.2×10^{-11}
		M	0.040	2.4×10^{-9}	0.020	1.7×10^{-9}	9.4×10^{-10}	5.5×10^{-10}	4.6×10^{-10}	3.8×10^{-10}
		S	0.020	2.6×10^{-9}	0.002	1.9×10^{-9}	9.0×10^{-10}	6.1×10^{-10}	4.9×10^{-10}	4.0×10^{-10}
U-232	72.0 a	F	0.040	1.6×10^{-5}	0.020	1.0×10^{-5}	6.9×10^{-6}	6.8×10^{-6}	7.5×10^{-6}	4.0×10^{-6}
		M	0.040	3.0×10^{-5}	0.020	2.4×10^{-5}	1.6×10^{-5}	1.1×10^{-5}	1.0×10^{-5}	7.8×10^{-6}
		S	0.020	1.0×10^{-4}	0.002	9.7×10^{-5}	6.6×10^{-5}	4.3×10^{-5}	3.8×10^{-5}	3.7×10^{-5}
U-233	1.58×10^{5} a	F	0.040	2.2×10^{-6}	0.020	1.4×10^{-6}	9.4×10^{-7}	8.4×10^{-7}	8.6×10^{-7}	5.8×10^{-7}
		M	0.040	1.5×10^{-5}	0.020	1.1×10^{-5}	7.2×10^{-6}	4.9×10^{-6}	4.3×10^{-6}	3.6×10^{-6}
		S	0.020	3.4×10^{-5}	0.002	3.0×10^{-5}	1.9×10^{-5}	1.2×10^{-5}	1.1×10^{-5}	9.6×10^{-6}
U-234	2.44×10^{5} a	F	0.040	2.1×10^{-6}	0.020	1.4×10^{-6}	9.0×10^{-7}	8.0×10^{-7}	8.2×10^{-7}	5.6×10^{-7}
		M	0.040	1.5×10^{-5}	0.020	1.1×10^{-5}	7.0×10^{-6}	4.8×10^{-6}	4.2×10^{-6}	3.5×10^{-6}
		S	0.020	3.3×10^{-5}	0.002	2.9×10^{-5}	1.9×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	9.4×10^{-6}
U-235	7.04×10^{8} a	F	0.040	2.0×10^{-6}	0.020	1.3×10^{-6}	8.5×10^{-7}	7.5×10^{-7}	7.7×10^{-7}	5.2×10^{-7}
		M	0.040	1.3×10^{-5}	0.020	1.0×10^{-5}	6.3×10^{-6}	4.3×10^{-6}	3.7×10^{-6}	3.1×10^{-6}
		S	0.020	3.0×10^{-5}	0.002	2.6×10^{-5}	1.7×10^{-5}	1.1×10^{-5}	9.2×10^{-6}	8.5×10^{-6}
U-236	2.34×10^{7} a	F	0.040	2.0×10^{-6}	0.020	1.3×10^{-6}	8.5×10^{-7}	7.5×10^{-7}	7.8×10^{-7}	5.3×10^{-7}
		M	0.040	1.4×10^{-5}	0.020	1.0×10^{-5}	6.5×10^{-6}	4.5×10^{-6}	3.9×10^{-6}	3.2×10^{-6}
		S	0.020	3.1×10^{-5}	0.002	2.7×10^{-5}	1.8×10^{-5}	1.1×10^{-5}	9.5×10^{-6}	8.7×10^{-6}
U-237	6.75 d	F	0.040	1.8×10^{-9}	0.020	1.5×10^{-9}	6.6×10^{-10}	4.2×10^{-10}	1.9×10^{-10}	1.8×10^{-10}
		M	0.040	7.8×10^{-9}	0.020	5.7×10^{-9}	3.3×10^{-9}	2.4×10^{-9}	2.1×10^{-9}	1.7×10^{-9}
		S	0.020	8.7×10^{-9}	0.002	6.4×10^{-9}	3.7×10^{-9}	2.7×10^{-9}	2.4×10^{-9}	1.9×10^{-9}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
U-238	4.47 x 10^9 a	F	0.040	1.9 x 10^{-6}	0.020	1.3 x 10^{-6}	8.2 x 10^{-7}	7.3 x 10^{-7}	7.4 x 10^{-7}	5.0 x 10^{-7}
		M	0.040	1.2 x 10^{-5}	0.020	9.4 x 10^{-6}	5.9 x 10^{-6}	4.0 x 10^{-6}	3.4 x 10^{-6}	2.9 x 10^{-6}
		S	0.020	2.9 x 10^{-5}	0.002	2.5 x 10^{-5}	1.6 x 10^{-5}	1.0 x 10^{-5}	8.7 x 10^{-6}	8.0 x 10^{-6}
U-239	0.392 h	F	0.040	1.0 x 10^{-10}	0.020	6.6 x 10^{-11}	2.9 x 10^{-11}	1.9 x 10^{-11}	1.2 x 10^{-11}	1.0 x 10^{-11}
		M	0.040	1.8 x 10^{-10}	0.020	1.2 x 10^{-10}	5.6 x 10^{-11}	3.8 x 10^{-11}	2.7 x 10^{-11}	2.2 x 10^{-11}
		S	0.020	1.9 x 10^{-10}	0.002	1.2 x 10^{-10}	5.9 x 10^{-11}	4.0 x 10^{-11}	2.9 x 10^{-11}	2.4 x 10^{-11}
U-240	14.1 h	F	0.040	2.4 x 10^{-9}	0.020	1.6 x 10^{-9}	7.1 x 10^{-10}	4.5 x 10^{-10}	2.3 x 10^{-10}	2.0 x 10^{-10}
		M	0.040	4.6 x 10^{-9}	0.020	3.1 x 10^{-9}	1.7 x 10^{-9}	1.1 x 10^{-9}	6.5 x 10^{-10}	5.3 x 10^{-10}
		S	0.020	4.9 x 10^{-9}	0.002	3.3 x 10^{-9}	1.6 x 10^{-9}	1.1 x 10^{-9}	7.0 x 10^{-10}	5.8 x 10^{-10}
Neptunium										
Np-232	0.245 h	F	0.005	2.0 x 10^{-10}	5.0 x 10^{-4}	1.9 x 10^{-10}	1.2 x 10^{-10}	1.1 x 10^{-10}	1.1 x 10^{-10}	1.2 x 10^{-10}
		M	0.005	8.9 x 10^{-11}	5.0 x 10^{-4}	8.1 x 10^{-11}	5.5 x 10^{-11}	4.5 x 10^{-11}	4.7 x 10^{-11}	5.0 x 10^{-11}
		S	0.005	1.2 x 10^{-10}	5.0 x 10^{-4}	9.7 x 10^{-11}	5.8 x 10^{-11}	3.9 x 10^{-11}	2.5 x 10^{-11}	2.4 x 10^{-11}
Np-233	0.603 h	F	0.005	1.1 x 10^{-11}	5.0 x 10^{-4}	8.7 x 10^{-12}	4.2 x 10^{-12}	2.5 x 10^{-12}	1.4 x 10^{-12}	1.1 x 10^{-12}
		M	0.005	1.5 x 10^{-11}	5.0 x 10^{-4}	1.1 x 10^{-11}	5.5 x 10^{-12}	3.3 x 10^{-12}	2.1 x 10^{-12}	1.6 x 10^{-12}
		S	0.005	1.5 x 10^{-11}	5.0 x 10^{-4}	1.2 x 10^{-11}	5.7 x 10^{-12}	3.4 x 10^{-12}	2.1 x 10^{-12}	1.7 x 10^{-12}
Np234	4.40 d	F	0.005	2.9 x 10^{-9}	5.0 x 10^{-4}	2.2 x 10^{-9}	1.1 x 10^{-9}	7.2 x 10^{-10}	4.3 x 10^{-10}	3.5 x 10^{-10}
		M	0.005	3.8 x 10^{-9}	5.0 x 10^{-4}	3.0 x 10^{-9}	1.6 x 10^{-9}	1.0 x 10^{-9}	6.5 x 10^{-10}	5.3 x 10^{-10}
		S	0.005	3.9 x 10^{-9}	5.0 x 10^{-4}	3.1 x 10^{-9}	1.6 x 10^{-9}	1.0 x 10^{-9}	6.8 x 10^{-10}	5.5 x 10^{-10}
Np-235	1.08 a	F	0.005	4.2 x 10^{-9}	5.0 x 10^{-4}	3.5 x 10^{-9}	1.9 x 10^{-9}	1.1 x 10^{-9}	7.5 x 10^{-10}	6.3 x 10^{-10}
		M	0.005	2.3 x 10^{-9}	5.0 x 10^{-4}	1.9 x 10^{-9}	1.1 x 10^{-9}	6.8 x 10^{-10}	5.1 x 10^{-10}	4.2 x 10^{-10}
		S	0.005	2.6 x 10^{-9}	5.0 x 10^{-4}	2.2 x 10^{-9}	1.3 x 10^{-9}	8.3 x 10^{-10}	6.3 x 10^{-10}	5.2 x 10^{-10}

Np-236	1.15 x 10^5 a	F	0.005	8.9 x 10^{-6}	5.0 x 10^{-4}	9.1 x 10^{-6}	7.2 x 10^{-6}	7.5 x 10^{-6}	7.9 x 10^{-6}	8.0 x 10^{-6}
		M	0.005	3.0 x 10^{-6}	5.0 x 10^{-4}	3.1 x 10^{-6}	2.7 x 10^{-6}	2.7 x 10^{-6}	3.1 x 10^{-6}	3.2 x 10^{-6}
		S	0.005	1.6 x 10^{-6}	5.0 x 10^{-4}	1.6 x 10^{-6}	1.3 x 10^{-6}	1.0 x 10^{-6}	1.0 x 10^{-6}	1.0 x 10^{-6}
Np-236	22.5 h	F	0.005	2.8 x 10^{-8}	5.0 x 10^{-4}	2.6 x 10^{-8}	1.5 x 10^{-8}	1.1 x 10^{-8}	8.9 x 10^{-9}	9.0 x 10^{-9}
		M	0.005	1.6 x 10^{-8}	5.0 x 10^{-4}	1.4 x 10^{-8}	8.9 x 10^{-9}	6.2 x 10^{-9}	5.6 x 10^{-9}	5.3 x 10^{-9}
		S	0.005	1.6 x 10^{-8}	5.0 x 10^{-4}	1.3 x 10^{-8}	8.5 x 10^{-9}	5.7 x 10^{-9}	4.8 x 10^{-9}	4.2 x 10^{-9}
Np-237	2.14 x 10^6 a	F	0.005	9.8 x 10^{-5}	5.0 x 10^{-4}	9.3 x 10^{-5}	6.0 x 10^{-5}	5.0 x 10^{-5}	4.7 x 10^{-5}	5.0 x 10^{-5}
		M	0.005	4.4 x 10^{-5}	5.0 x 10^{-4}	4.0 x 10^{-5}	2.8 x 10^{-5}	2.2 x 10^{-5}	2.2 x 10^{-5}	2.3 x 10^{-5}
		S	0.005	3.7 x 10^{-5}	5.0 x 10^{-4}	3.2 x 10^{-5}	2.1 x 10^{-5}	1.4 x 10^{-5}	1.3 x 10^{-5}	1.2 x 10^{-5}
Np-238	2.12 d	F	0.005	9.0 x 10^{-9}	5.0 x 10^{-4}	7.9 x 10^{-9}	4.8 x 10^{-9}	3.7 x 10^{-9}	3.3 x 10^{-9}	3.5 x 10^{-9}
		M	0.005	7.3 x 10^{-9}	5.0 x 10^{-4}	5.8 x 10^{-9}	3.4 x 10^{-9}	2.5 x 10^{-9}	2.2 x 10^{-9}	2.1 x 10^{-9}
		S	0.005	8.1 x 10^{-9}	5.0 x 10^{-4}	6.2 x 10^{-9}	3.2 x 10^{-9}	2.1 x 10^{-9}	1.7 x 10^{-9}	1.5 x 10^{-9}
Np-239	2.36 d	F	0.005	2.6 x 10^{-9}	5.0 x 10^{-4}	1.4 x 10^{-9}	6.3 x 10^{-10}	3.8 x 10^{-10}	2.1 x 10^{-10}	1.7 x 10^{-10}
		M	0.005	5.9 x 10^{-9}	5.0 x 10^{-4}	4.2 x 10^{-9}	2.0 x 10^{-9}	1.4 x 10^{-9}	1.2 x 10^{-9}	9.3 x 10^{-10}
		S	0.005	5.6 x 10^{-9}	5.0 x 10^{-4}	4.0 x 10^{-9}	2.2 x 10^{-9}	1.6 x 10^{-9}	1.3 x 10^{-9}	1.0 x 10^{-9}
Np-240	1.08 h	F	0.005	3.6 x 10^{-10}	5.0 x 10^{-4}	2.6 x 10^{-10}	1.2 x 10^{-10}	7.7 x 10^{-11}	4.7 x 10^{-11}	4.0 x 10^{-11}
		M	0.005	6.3 x 10^{-10}	5.0 x 10^{-4}	4.4 x 10^{-10}	2.2 x 10^{-10}	1.4 x 10^{-10}	1.0 x 10^{-10}	8.5 x 10^{-11}
		S	0.005	6.5 x 10^{-10}	5.0 x 10^{-4}	4.6 x 10^{-10}	2.3 x 10^{-10}	1.5 x 10^{-10}	1.1 x 10^{-10}	9.0 x 10^{-11}
Plutonium										
Pu-234	8.80 h	F	0.005	3.0 x 10^{-8}	5.0 x 10^{-4}	2.0 x 10^{-8}	9.8 x 10^{-9}	5.7 x 10^{-9}	3.6 x 10^{-9}	3.0 x 10^{-9}
		M	0.005	7.8 x 10^{-8}	5.0 x 10^{-4}	5.9 x 10^{-8}	3.7 x 10^{-8}	2.8 x 10^{-8}	2.6 x 10^{-8}	2.1 x 10^{-8}
		S	1.0 x 10^{-4}	8.7 x 10^{-8}	1.0 x 10^{-5}	6.6 x 10^{-8}	4.2 x 10^{-8}	3.1 x 10^{-8}	3.0 x 10^{-8}	2.4 x 10^{-8}
Pu-235	0.422 h	F	0.005	1.0 x 10^{-11}	5.0 x 10^{-4}	7.9 x 10^{-12}	3.9 x 10^{-12}	2.2 x 10^{-12}	1.3 x 10^{-12}	1.0 x 10^{-12}
		M	0.005	1.3 x 10^{-11}	5.0 x 10^{-4}	1.0 x 10^{-11}	5.0 x 10^{-12}	2.9 x 10^{-12}	1.9 x 10^{-12}	1.4 x 10^{-12}
		S	1.0 x 10^{-4}	1.3 x 10^{-11}	1.0 x 10^{-5}	1.0 x 10^{-11}	5.1 x 10^{-12}	3.0 x 10^{-12}	1.9 x 10^{-12}	1.5 x 10^{-12}
Pu-236	2.85 a	F	0.005	1.0 x 10^{-4}	5.0 x 10^{-4}	9.5 x 10^{-5}	6.1 x 10^{-5}	4.4 x 10^{-5}	3.7 x 10^{-5}	4.0 x 10^{-5}
		M	0.005	4.8 x 10^{-5}	5.0 x 10^{-4}	4.3 x 10^{-5}	2.9 x 10^{-5}	2.1 x 10^{-5}	1.9 x 10^{-5}	2.0 x 10^{-5}
		S	1.0 x 10^{-4}	3.6 x 10^{-5}	1.0 x 10^{-5}	3.1 x 10^{-5}	2.0 x 10^{-5}	1.4 x 10^{-5}	1.2 x 10^{-5}	1.0 x 10^{-5}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Pu-237	45.3 d	F	0.005	2.2×10^{-9}	5.0×10^{-4}	1.6×10^{-9}	7.9×10^{-10}	4.8×10^{-10}	2.9×10^{-10}	2.6×10^{-10}
		M	0.005	1.9×10^{-9}	5.0×10^{-4}	1.4×10^{-9}	8.2×10^{-10}	5.4×10^{-10}	4.3×10^{-10}	3.5×10^{-10}
		S	1.0×10^{-4}	2.0×10^{-9}	1.0×10^{-5}	1.5×10^{-9}	8.8×10^{-10}	5.9×10^{-10}	4.8×10^{-10}	3.9×10^{-10}
Pu-238	87.7 a	F	0.005	2.0×10^{-4}	5.0×10^{-4}	1.9×10^{-4}	1.4×10^{-4}	1.1×10^{-4}	1.0×10^{-4}	1.1×10^{-4}
		M	0.005	7.8×10^{-5}	5.0×10^{-4}	7.4×10^{-5}	5.6×10^{-5}	4.4×10^{-5}	4.3×10^{-5}	4.6×10^{-5}
		S	1.0×10^{-4}	4.5×10^{-5}	1.0×10^{-5}	4.0×10^{-5}	2.7×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.6×10^{-5}
Pu-239	2.41×10^{4} a	F	0.005	2.1×10^{-4}	5.0×10^{-4}	2.0×10^{-4}	1.5×10^{-4}	1.2×10^{-4}	1.1×10^{-4}	1.2×10^{-4}
		M	0.005	8.0×10^{-5}	5.0×10^{-4}	7.7×10^{-5}	6.0×10^{-5}	4.8×10^{-5}	4.7×10^{-5}	5.0×10^{-5}
		S	1.0×10^{-4}	4.3×10^{-5}	1.0×10^{-5}	3.9×10^{-5}	2.7×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.6×10^{-5}
Pu-240	6.54×10^{3} a	F	0.005	2.1×10^{-4}	5.0×10^{-4}	2.0×10^{-4}	1.5×10^{-4}	1.2×10^{-4}	1.1×10^{-4}	1.2×10^{-4}
		M	0.005	8.0×10^{-5}	5.0×10^{-4}	7.7×10^{-5}	6.0×10^{-5}	4.8×10^{-5}	4.7×10^{-5}	5.0×10^{-5}
		S	1.0×10^{-4}	4.3×10^{-5}	1.0×10^{-5}	3.9×10^{-5}	2.7×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.6×10^{-5}
Pu-241	14.4 a	F	0.005	2.8×10^{-6}	5.0×10^{-4}	2.9×10^{-6}	2.6×10^{-6}	2.4×10^{-6}	2.2×10^{-6}	2.3×10^{-6}
		M	0.005	9.1×10^{-7}	5.0×10^{-4}	9.7×10^{-7}	9.2×10^{-7}	8.3×10^{-7}	8.6×10^{-7}	9.0×10^{-7}
		S	1.0×10^{-4}	2.2×10^{-7}	1.0×10^{-5}	2.3×10^{-7}	2.0×10^{-7}	1.7×10^{-7}	1.7×10^{-7}	1.7×10^{-7}
Pu-242	3.76×10^{5} a	F	0.005	2.0×10^{-4}	5.0×10^{-4}	1.9×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	1.1×10^{-4}	1.1×10^{-4}
		M	0.005	7.6×10^{-5}	5.0×10^{-4}	7.3×10^{-5}	5.7×10^{-5}	4.5×10^{-5}	4.5×10^{-5}	4.8×10^{-5}
		S	1.0×10^{-4}	4.0×10^{-5}	1.0×10^{-5}	3.6×10^{-5}	2.5×10^{-5}	1.7×10^{-5}	1.6×10^{-5}	1.5×10^{-5}
Pu-243	4.95 h	F	0.005	2.7×10^{-10}	5.0×10^{-4}	1.9×10^{-10}	8.8×10^{-11}	5.7×10^{-11}	3.5×10^{-11}	3.2×10^{-11}
		M	0.005	5.6×10^{-10}	5.0×10^{-4}	3.9×10^{-10}	1.9×10^{-10}	1.3×10^{-10}	8.7×10^{-11}	8.3×10^{-11}
		S	1.0×10^{-4}	6.0×10^{-10}	1.0×10^{-5}	4.1×10^{-10}	2.0×10^{-10}	1.4×10^{-10}	9.2×10^{-11}	8.6×10^{-11}
Pu-244	8.26×10^{7} a	F	0.005	2.0×10^{-4}	5.0×10^{-4}	1.9×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	1.1×10^{-4}	1.1×10^{-4}
		M	0.005	7.4×10^{-5}	5.0×10^{-4}	7.2×10^{-5}	5.6×10^{-5}	4.5×10^{-5}	4.4×10^{-5}	4.7×10^{-5}
		S	1.0×10^{-4}	3.9×10^{-5}	1.0×10^{-5}	3.5×10^{-5}	2.4×10^{-5}	1.7×10^{-5}	1.5×10^{-5}	1.5×10^{-5}

Pu-245	10.5 h	F	0.005	1.8×10^{-9}	5.0×10^{-4}	1.3×10^{-9}	5.6×10^{-10}	3.5×10^{-10}	1.9×10^{-10}	1.6×10^{-10}
		M	0.005	3.6×10^{-9}	5.0×10^{-4}	2.5×10^{-9}	1.2×10^{-9}	8.0×10^{-10}	5.0×10^{-10}	4.0×10^{-10}
		S	1.0×10^{-4}	3.8×10^{-9}	1.0×10^{-5}	2.6×10^{-9}	1.3×10^{-9}	8.5×10^{-10}	5.4×10^{-10}	4.3×10^{-10}
Pu-246	10.9 d	F	0.005	2.0×10^{-8}	5.0×10^{-4}	1.4×10^{-8}	7.0×10^{-9}	4.4×10^{-9}	2.8×10^{-9}	2.5×10^{-9}
		M	0.005	3.5×10^{-8}	5.0×10^{-4}	2.6×10^{-8}	1.5×10^{-8}	1.1×10^{-8}	9.1×10^{-9}	7.4×10^{-9}
		S	1.0×10^{-4}	3.8×10^{-8}	1.0×10^{-5}	2.8×10^{-8}	1.6×10^{-8}	1.2×10^{-8}	1.0×10^{-8}	8.0×10^{-9}
Americium										
Am-237	1.22 h	F	0.005	9.8×10^{-11}	5.0×10^{-4}	7.3×10^{-11}	3.5×10^{-11}	2.2×10^{-11}	1.3×10^{-11}	1.1×10^{-11}
		M	0.005	1.7×10^{-10}	5.0×10^{-4}	1.2×10^{-10}	6.2×10^{-11}	4.1×10^{-11}	3.0×10^{-11}	2.5×10^{-11}
		S	0.005	1.7×10^{-10}	5.0×10^{-4}	1.3×10^{-10}	6.5×10^{-11}	4.3×10^{-11}	3.2×10^{-11}	2.6×10^{-11}
Am-238	1.63 h	F	0.005	4.1×10^{-10}	5.0×10^{-4}	3.8×10^{-10}	2.5×10^{-10}	2.0×10^{-10}	1.8×10^{-10}	1.9×10^{-10}
		M	0.005	3.1×10^{-10}	5.0×10^{-4}	2.6×10^{-10}	1.3×10^{-10}	9.6×10^{-11}	8.8×10^{-11}	9.0×10^{-11}
		S	0.005	2.7×10^{-10}	5.0×10^{-4}	2.2×10^{-10}	1.3×10^{-10}	8.2×10^{-11}	6.1×10^{-11}	5.4×10^{-11}
Am-239	11.9 h	F	0.005	8.1×10^{-10}	5.0×10^{-4}	5.8×10^{-10}	2.6×10^{-10}	1.6×10^{-10}	9.1×10^{-11}	7.6×10^{-11}
		M	0.005	1.5×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	5.6×10^{-10}	3.7×10^{-10}	2.7×10^{-10}	2.2×10^{-10}
		S	0.005	1.6×10^{-9}	5.0×10^{-4}	1.1×10^{-9}	5.9×10^{-10}	4.0×10^{-10}	2.5×10^{-10}	2.4×10^{-10}
Am-240	2.12 d	F	0.005	2.0×10^{-9}	5.0×10^{-4}	1.7×10^{-9}	8.8×10^{-10}	5.7×10^{-10}	3.6×10^{-10}	2.3×10^{-10}
		M	0.005	2.9×10^{-9}	5.0×10^{-4}	2.2×10^{-9}	1.2×10^{-9}	7.7×10^{-10}	5.3×10^{-10}	4.3×10^{-10}
		S	0.005	3.0×10^{-9}	5.0×10^{-4}	2.3×10^{-9}	1.2×10^{-9}	7.8×10^{-10}	5.3×10^{-10}	4.3×10^{-10}
Am-241	4.32×10^{2} a	F	0.005	1.8×10^{-4}	5.0×10^{-4}	1.8×10^{-4}	1.2×10^{-4}	1.0×10^{-4}	9.2×10^{-5}	9.6×10^{-5}
		M	0.005	7.3×10^{-5}	5.0×10^{-4}	6.9×10^{-5}	5.1×10^{-5}	4.0×10^{-5}	4.0×10^{-5}	4.2×10^{-5}
		S	0.005	4.6×10^{-5}	5.0×10^{-4}	4.0×10^{-5}	2.7×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.6×10^{-5}
Am-242	16.0 h	F	0.005	9.2×10^{-8}	5.0×10^{-4}	7.1×10^{-8}	3.5×10^{-8}	2.1×10^{-8}	1.4×10^{-8}	1.1×10^{-8}
		M	0.005	7.6×10^{-8}	5.0×10^{-4}	5.9×10^{-8}	3.6×10^{-8}	2.4×10^{-8}	2.1×10^{-8}	1.7×10^{-8}
		S	0.005	8.0×10^{-8}	5.0×10^{-4}	6.2×10^{-8}	3.9×10^{-8}	2.7×10^{-8}	2.4×10^{-8}	2.0×10^{-8}
Am-242m	1.52×10^{2} a	F	0.005	1.6×10^{-4}	5.0×10^{-4}	1.5×10^{-4}	1.1×10^{-4}	9.4×10^{-5}	8.8×10^{-5}	9.2×10^{-5}
		M	0.005	5.2×10^{-5}	5.0×10^{-4}	5.3×10^{-5}	4.1×10^{-5}	3.4×10^{-5}	3.5×10^{-5}	3.7×10^{-5}
		S	0.005	2.5×10^{-5}	5.0×10^{-4}	2.4×10^{-5}	1.7×10^{-5}	1.2×10^{-5}	1.1×10^{-5}	1.1×10^{-5}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Am-243	7.38 x 10^3 a	F	0.005	1.8 x 10^{-4}	5.0 x 10^{-4}	1.7 x 10^{-4}	1.2 x 10^{-4}	1.0 x 10^{-4}	9.1 x 10^{-5}	9.6 x 10^{-5}
		M	0.005	7.2 x 10^{-5}	5.0 x 10^{-4}	6.8 x 10^{-5}	5.0 x 10^{-5}	4.0 x 10^{-5}	4.0 x 10^{-5}	4.1 x 10^{-5}
		S	0.005	4.4 x 10^{-5}	5.0 x 10^{-4}	3.9 x 10^{-5}	2.6 x 10^{-5}	1.8 x 10^{-5}	1.6 x 10^{-5}	1.5 x 10^{-5}
Am-244	10.1 h	F	0.005	1.0 x 10^{-8}	5.0 x 10^{-4}	9.2 x 10^{-9}	5.6 x 10^{-9}	4.1 x 10^{-9}	3.5 x 10^{-9}	3.7 x 10^{-9}
		M	0.005	6.0 x 10^{-9}	5.0 x 10^{-4}	5.0 x 10^{-9}	3.2 x 10^{-9}	2.2 x 10^{-9}	2.0 x 10^{-9}	2.0 x 10^{-9}
		S	0.005	6.1 x 10^{-9}	5.0 x 10^{-4}	4.8 x 10^{-9}	2.4 x 10^{-9}	1.6 x 10^{-9}	1.4 x 10^{-9}	1.2 x 10^{-9}
Am-244m	0.433 h	F	0.005	4.6 x 10^{-10}	5.0 x 10^{-4}	4.0 x 10^{-10}	2.4 x 10^{-10}	1.8 x 10^{-10}	1.5 x 10^{-10}	1.6 x 10^{-10}
		M	0.005	3.3 x 10^{-10}	5.0 x 10^{-4}	2.1 x 10^{-10}	1.3 x 10^{-10}	9.2 x 10^{-11}	8.3 x 10^{-11}	8.4 x 10^{-11}
		S	0.005	3.0 x 10^{-10}	5.0 x 10^{-4}	2.2 x 10^{-10}	1.2 x 10^{-10}	8.1 x 10^{-11}	5.5 x 10^{-11}	5.7 x 10^{-11}
Am-245	2.05 h	F	0.005	2.1 x 10^{-10}	5.0 x 10^{-4}	1.4 x 10^{-10}	6.2 x 10^{-11}	4.0 x 10^{-11}	2.4 x 10^{-11}	2.1 x 10^{-11}
		M	0.005	3.9 x 10^{-10}	5.0 x 10^{-4}	2.6 x 10^{-10}	1.3 x 10^{-10}	8.7 x 10^{-11}	6.4 x 10^{-11}	5.3 x 10^{-11}
		S	0.005	4.1 x 10^{-10}	5.0 x 10^{-4}	2.8 x 10^{-10}	1.3 x 10^{-10}	9.2 x 10^{-11}	6.8 x 10^{-11}	5.6 x 10^{-11}
Am-246	0.650 h	F	0.005	3.0 x 10^{-10}	5.0 x 10^{-4}	2.0 x 10^{-10}	9.3 x 10^{-11}	6.1 x 10^{-11}	3.8 x 10^{-11}	3.3 x 10^{-11}
		M	0.005	5.0 x 10^{-10}	5.0 x 10^{-4}	3.4 x 10^{-10}	1.6 x 10^{-10}	1.1 x 10^{-10}	7.9 x 10^{-11}	6.6 x 10^{-11}
		S	0.005	5.3 x 10^{-10}	5.0 x 10^{-4}	3.6 x 10^{-10}	1.7 x 10^{-10}	1.2 x 10^{-10}	8.3 x 10^{-11}	6.9 x 10^{-11}
Am-246m	0.417 h	F	0.005	1.3 x 10^{-10}	5.0 x 10^{-4}	8.9 x 10^{-11}	4.2 x 10^{-11}	2.6 x 10^{-11}	1.6 x 10^{-11}	1.4 x 10^{-11}
		M	0.005	1.9 x 10^{-10}	5.0 x 10^{-4}	1.3 x 10^{-10}	6.1 x 10^{-11}	4.0 x 10^{-11}	2.6 x 10^{-11}	2.2 x 10^{-11}
		S	0.005	2.0 x 10^{-10}	5.0 x 10^{-4}	1.4 x 10^{-10}	6.4 x 10^{-11}	4.1 x 10^{-11}	2.7 x 10^{-11}	2.3 x 10^{-11}
Curium										
Cm-238	2.40 h	F	0.005	7.7 x 10^{-9}	5.0 x 10^{-4}	5.4 x 10^{-9}	2.6 x 10^{-9}	1.8 x 10^{-9}	9.2 x 10^{-10}	7.8 x 10^{-10}
		M	0.005	2.1 x 10^{-8}	5.0 x 10^{-4}	1.5 x 10^{-8}	7.9 x 10^{-9}	5.9 x 10^{-9}	5.6 x 10^{-9}	4.5 x 10^{-9}
		S	0.005	2.2 x 10^{-8}	5.0 x 10^{-4}	1.6 x 10^{-8}	8.6 x 10^{-9}	6.4 x 10^{-9}	6.1 x 10^{-9}	4.9 x 10^{-9}
Cm-240	27.0 d	F	0.005	8.3 x 10^{-6}	5.0 x 10^{-4}	6.3 x 10^{-6}	3.2 x 10^{-6}	2.0 x 10^{-6}	1.5 x 10^{-6}	1.3 x 10^{-6}
		M	0.005	1.2 x 10^{-5}	5.0 x 10^{-4}	9.1 x 10^{-6}	5.8 x 10^{-6}	4.2 x 10^{-6}	3.8 x 10^{-6}	3.2 x 10^{-6}
		S	0.005	1.3 x 10^{-5}	5.0 x 10^{-4}	9.9 x 10^{-6}	6.4 x 10^{-6}	4.6 x 10^{-6}	4.3 x 10^{-6}	3.5 x 10^{-6}

Cm-241	32.8 d	F	0.005	1.1×10^{-7}	5.0×10^{-4}	8.9×10^{-8}	4.9×10^{-8}	3.5×10^{-8}	2.8×10^{-8}	2.7×10^{-8}
		M	0.005	1.3×10^{-7}	5.0×10^{-4}	1.0×10^{-7}	6.6×10^{-8}	4.8×10^{-8}	4.4×10^{-8}	3.7×10^{-8}
		S	0.005	1.4×10^{-7}	5.0×10^{-4}	1.1×10^{-7}	6.9×10^{-8}	4.9×10^{-8}	4.5×10^{-8}	3.7×10^{-8}
Cm-242	163 d	F	0.005	2.7×10^{-5}	5.0×10^{-4}	2.1×10^{-5}	1.0×10^{-5}	6.1×10^{-6}	4.0×10^{-6}	3.3×10^{-6}
		M	0.005	2.2×10^{-5}	5.0×10^{-4}	1.8×10^{-5}	1.1×10^{-5}	7.3×10^{-6}	6.4×10^{-6}	5.2×10^{-6}
		S	0.005	2.4×10^{-5}	5.0×10^{-4}	1.9×10^{-5}	1.2×10^{-5}	8.2×10^{-6}	7.3×10^{-6}	5.9×10^{-6}
Cm-243	28.5 a	F	0.005	1.6×10^{-4}	5.0×10^{-4}	1.5×10^{-4}	9.5×10^{-5}	7.3×10^{-5}	6.5×10^{-5}	6.9×10^{-5}
		M	0.005	6.7×10^{-5}	5.0×10^{-4}	6.1×10^{-5}	4.2×10^{-5}	3.1×10^{-5}	3.0×10^{-5}	3.1×10^{-5}
		S	0.005	4.6×10^{-5}	5.0×10^{-4}	4.0×10^{-5}	2.6×10^{-5}	1.8×10^{-5}	1.6×10^{-5}	1.5×10^{-5}
Cm-244	18.1 a	F	0.005	1.5×10^{-4}	5.0×10^{-4}	1.3×10^{-4}	8.3×10^{-5}	6.1×10^{-5}	5.3×10^{-5}	5.7×10^{-5}
		M	0.005	6.2×10^{-5}	5.0×10^{-4}	5.7×10^{-5}	3.7×10^{-5}	2.7×10^{-5}	2.6×10^{-5}	2.7×10^{-5}
		S	0.005	4.4×10^{-5}	5.0×10^{-4}	3.8×10^{-5}	2.5×10^{-5}	1.7×10^{-5}	1.5×10^{-5}	1.3×10^{-5}
Cm-245	8.50×10^{3} a	F	0.005	1.9×10^{-4}	5.0×10^{-4}	1.8×10^{-4}	1.2×10^{-4}	1.0×10^{-4}	9.4×10^{-5}	9.9×10^{-5}
		M	0.005	7.3×10^{-5}	5.0×10^{-4}	6.9×10^{-5}	5.1×10^{-5}	4.1×10^{-5}	4.1×10^{-5}	4.2×10^{-5}
		S	0.005	4.5×10^{-5}	5.0×10^{-4}	4.0×10^{-5}	2.7×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.6×10^{-5}
Cm-246	4.73×10^{3} a	F	0.005	1.9×10^{-4}	5.0×10^{-4}	1.8×10^{-4}	1.2×10^{-4}	1.0×10^{-4}	9.4×10^{-5}	9.8×10^{-5}
		M	0.005	7.3×10^{-5}	5.0×10^{-4}	6.9×10^{-5}	5.1×10^{-5}	4.1×10^{-5}	4.1×10^{-5}	4.2×10^{-5}
		S	0.005	4.6×10^{-5}	5.0×10^{-4}	4.0×10^{-5}	2.7×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.6×10^{-5}
Cm-247	1.56×10^{7} a	F	0.005	1.7×10^{-4}	5.0×10^{-4}	1.6×10^{-4}	1.1×10^{-4}	9.4×10^{-5}	8.6×10^{-5}	9.0×10^{-5}
		M	0.005	6.7×10^{-5}	5.0×10^{-4}	6.3×10^{-5}	4.7×10^{-5}	3.7×10^{-5}	3.7×10^{-5}	3.9×10^{-5}
		S	0.005	4.1×10^{-5}	5.0×10^{-4}	3.6×10^{-5}	2.4×10^{-5}	1.7×10^{-5}	1.5×10^{-5}	1.4×10^{-5}
Cm-248	3.39×10^{5} a	F	0.005	6.8×10^{-4}	5.0×10^{-4}	6.5×10^{-4}	4.5×10^{-4}	3.7×10^{-4}	3.4×10^{-4}	3.6×10^{-4}
		M	0.005	2.5×10^{-4}	5.0×10^{-4}	2.4×10^{-4}	1.8×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	1.5×10^{-4}
		S	0.005	1.4×10^{-4}	5.0×10^{-4}	1.2×10^{-4}	8.2×10^{-5}	5.6×10^{-5}	5.0×10^{-5}	4.8×10^{-5}
Cm-249	1.07 h	F	0.005	1.8×10^{-10}	5.0×10^{-4}	9.8×10^{-11}	5.9×10^{-11}	4.6×10^{-11}	4.0×10^{-11}	4.0×10^{-11}
		M	0.005	2.4×10^{-10}	5.0×10^{-4}	1.6×10^{-10}	8.2×10^{-11}	5.8×10^{-11}	3.7×10^{-11}	3.3×10^{-11}
		S	0.005	2.4×10^{-10}	5.0×10^{-4}	1.6×10^{-10}	7.8×10^{-11}	5.3×10^{-11}	3.9×10^{-11}	3.3×10^{-11}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Nuclide	*Physical half-life*	*Type*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)*
			f_1	*e(g)*						
Cm-250	6.90 x 10^3 a	F	0.005	3.9 x 10^{-3}	5.0 x 10^{-4}	3.7 x 10^{-3}	2.6 x 10^{-3}	2.1 x 10^{-3}	2.0 x 10^{-3}	2.1 x 10^{-3}
		M	0.005	1.4 x 10^{-3}	5.0 x 10^{-4}	1.3 x 10^{-3}	9.9 x 10^{-4}	7.9 x 10^{-4}	7.9 x 10^{-4}	8.4 x 10^{-4}
		S	0.005	7.2 x 10^{-4}	5.0 x 10^{-4}	6.5 x 10^{-4}	4.4 x 10^{-4}	3.0 x 10^{-4}	2.7 x 10^{-4}	2.6 x 10^{-4}
Berkelium										
Bk-245	4.94 d	M	0.005	8.8 x 10^{-9}	5.0 x 10^{-4}	6.6 x 10^{-9}	4.0 x 10^{-9}	2.9 x 10^{-9}	2.6 x 10^{-9}	2.1 x 10^{-9}
Bk-246	1.83 d	M	0.005	2.1 x 10^{-9}	5.0 x 10^{-4}	1.7 x 10^{-9}	9.3 x 10^{-10}	6.0 x 10^{-10}	4.0 x 10^{-10}	3.3 x 10^{-10}
Bk-247	1.38 x 10^3 a	M	0.005	1.5 x 10^{-4}	5.0 x 10^{-4}	1.5 x 10^{-4}	1.1 x 10^{-4}	7.9 x 10^{-5}	7.2 x 10^{-5}	6.9 x 10^{-5}
Bk-249	320 d	M	0.005	3.3 x 10^{-7}	5.0 x 10^{-4}	3.3 x 10^{-7}	2.4 x 10^{-7}	1.8 x 10^{-7}	1.6 x 10^{-7}	1.6 x 10^{-7}
Bk-250	3.22 h	M	0.005	3.4 x 10^{-9}	5.0 x 10^{-4}	3.1 x 10^{-9}	2.0 x 10^{-9}	1.3 x 10^{-9}	1.1 x 10^{-9}	1.0 x 10^{-9}
Californium										
Cf-244	0.323 h	M	0.005	7.6 x 10^{-8}	5.0 x 10^{-4}	5.4 x 10^{-8}	2.8 x 10^{-8}	2.0 x 10^{-8}	1.6 x 10^{-8}	1.4 x 10^{-8}
Cf-246	1.49 d	M	0.005	1.7 x 10^{-6}	5.0 x 10^{-4}	1.3 x 10^{-6}	8.3 x 10^{-7}	6.1 x 10^{-7}	5.7 x 10^{-7}	4.5 x 10^{-7}
Cf-248	334 d	M	0.005	3.8 x 10^{-5}	5.0 x 10^{-4}	3.2 x 10^{-5}	2.1 x 10^{-5}	1.4 x 10^{-5}	1.0 x 10^{-5}	8.8 x 10^{-6}
Cf-249	3.50 x 10^2 a	M	0.005	1.6 x 10^{-4}	5.0 x 10^{-4}	1.5 x 10^{-4}	1.1 x 10^{-4}	8.0 x 10^{-5}	7.2 x 10^{-5}	7.0 x 10^{-5}
Cf-250	13.1 a	M	0.005	1.1 x 10^{-4}	5.0 x 10^{-4}	9.8 x 10^{-5}	6.6 x 10^{-5}	4.2 x 10^{-5}	3.5 x 10^{-5}	3.4 x 10^{-5}
Cf-251	8.98 x 10^2 a	M	0.005	1.6 x 10^{-4}	5.0 x 10^{-4}	1.5 x 10^{-4}	1.1 x 10^{-4}	8.1 x 10^{-5}	7.3 x 10^{-5}	7.1 x 10^{-5}
Cf-252	2.64 a	M	0.005	9.7 x 10^{-5}	5.0 x 10^{-4}	8.7 x 10^{-5}	5.6 x 10^{-5}	3.2 x 10^{-5}	2.2 x 10^{-5}	2.0 x 10^{-5}
Cf-253	17.8 d	M	0.005	5.4 x 10^{-6}	5.0 x 10^{-4}	4.2 x 10^{-6}	2.6 x 10^{-6}	1.9 x 10^{-6}	1.7 x 10^{-6}	1.3 x 10^{-6}
Cf-254	60.5 d	M	0.005	2.5 x 10^{-4}	5.0 x 10^{-4}	1.9 x 10^{-4}	1.1 x 10^{-4}	7.0 x 10^{-5}	4.8 x 10^{-5}	4.1 x 10^{-5}
Einsteinium										
Es-250	2.10 h	M	0.005	2.0 x 10^{-9}	5.0 x 10^{-4}	1.8 x 10^{-9}	1.2 x 10^{-9}	7.8 x 10^{-10}	6.4 x 10^{-10}	6.3 x 10^{-10}
Es-251	1.38 d	M	0.005	7.9 x 10^{-9}	5.0 x 10^{-4}	6.0 x 10^{-9}	3.9 x 10^{-9}	2.8 x 10^{-9}	2.6 x 10^{-9}	2.1 x 10^{-9}
Es-253	20.5 d	M	0.005	1.1 x 10^{-5}	5.0 x 10^{-4}	8.0 x 10^{-6}	5.1 x 10^{-6}	3.7 x 10^{-6}	3.4 x 10^{-6}	2.7 x 10^{-6}

Es-254	276 d	M	0.005	3.7×10^{-5}	5.0×10^{-4}	3.1×10^{-5}	2.0×10^{-5}	1.3×10^{-5}	1.0×10^{-5}	8.6×10^{-6}
Es-254m	1.64 d	M	0.005	1.7×10^{-6}	5.0×10^{-4}	1.3×10^{-6}	8.4×10^{-7}	6.3×10^{-7}	5.9×10^{-7}	4.7×10^{-7}
Fermium										
Fm-252	22.7 h	M	0.005	1.2×10^{-6}	5.0×10^{-4}	9.0×10^{-7}	5.8×10^{-7}	4.3×10^{-7}	4.0×10^{-7}	3.2×10^{-7}
Fm-253	3.00 d	M	0.005	1.5×10^{-6}	5.0×10^{-4}	1.2×10^{-6}	7.3×10^{-7}	5.4×10^{-7}	5.0×10^{-7}	4.0×10^{-7}
Fm-254	3.24 h	M	0.005	3.2×10^{-7}	5.0×10^{-4}	2.3×10^{-7}	1.3×10^{-7}	9.8×10^{-8}	7.6×10^{-8}	6.1×10^{-8}
Fm-255	20.1 h	M	0.005	1.2×10^{-6}	5.0×10^{-4}	7.3×10^{-7}	4.7×10^{-7}	3.5×10^{-7}	3.4×10^{-7}	2.7×10^{-7}
Fm-257	101 d	M	0.005	3.3×10^{-5}	5.0×10^{-4}	2.6×10^{-5}	1.6×10^{-5}	1.1×10^{-5}	8.8×10^{-6}	7.1×10^{-6}
Mendelevium										
Md-257	5.20 h	M	0.005	1.0×10^{-7}	5.0×10^{-4}	8.2×10^{-8}	5.1×10^{-8}	3.6×10^{-8}	3.1×10^{-8}	2.5×10^{-8}
Md-258	55.0 d	M	0.005	2.4×10^{-5}	5.0×10^{-4}	1.9×10^{-5}	1.2×10^{-5}	8.6×10^{-6}	7.3×10^{-6}	5.9×10^{-6}

Note: Types F, M and S denote fast, moderate and slow absorption from the lung respectively.

Table VIII

LUNG ABSORPTION TYPES USED TO CALCULATE COMMITTED EFFECTIVE DOSE PER UNIT INTAKE THROUGH INHALATION FOR EXPOSURE TO PARTICULATE AEROSOLS OR GASES AND VAPOURS — FOR MEMBERS OF THE PUBLIC

Element	*Absorption type(s)* [a]
Hydrogen	F, M [b], S, G
Beryllium	M, S
Carbon	F, M [b], S, G
Fluorine	F, M, S
Sodium	F
Magnesium	F, M
Aluminium	F, M
Silicon	F, M, S
Phosphorus	F, M
Sulphur	F, M[b], S, G
Chlorine	F, M
Potassium	F
Calcium	F, M, S
Scandium	S
Titanium	F, M, S
Vanadium	F, M
Chromium	F, M, S
Manganese	F, M
Iron	F, M[b], S
Cobalt	F, M[b], S
Nickel	F, M[b], S, G
Copper	F, M, S
Zinc	F, M[b], S
Gallium	F, M
Germanium	F, M
Arsenic	M
Selenium	F[b], M, S
Bromine	F, M
Rubidium	F
Strontium	F, M [b], S
Yttrium	M, S

[a] For particulates: F: fast; M: moderate; S: slow; G: gases and vapour.

[b] Recommended default absorption type for particulate aerosol when no information is available.

Element	*Absorption type(s)* [a]
Zirconium	F, M[b], S
Niobium	F, M[b], S
Molybdenum	F, M[b], S
Technetium	F, M[b], S
Ruthenium	F, M[b], S, G
Rhodium	F, M, S
Palladium	F, M, S
Silver	F, M[b], S
Cadmium	F, M, S
Indium	F, M
Tin	F, M
Antimony	F, M[b], S
Tellurium	F, M[b], S, G
Iodine	F[b], M, S, G
Caesium	F[b], M, S
Barium	F, M[b], S
Lanthanum	F, M
Cerium	F, M[b], S
Praseodymium	M, S
Neodymium	M, S
Promethium	M, S
Samarium	M
Europium	M
Gadolinium	F, M
Terbium	M
Dysprosium	M
Holmium	M
Erbium	M
Thulium	M
Ytterbium	M, S
Lutetium	M, S
Hafnium	F, M
Tantalum	M, S
Tungsten	F
Rhenium	F, M
Osmium	F, M, S

[a] For particulates: F: fast; M: moderate; S: slow; G: gases and vapour.

[b] Recommended default absorption type for particulate aerosol when no information is available.

Element	*Absorption type(s)* [a]
Iridium	F, M, S
Platinum	F
Gold	F, M, S
Mercury	F, M, G
Thallium	F
Lead	F, M[b], S, G
Bismuth	F, M
Polonium	F, M[b], S, G
Astatine	F, M
Francium	F
Radium	F, M[b], S
Actinium	F, M, S
Thorium	F, M, S[b]
Protactinium	M, S
Uranium	F, M[b], s
Neptunium	F, M[b], S
Plutonium	F, M[b], s
Americium	F, M[b], S
Curium	F, M[b], S
Berkelium	M
Californium	M
Einsteinium	M
Fermium	M
Mendelevium	M

[a] For particulates: F: fast; M: moderate; S: slow; G: gases and vapour.

[b] Recommended default absorption type for particulate aerosol when no information is available.

Table IX

INHALATION: COMMITTED EFFECTIVE DOSE PER UNIT INTAKE
e (g) ($Sv.Bq^{-1}$) FOR SOLUBLE OR REACTIVE GASES AND VAPOURS

Nuclide	*Physical half-life*	*Absorption* [a]	*% Deposit*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)* [b]
				f_1	*e(g)*						
Tritiated water	12.3 a	V	100	1.000	6.4×10^{-11}	1.000	4.8×10^{-11}	3.1×10^{-11}	2.3×10^{-11}	1.8×10^{-11}	1.8×10^{-11}
Elemental hydrogen	12.3 a	V	0.01	1.000	6.4×10^{-15}	1.000	4.8×10^{-15}	3.1×10^{-15}	2.3×10^{-15}	1.8×10^{-15}	1.8×10^{-15}
Tritiated methane	12.3 a	V	1	1.000	6.4×10^{-13}	1.000	4.8×10^{-13}	3.1×10^{-13}	2.3×10^{-13}	1.8×10^{-13}	1.8×10^{-13}
Organically bound tritium	12.3 a	V	100	1.000	1.1×10^{-10}	1.000	1.1×10^{-10}	7.0×10^{-10}	5.5×10^{-11}	4.1×10^{-11}	4.1×10^{-11}
Carbon-11 vapour	0.340 h	V	100	1.000	2.8×10^{-11}	1.000	1.8×10^{-11}	9.7×10^{-12}	6.1×10^{-12}	3.8×10^{-12}	3.2×10^{-12}
Carbon-11 dioxide	0.340 h	V	100	1.000	1.8×10^{-11}	1.000	1.2×10^{-11}	6.5×10^{-12}	4.1×10^{-12}	2.5×10^{-12}	2.2×10^{-12}
Carbon-11 monoxide	0.340 h	V	40	1.000	1.0×10^{-11}	1.000	6.7×10^{-12}	3.5×10^{-12}	2.2×10^{-12}	1.4×10^{-12}	1.2×10^{-12}
Carbon 14 vapour	5.73×10^{3} a	V	100	1.000	1.3×10^{-9}	1.000	1.6×10^{-9}	9.7×10^{-10}	7.9×10^{-10}	5.7×10^{-10}	5.8×10^{-10}
Carbon-14 dioxide	5.73×10^{3} a	V	100	1.000	1.9×10^{-11}	1.000	1.9×10^{-11}	1.1×10^{-11}	8.9×10^{-12}	6.3×10^{-12}	6.2×10^{-12}
Carbon-14 monoxide	5.73×10^{3} a	V	40	1.000	9.1×10^{-12}	1.000	5.7×10^{-12}	2.8×10^{-12}	1.7×10^{-12}	9.9×10^{-13}	8.0×10^{-13}
Carbon disulphide-35	87.4 d	F	100	1.000	6.9×10^{-9}	1.000	4.8×10^{-9}	2.4×10^{-9}	1.4×10^{-9}	8.6×10^{-10}	7.0×10^{-10}
Sulphur-35 dioxide	87.4 d	F	85	1.000	9.4×10^{-10}	1.000	6.6×10^{-10}	3.4×10^{-10}	2.1×10^{-10}	1.3×10^{-10}	1.1×10^{-10}
Nickel-56 carbonyl	6.10 d	C	100	1.000	6.8×10^{-9}	1.000	5.2×10^{-9}	3.2×10^{-9}	2.1×10^{-9}	1.4×10^{-9}	1.2×10^{-9}
Nickel-57 carbonyl	1.50 d	C	100	1.000	3.1×10^{-9}	1.000	2.3×10^{-9}	1.4×10^{-9}	9.2×10^{-10}	6.5×10^{-10}	5.6×10^{-10}
Nickel-59 carbonyl	7.5×10^{4} a	C	100	1.000	4.0×10^{-9}	1.000	3.3×10^{-9}	2.0×10^{-9}	1.3×10^{-9}	9.1×10^{-10}	8.3×10^{-10}
Nickel-63 carbonyl	96.0 a	C	100	1.000	9.5×10^{-9}	1.000	8.0×10^{-9}	4.8×10^{-9}	3.0×10^{-9}	2.2×10^{-9}	2.0×10^{-9}

[a] F: fast; V: material is taken to be completely and instantaneously transferred to body fluids.
[b] Applicable to both workers and adult member of the public.
[c] Deposition 30%: 10%: 20% 40% (extrathoracic: bronchial: bronchiolar: alveolar-interstitial), 0.1 day retention half-time.

Nuclide	*Physical half-life*	*Absorption* [a]	*% Deposit*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)* [b]
				f_1	*e(g)*						
Nickel-65 carbonyl	2.52 h	C	100	1.000	2.0×10^{-9}	1.000	1.4×10^{-9}	8.1×10^{-10}	5.6×10^{-10}	4.0×10^{-10}	3.6×10^{-10}
Nickel-66 carbonyl	2.27 d	C	100	1.000	1.0×10^{-8}	1.000	7.1×10^{-9}	4.0×10^{-9}	2.7×10^{-9}	1.8×10^{-9}	1.6×10^{-9}
Ruthenium-94 tetroxide	0.863 h	F	100	0.100	5.5×10^{-10}	0.050	3.5×10^{-10}	1.8×10^{-10}	1.1×10^{-10}	7.0×10^{-11}	5.6×10^{-11}
Ruthenium-97 tetroxide	2.90 d	F	100	0.100	8.7×10^{-10}	0.050	6.2×10^{-10}	3.4×10^{-10}	2.2×10^{-10}	1.4×10^{-10}	1.2×10^{-10}
Ruthenium-103 tetroxide	39.3 d	F	100	0.100	9.0×10^{-9}	0.050	6.2×10^{-9}	3.3×10^{-9}	2.1×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Ruthenium-105 tetroxide	4.44 h	F	100	0.100	1.6×10^{-9}	0.050	1.0×10^{-9}	5.3×10^{-10}	3.2×10^{-10}	2.2×10^{-10}	1.8×10^{-10}
Ruthenium-106 tetroxide	1.01 a	F	100	0.100	1.6×10^{-7}	0.050	1.1×10^{-7}	6.1×10^{-8}	3.7×10^{-8}	2.2×10^{-8}	1.8×10^{-8}
Tellurium-116 vapour	2.49 h	F	100	0.600	5.9×10^{-10}	0.300	4.4×10^{-10}	2.5×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.7×10^{-11}
Tellurium-121 vapour	17.0 d	F	100	0.600	3.0×10^{-9}	0.300	2.4×10^{-9}	1.4×10^{-9}	9.6×10^{-10}	6.7×10^{-10}	5.1×10^{-10}
Tellurium-121m vapour	154 d	F	100	0.600	3.5×10^{-8}	0.300	2.7×10^{-8}	1.6×10^{-8}	9.8×10^{-9}	6.6×10^{-9}	5.5×10^{-9}
Tellurium-123 vapour	1.00×10^{13} a	F	100	0.600	2.8×10^{-8}	0.300	2.5×10^{-8}	1.9×10^{-8}	1.5×10^{-8}	1.3×10^{-8}	1.2×10^{-8}
Tellurium-123m vapour	120 d	F	100	0.600	2.5×10^{-8}	0.300	1.8×10^{-8}	1.0×10^{-8}	5.7×10^{-9}	3.5×10^{-9}	2.9×10^{-9}
Tellurium-125m vapour	58.0 d	F	100	0.060	1.5×10^{-8}	0.300	1.1×10^{-8}	5.9×10^{-9}	3.2×10^{-9}	1.9×10^{-9}	1.5×10^{-9}
Tellurium-127 vapour	9.35 h	F	100	0.600	6.1×10^{-10}	0.300	4.4×10^{-10}	2.3×10^{-10}	1.4×10^{-10}	9.2×10^{-11}	7.7×10^{-11}
Tellurium-127m vapour	109 d	F	100	0.600	5.3×10^{-8}	0.300	3.7×10^{-8}	1.9×10^{-8}	1.0×10^{-8}	6.1×10^{-9}	4.6×10^{-9}
Tellurium-129 vapour	1.16 h	F	100	0.600	2.5×10^{-10}	0.300	1.7×10^{-10}	9.4×10^{-11}	6.2×10^{-11}	4.3×10^{-11}	3.7×10^{-11}

Tellurium-129m vapour	33.6 d	F	100	0.600	4.8×10^{-8}	0.300	3.2×10^{-8}	1.6×10^{-8}	8.5×10^{-9}	5.1×10^{-9}	3.7×10^{-9}
Tellurium-131 vapour	0.417 h	F	100	0.600	5.1×10^{-10}	0.300	4.5×10^{-10}	2.6×10^{-10}	1.4×10^{-10}	9.5×10^{-11}	6.8×10^{-11}
Tellurium-131m vapour	1.25 d	F	100	0.600	2.1×10^{-8}	0.300	1.9×10^{-8}	1.1×10^{-8}	5.6×10^{-9}	3.7×10^{-9}	2.4×10^{-9}
Tellurium-132 vapour	3.26 d	F	100	0.600	5.4×10^{-8}	0.300	4.5×10^{-8}	2.4×10^{-8}	1.2×10^{-8}	7.6×10^{-9}	5.1×10^{-9}
Tellurium-133 vapour	0.207 h	F	100	0.600	5.5×10^{-10}	0.300	4.7×10^{-10}	2.5×10^{-10}	1.2×10^{-10}	8.1×10^{-11}	5.6×10^{-11}
Tellurium-133m vapour	0.923 h	F	100	0.600	2.3×10^{-9}	0.300	2.0×10^{-9}	1.1×10^{-9}	5.0×10^{-10}	3.3×10^{-10}	2.2×10^{-10}
Tellurium-134 vapour	0.696 h	F	100	0.600	6.8×10^{-10}	0.300	5.5×10^{-10}	3.0×10^{-10}	1.6×10^{-10}	1.1×10^{-10}	8.4×10^{-11}
Elemental iodine-120	1.35 h	V	100	1.000	3.0×10^{-9}	1.000	2.4×10^{-9}	1.3×10^{-9}	6.4×10^{-10}	4.3×10^{-10}	3.0×10^{-10}
Elemental iodine-120m	0.883 h	V	100	1.000	1.5×10^{-9}	1.000	1.2×10^{-9}	6.4×10^{-10}	3.4×10^{-10}	2.3×10^{-10}	1.8×10^{-10}
Elemental iodine-121	2.12 h	V	100	1.000	5.7×10^{-10}	1.000	5.1×10^{-10}	3.0×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	8.6×10^{-11}
Elemental iodine-123	13.2 h	V	100	1.000	2.1×10^{-9}	1.000	1.8×10^{-9}	1.0×10^{-9}	4.7×10^{-10}	3.2×10^{-10}	2.1×10^{-10}
Elemental iodine-124	4.18 d	V	100	1.000	1.1×10^{-7}	1.000	1.0×10^{-7}	5.8×10^{-8}	2.8×10^{-8}	1.8×10^{-8}	1.2×10^{-8}
Elemental iodine-125	60.1 d	V	100	1.000	4.7×10^{-8}	1.000	5.2×10^{-8}	3.7×10^{-8}	2.8×10^{-8}	2.0×10^{-8}	1.4×10^{-8}
Elemental iodine-126	13.0 d	V	100	1.000	1.9×10^{-7}	1.000	1.9×10^{-7}	1.1×10^{-7}	6.2×10^{-8}	4.1×10^{-8}	2.6×10^{-8}
Elemental iodine-128	0.416 h	V	100	1.000	4.2×10^{-10}	1.000	2.8×10^{-10}	1.6×10^{-10}	1.0×10^{-10}	7.5×10^{-11}	6.5×10^{-11}

[a] F: fast; V: material is taken to be completely and instantaneously transferred to body fluids.
[b] Applicable to both workers and adult member of the public.

Nuclide	*Physical half-life*	*Absorption* [a]	*% Deposit*	*Age g ≤ 1 a*		*f_1 for g > 1 a*	*Age 1-2 a e(g)*	*Age 2-7 a e(g)*	*Age 7-12 a e(g)*	*Age 12-17 a e(g)*	*Age > 17 a e(g)* [b]
				f_1	*e(g)*						
Elemental iodine-129	1.57 X 10^7 a	V	100	1.000	1.7 x 10^{-7}	1.000	2.0 x 10^{-7}	1.6 x 10^{-7}	1.7 x 10^{-7}	1.3 x 10^{-7}	9.6 x 10^{-8}
Elemental iodine-130	12.4 h	V	100	1.000	1.9 x 10^{-8}	1.000	1.7 x 10^{-8}	9.2 x 10^{-9}	4.3 x 10^{-9}	2.8 x 10^{-9}	1.9 x 10^{-9}
Elemental iodine-131	8.04 d	V	100	1.000	1.7 x 10^{-7}	1.000	1.6 x 10^{-7}	9.4 x 10^{-8}	4.8 x 10^{-8}	3.1 x 10^{-8}	2.0 x 10^{-8}
Elemental iodine-132	2.30 h	V	100	1.000	2.8 x 10^{-9}	1.000	2.3 x 10^{-9}	1.3 x 10^{-9}	6.4 x 10^{-10}	4.3 x 10^{-10}	3.1 x 10^{-10}
Elemental iodine-132m	1.39 h	V	100	1.000	2.4 x 10^{-9}	1.000	2.1 x 10^{-9}	1.1 x 10^{-9}	5.6 x 10^{-10}	3.8 x 10^{-10}	2.7 x 10^{-10}
Elemental iodine-133	20.8 h	V	100	1.000	4.5 x 10^{-8}	1.000	4.1 x 10^{-8}	2.1 x 10^{-8}	9.7 x 10^{-10}	6.3 x 10^{-10}	4.0 x 10^{-9}
Elemental iodine-134	0.876 h	V	100	1.000	8.7 x 10^{-10}	1.000	6.9 x 10^{-10}	3.9 x 10^{-10}	2.2 x 10^{-10}	1.6 x 10^{-10}	1.5 x 10^{-10}
Elemental iodine-135	6.61 h	V	100	1.000	9.7 x 10^{-9}	1.000	8.5 x 10^{-9}	4.5 x 10^{-9}	2.1 x 10^{-9}	1.4 x 10^{-9}	9.2 x 10^{-10}
Methyl iodine-120	1.35 h	V	70	1.000	2.3 x 10^{-9}	1.000	1.9 x 10^{-9}	1.0 x 10^{-9}	4.8 x 10^{-10}	3.1 x 10^{-10}	2.0 x 10^{-10}
Methyl iodine-120m	0.883 h	V	70	1.000	1.0 x 10^{-9}	1.000	8.7 x 10^{-10}	4.6 x 10^{-10}	2.2 x 10^{-10}	1.5 x 10^{-10}	1.0 x 10^{-10}
Methyl iodine-121	2.12 h	V	70	1.000	4.2 x 10^{-10}	1.000	3.8 x 10^{-10}	2.2 x 10^{-10}	1.2 x 10^{-10}	8.3 x 10^{-11}	5.6 x 10^{-11}
Methyl iodine-123	13.2 h	V	70	1.000	1.6 x 10^{-9}	1.000	1.4 x 10^{-9}	7.7 x 10^{-10}	3.6 x 10^{-10}	2.4 x 10^{-10}	1.5 x 10^{-10}
Methyl iodine-124	4.18 d	V	70	1.000	8.5 x 10^{-8}	1.000	8.0 x 10^{-8}	4.5 x 10^{-8}	2.2 x 10^{-8}	1.4 x 10^{-8}	9.2 x 10^{-9}
Methyl iodine-125	6.01 d	V	70	1.000	3.7 x 10^{-8}	1.000	4.0 x 10^{-8}	2.9 x 10^{-8}	2.2 x 10^{-8}	1.6 x 10^{-8}	1.1 x 10^{-8}
Methyl iodine-126	13.0 d	V	70	1.000	1.5 x 10^{-7}	1.000	1.5 x 10^{-7}	9.0 x 10^{-8}	4.8 x 10^{-8}	3.2 x 10^{-8}	2.0 x 10^{-8}
Methyl iodine-128	0.416 h	V	70	1.000	1.5 x 10^{-10}	1.000	1.2 x 10^{-10}	6.3 x 10^{-11}	3.0 x 10^{-11}	1.9 x 10^{-11}	1.3 x 10^{-11}
Methyl iodine-129	1.57 x 10^7 a	V	70	1.000	1.3 x 10^{-7}	1.000	1.5 x 10^{-7}	1.2 x 10^{-7}	1.3 x 10^{-7}	9.9 x 10^{-8}	7.4 x 10^{-8}
Methyl iodine-130	12.4 h	V	70	1.000	1.5 x 10^{-8}	1.000	1.3 x 10^{-8}	7.2 x 10^{-9}	3.3 x 10^{-9}	2.2 x 10^{-9}	1.4 x 10^{-9}
Methyl iodine-131	8.04 d	V	70	1.000	1.3 x 10^{-7}	1.000	1.3 x 10^{-7}	7.4 x 10^{-8}	3.7 x 10^{-8}	2.4 x 10^{-8}	1.5 x 10^{-8}

Methyl iodine-132	2.30 h	V	70	1.000	2.0×10^{-9}	1.000	1.8×10^{-9}	9.5×10^{-10}	4.4×10^{-10}	2.9×10^{-10}	1.9×10^{-10}
Methyl iodine-132m	1.39 h	V	70	1.000	1.8×10^{-9}	1.000	1.6×10^{-9}	8.3×10^{-10}	3.9×10^{-10}	2.5×10^{-10}	1.6×10^{-10}
Methyl iodine-133	20.8 h	V	70	1.000	3.5×10^{-8}	1.000	3.2×10^{-8}	1.7×10^{-8}	7.6×10^{-9}	4.9×10^{-9}	3.1×10^{-9}
Methyl iodine-134	0.876 h	V	70	1.000	5.1×10^{-10}	1.000	4.3×10^{-10}	2.3×10^{-10}	1.1×10^{-10}	7.4×10^{-11}	5.0×10^{-11}
Methyl iodine-135	6.61 h	V	70	1.000	7.5×10^{-9}	1.000	6.7×10^{-9}	3.5×10^{-9}	1.6×10^{-9}	1.1×10^{-9}	6.8×10^{-10}
Mercury-193 vapour	3.50 h	D	70	1.000	4.2×10^{-9}	1.000	3.4×10^{-9}	2.2×10^{-9}	1.6×10^{-9}	1.2×10^{-9}	1.1×10^{-9}
Mercury-193m vapour	11.1 h	D	70	1.000	1.2×10^{-8}	1.000	9.4×10^{-9}	6.1×10^{-9}	4.5×10^{-9}	3.4×10^{-9}	3.1×10^{-9}
Mercury -194 vapour	2.60×10^{2} a	D	70	1.000	9.4×10^{-8}	1.000	8.3×10^{-8}	6.2×10^{-8}	5.0×10^{-8}	4.3×10^{-8}	4.0×10^{-8}
Mercury-195 vapour	9.90 h	D	70	1.000	5.3×10^{-9}	1.000	4.3×10^{-9}	2.8×10^{-9}	2.1×10^{-9}	1.6×10^{-9}	1.4×10^{-9}
Mercury-195m vapour	1.73 d	D	70	1.000	3.0×10^{-8}	1.000	2.5×10^{-8}	1.6×10^{-8}	1.2×10^{-8}	8.8×10^{-9}	8.2×10^{-9}
Mercury-197 vapour	2.67 d	D	70	1.000	1.6×10^{-8}	1.000	1.3×10^{-8}	8.4×10^{-9}	6.3×10^{-9}	4.7×10^{-9}	4.4×10^{-9}
Mercury-197m vapour	23.8 h	D	70	1.000	2.1×10^{-8}	1.000	1.7×10^{-8}	1.1×10^{-8}	8.2×10^{-9}	6.2×10^{-9}	5.8×10^{-9}
Mercury-199m vapour	0.710 h	D	70	1.000	6.5×10^{-10}	1.000	5.3×10^{-10}	3.4×10^{-10}	2.5×10^{-10}	1.9×10^{-10}	1.8×10^{-10}
Mercury-203 vapour	46.6 d	D	70	1.000	3.0×10^{-8}	1.000	2.3×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	7.7×10^{-9}	7.0×10^{-9}

[a] F: fast; V: material is taken to be completely and instantaneously transferred to body fluids.
[b] Applicable to both workers and adult member of the public.
d Deposition 10% : 20% : 40% (Bronchial : bronchiolar alveolar interstitial), 1.7 day retention

Table X

EFFECTIVE DOSE RATE FOR EXPOSURE TO INERT GASES FOR ADULTS [9]

Nuclide	*Physical half-life*	*Effective dose rate per unit integrated air concentration ($Sv.d^{-1}/Bq.m^{-3}$)[a]*
Argon		
Ar-37	35.0 d	4.1×10^{-15}
Ar-39	269 a	1.1×10^{-11}
Ar-41	1.83 h	5.3×10^{-9}
Krypton		
Kr-74	11.5 m	4.5×10^{-9}
Kr-76	14.8 h	1.6×10^{-9}
Kr-77	74.7 m	3.9×10^{-9}
Kr-79	1.46 d	9.7×10^{-10}
Kr-81	2.10×10^{5} a	2.1×10^{-11}
Kr-83m	1.83 h	2.1×10^{-13}
Kr-85	10.7 a	2.2×10^{-11}
Kr-85m	4.48 h	5.9×10^{-10}
Kr-87	1.27 h	3.4×10^{-9}
Kr-88	2.84 h	8.4×10^{-9}
Xenon		
Xe-120	40.0 m	1.5×10^{-9}
Xe-121	40.1 m	7.5×10^{-9}
Xe-122	20.1 h	1.9×10^{-10}
Xe-123	2.08 h	2.4×10^{-9}
Xe-125	17.0 h	9.3×10^{-10}
Xe-127	36.4 d	9.7×10^{-10}
Xe-129m	8.0 d	8.1×10^{-11}
Xe-131m	11.9 d	3.2×10^{-11}
Xe-133m	2.19 d	1.1×10^{-10}
Xe-133	5.24 d	1.2×10^{-10}
Xe-135m	15.3 m	1.6×10^{-9}
Xe-135	9.10 h	9.6×10^{-10}
Xe-138	14.2 m	4.7×10^{-9}

[a] Application for both workers and adult members of the public.

FOURTH SCHEDULE

COLLECTIVE EFFECTIVE DOSE, COMMITTED ABSORBED DOSE, COMMITTED EFFECTIVE DOSE AND COMMITTED EQUIVALENT DOSE

[regulation 3]

(1) The collective effective dose is the total effective dose, *S* to a population which is defined as—

$$S = \sum_{i} E_i \cdot N_I$$

where E_i is the average effective dose in the population subgroup *i* and N_i is the number of individuals in the subgroup. It can also be defined by the integral—

$$S = \int_{0}^{\infty} E \frac{dN}{dE} dE$$

where in $\frac{dN}{dE}$, dE is the number of individuals receiving an effective dose between *E* and *E* + *dE*.

The collective effective dose, S_k committed by an event, a decision or a finite portion of a practice *k* is given by—

$$S_k = \int_{0} \dot{S}_K(t) \quad dt$$

where $\dot{S}_k(t)$ is the collective effective dose rate at time t caused by the practice *k*.

(2) The committed absorbed dose is the absorbed dose which an individual is committed to received from an intake of radioactive material and is defined as—

$$D(\tau) = \int_{t_0}^{t_0 + \tau} \dot{D}(t) \quad dt$$

where t_0 is the time of intake, $\dot{D}t$ dt is the absorbed dose rate at the time t and τ is the time elapsed after an intake of radioactive material. When τ is not specified, it will be taken to be 50 years for adults and to age 70 years for intakes by children.

(3) The committed effective dose is the effective dose which an individual is committed to receive from an intake of radioactive material and is defined as—

$$E(\tau) = \sum_{T} W_T . H_T(\tau)$$

where $H_T(\tau)$ is the committed equivalent dose to tissue T over the integration time τ. When τ is not specified, it will be taken to be 50 years for adults and to age 70 years for intakes by children.

(4) The committed equivalent dose is the equivalent dose which would be received by an organ or tissue from an intake of radioactive material and is defined as—

$$H_T(\tau) = \int_{t_0}^{t_0 + \tau} \dot{H}_T(t) \quad dt$$

where t_0 is the time of intake, $\dot{H}_T(t)$ is the equivalent dose rate at time (t) in an organ or tissue T and τ is the time elapsed after an intake of radioactive material. When τ is not specified, it will be taken to be 50 years for adults and to age 70 years for intakes by children.

Fifth Schedule

PROVISIONS OF HELSINKI DECLARATION APPLICABLE TO MEDICAL RESEARCH INVOLVING THE USE OF IONIZING RADIATION

[regulation 42]

SECTION I

Basic Principles

1. Biomedical research involving human subjects shall conform to generally accepted scientific principles and shall be based on adequately performed laboratory and animal experimentation and on a thorough knowledge of the scientific literature.

2. The design and performance of each experimental procedure involving human subjects shall be clearly formulated in an experimental protocol which shall be transmitted for consideration, comment and guidance to a specially appointed committee independent of the investigator and the sponsor, provided that this independent committee is in conformity with the laws and regulations in this country in which the research experiment is to be carried out.

3. Biomedical research involving human subjects shall be conducted only by scientifically qualified persons and under the supervision of a clinically competent medical person. The responsibility for the human subject shall always rest with a medically qualified person and never rest on the subject of the research, even though the subject has given his or her consent.

4. Biomedical research involving human subjects shall not legitimately be carried out unless the importance of the objective is in proportion to the inherent risk to the subject.

5. Every biomedical research involving human subjects shall be preceded by careful assessment of predictable risks in comparison with foreseeable benefits to the subject or to others. Concern for the interests of the subject shall always prevail over the interest of science and society.

6. The right of the research subject to safeguard his or her integrity shall always be respected. Every precaution shall be taken to respect the privacy of the subject and to minimize the impact of the study on the subject's physical and mental integrity and on the personality of the subject.

7. Physicians shall abstain from engaging in research projects involving human subjects unless they are satisfied that the hazards involved are believed to be predictable. Physicians shall cease any investigation if the hazards are found to outweigh the potential benefits.

8. In publication of the results of his or her research, the physician is obliged to preserve the accuracy of the results. Reports of experimentation not in accordance with the principles laid down in this Declaration shall not be accepted for publication.

9. In any research on human beings, each potential subject shall be adequately informed of the aims, methods, anticipated benefits and potential hazards of the study and the discomfort it may entail. He or she shall be informed that he or she is at liberty to abstain from participation in the study and that he or she is free to withdraw his or her consent to participation at any time. The physician shall then obtain the subject's freely given informed consent, preferably in writing.

10. When obtaining informed consent for the research project, the physician shall be particularly cautions if the subject is in a dependent relationship to him or her or may consent under duress. In that case, the informed consent shall be obtained by a physician who is not engaged in the investigation and who is completely independent of this official relationship.

11. In case of legal incompetence, informed consent shall be obtained from the legal guardian in accordance with the law. Where physical or mental incapacity makes it impossible to obtain informed consent, or when the subject is a minor, permission from the responsible relative replaces that of the subject in accordance with the law. Whenever the minor is in fact able to give a consent, the minor's consent shall be obtained in addition to the consent from the minor's legal guardian.

12. The research protocol shall always contain a statement of the ethical considerations involved and shall indicate that the principles enunciated in the present Declaration are complied with.

SECTION II

Principles of Medical Research Combined with Professional Care (Clinical Research)

13. In the treatment of the sick person, the physician shall be free to use a new diagnostic and therapeutic measure, if in his or her judgement it offers hope of saving life, re-establishing health or alleviating suffering.

14. The potential benefits, hazards and discomfort of a new method shall be weighed against the advantages of the best current diagnostic and therapeutic methods.

15. In any medical study, every patient, including those of a control group, if any, shall be assured of the best proven diagnostic and therapeutic method.

16. The refusal of the patient to participate in a study shall never interfere with the physician-patient relationship.

17. If the physician considers it essential not to obtain informed consent, the specific reasons for this proposal shall be stated in the experimental protocol for transmission to the independent committee.

18. The physician can combine medical research with professional care, the objective being the acquisition of new medical knowledge, only to the extent that medical research is justified by its potential diagnostic or therapeutic value for the patient.

SECTION III

Principles of Non-Therapeutic Biomedical Research Involving Human Subjects (Non-Clinical Biomedical Research)

19. In the purely scientific application of medical research carried out on a human being, it is the duty of the physician to remain the protector of the life and health of that person on whom biomedical research is being carried out.

20. The subjects shall be volunteers, either healthy persons or patients, for whom the experimental design is not related to the patient's illness.

21. The investigator or the investigating team shall discontinue the research if in his/her or their judgement it may, if continued, be harmful to the individual.

22. In research on man, the interest of science and society shall never take precedence over considerations related to the well-being of the subject.

SIXTH SCHEDULE

GUIDANCE LEVELS OF DOSE, DOSE RATE AND ACTIVITY FOR MEDICAL EXPOSURE

[regulations 48, 49, 54 and 56]

PART I

GUIDANCE LEVELS FOR DIAGNOSTIC RADIOLOGICAL PROCEDURES

Table I

Guidance levels of dose for diagnostic radiography for a typical adult patient

Examination	*Entrance surface dose per radiograph* [a] *(mGy)*	
Lumbar spine	AP	10
	LAT	30
	LSJ	40

Examination	*Entrance surface dose per radiograph* [a] *(mGy)*	
Abdomen, intravenous, urography and cholecystography	AP	10
Pelvis	AP	10
Hip joint	AP	10
Chest	PA	0.4
	LAT	1.5
Thoracic spine	AP	7
	LAT	20
Dental	Periapical	7
	AP	5
Skull	PA	5
	LAT	3

Notes:

PA posterior-anterior projection; LAT: lateral projection; LSJ: lumbo-sacral-joint projection; AP: anterior-posterior projection.

[a] In air with back-scatter. These values are for conventional film screen combination in the relative speed of 200. For high speed film screen combinations (400-600), the values should be reduced by a factor of 2 to 3.

Table II

Dose guidance levels for computed tomography for a typical adult patient

Examination	*Multiple scan average dose* [a] *(mGy)*
Head	50
Lumbar spine	35
Abdomen	25

[a] Derived from measurements on the axis of rotation in water equivalent phantoms, 15 cm in length and 16 cm (head) and 30 cm (lumbar spine and abdomen) in diameter.

Table III

Dose guidance levels for mammography for a typical adult patient

Average glandular dose per craniocaudal projection [a] *1 mGy (without grid)* *3 mGy (with grid)*

[a] Determined in a 4.5 cm compressed breast consisting of 50% glandular and 50% adipose tissue, for film--screen systems and dedicated Mo--target Mo--filter mammography units.

Table IV

Dose rate guidance levels for fluoroscopy for a typical adult patient

Mode of operation	*Entrance surface dose rate* [a] *(mGy/min)*
Normal	25
High level [b]	100

[a] In air with backscatter;

[b] For fluoroscopes that have an optional 'high level' operational mode, as those frequently used in interventional radiology.

PART II

GUIDANCE LEVELS FOR DIAGNOSTIC PROCEDURES IN NUCLEAR MEDICINE

Table V

Guidance levels of activity for procedures in nuclear medicine for a typical adult patient

Test	*Radionuclide*	*Chemical form* [a]	*Maximum usual activity per test* [b] *(MBq)*
Bone			
Bone imaging	^{99} Tc ^{m}	Phosphonate and Phosphate compounds	1100
	^{99} Tc ^{m}	Methylene Diphosphonate	800
Bone imaging by single photon emission computerized tomography (SPECT)	^{99} Tc ^{m}	Phosphonate and Phosphate compounds	1100
Bone marrow imaging	^{99} Tc ^{m}	Labelled colloid	400
Brain			
Brain imaging (static)	^{99} Tc ^{m}	TcO_4^-	740
	^{99} Tc ^{m}	Diethylenetriaminepenta-acetic acid (DTPA), gluconate and glucoheptonate	800
Brain imaging (SPECT)	^{99} Tc ^{m}	TcO_4^-	800
	^{99} Tc ^{m}	DTPA, gluconate and glucoheptonate	800
	^{99} Tc ^{m}	Exametazine	750
Cerebral blood flow	^{133} Xe	In isotonic sodium chloride solution	400
	^{99} Tc ^{m}	TcO_4^-	740
	^{99} Tc ^{m}	Hexametyl propylene amine oxyme (HM-PAO)	750
Cisternography	^{111} In	DTPA	40
Lacrimal			
Lacrimal drainage	^{99} Tc ^{m}	TcO_4^-	6
	^{99} Tc ^{m}	Labelled colloid	6

[a] In some countries some of the compounds are considered obsolete;

[b] In some countries the typical values are lower than those indicated in the Table.

Test	*Radionuclide*	*Chemical form* [a]	*Maximum usual activity per test* [b] *(MBq)*
Thyroid			
Thyroid imaging	^{99}Tc^{m}	TcO_4^-	250
	^{123}I	I^-	20
Thyroid metastases (after ablation)	^{131}I	I^-	190
Parathyroid imaging	^{201}Tl	Tl^-, chloride	100
Lung			
Lung ventilation imaging	^{81}Kr^{m}	Gas	6000
	^{99}Tc^{m}	DTPA – aerosol	1200
	^{99}Tc^{m}	Technegas	740
Lung ventilation study	^{133}Xe	Gas	400
	^{127}Xe	Gas	200
Lung perfusion imaging	^{81}Kr^{m}	Aqueous solution	6000
	^{99}Tc^{m}	Human albumin (macroagregate or microsphere)	200
Lung perfusion studies	^{133}Xe	Isotonic solution	200
	^{127}Xe	Isotonic chloride solution	200
Lung imaging (SPECT)	^{99}Tc	Macroaggregated albumin (MAA)	200
Liver and spleen			
Liver and spleen imaging	^{99}Tc^{m}	Labelled colloid	300
Functional biliary system Imaging	^{99}Tc^{m}	Iminodiacetates and equivalent agents	200
Spleen imaging	^{99}Tc^{m}	Labelled denaturated red blood cells	190
Liver imaging (SPECT)	^{99}Tc^{m}	Labelled colloid	200
Cardiovascular			
First pass blood flow studies	^{99}Tc^{m}	TcO_4^-	740
	^{99}Tc^{m}	DTPA	800
	^{99}Tc^{m}	Macroaggregated globulin 3	400

[a] In some countries some of the compounds are considered obsolete;

[b] In some countries the typical values are lower than those indicated in the Table.

Test	*Radionuclide*	*Chemical form* [a]	*Maximum usual activity per test* [b] *(MBq)*
Blood pool imaging	^{99}Tc^{m}	Human albumin complex	40
	^{99}Tc^{m}	Labelled red blood cell	740
Cardiac and vascular imaging/probe studies	^{99}Tc^{m}	Human albumin complex	800
Myocardial imaging/ probe studies	^{99}Tc^{m}	Labelled normal red blood cells	900
Myocardial imaging	^{99}Tc^{m}	Phosponate and Phosphate compounds	800
Myocardial imaging(SPECT)	^{99}Tc^{m}	Isonitriles	1100
	^{201}Tl	Tl^{-}, chloride	120
	^{99}Tc^{m}	Phosphonate and Phosphate compounds	1000
	^{99}Tc^{m}	Isonitriles	1100
	^{99}Tc^{m}	Tetrafosmin	1100
Stomach, gastrointestinal tract			
Stomach/salivary gland imaging	^{99}Tc^{m}	TcO_4^-	190
Meckel's diverticulum imaging	^{99}Tc^{m}	TcO_4^-	400
Gastrointestinal bleeding	^{99}Tc^{m}	Labelled colloid	600
	^{99}Tc^{m}	Labelled normal red blood cells	930
Oesophageal transit and reflux	^{99}Tc^{m}	Labelled colloid	40
	^{99}Tc^{m}	DTPA	40
	^{99}Tc^{m}	Non-absorbable compounds	40
Gastric emptying	^{99}Tc^{m}	Non-absorbable compounds	40
	^{111}In	Non-absorbable compounds	12
	^{113}In^{m}	Non-absorbable compounds	12
Kidney, urinary system and adrenals			
Renal imaging	^{99}Tc^{m}	Dimercaptosuccinic acid	190

[a] In some countries some of the compounds are considered obsolete;

[b] In some countries the typical values are lower than those indicated in the Table.

Test	*Radionuclide*	*Chemical form* [a]	*Maximum usual activity per test* [b] *(MBq)*
Renal imaging/ renography	^{99}Tc^{m}	DTPA, gluconate and glucoheptonate	500
	^{99}Tc^{m}	MAG 3	100
	^{123}I	O-iodohippurate	20
Adrenal imaging	^{75}Se	Selenorcholesterol	12
Miscellaneous			
Tumour imaging	^{67}Ga	Citrate	370
Abscess Imaging	^{67}Ga	Citrate	190
Tumor and abcess imaging	^{201}Tl	Chloride	120
Tumour imaging	^{99}Tc^{m}	Dimercaptosuccinic acid	560
Neuroectodermal tumor imaging	^{123}I	Meta-iodo-benzyl guanidine	400
	^{131}I	Meta-iodo-benzil guanidine	40
Lymph node imaging	^{99}Tc^{m}	Labelled colloid	80
Abscess imaging	^{99}Tc^{m}	Exametazime labelled white cells	260
	^{111}In	Labelled white cells	20
Thrombus imaging	^{111}In	Labelled platelets	20
MCU (Cystography)	^{99}Tc^{m}	TcO_4^-	40
Pentetreotide/osteo scan scintigraphy	^{111}In		230
V-DMSA wholebody/ SPECT scintigraphy for medullary carcinome	^{99}Tc^{m}	DMSA	370

[a] In some countries some of the compounds are considered obsolete;

[b] In some countries the typical values are lower than those indicated in the Table.

PART III

GUIDANCE LEVELS OF
ACTIVITY ON DISCHARGE FROM HOSPITAL

Table VI

Guidance level for maximum activity for patients in therapy on discharge from hospital

Radionuclide	*Activity (MBq)*
Iodine – 131	1100 [a]

[a] In some countries a level of 400 MBq in used as an example of good practice.

SEVENTH SCHEDULE

DOSE LEVELS AT WHICH INTERVENTION IS
EXPECTED TO BE UNDERTAKEN UNDER ANY CIRCUMSTANCES

[regulation 73]

Table I

Action level of dose for acute exposure

Organ or tissue	*Projected absorbed dose to the organ or tissue in less than 2 days (Gy)*
Whole body (bone marrow)	1
Lung	6
Skin	3
Thyroid	5
Lens of the eye	2
Gonads	3

Note:

The possibility of deterministic effects for doses greater than about 0.1 Gy (delivered over less than 2 days) to the foetus should be taken into account in considering the justification and optimization of actual action levels for immediate protection.

Table II

Action level of dose rate for chronic exposure

Organ or tissue	*Equivalent dose rate (Gy per year)*
Gonads	0.2
Lens of the eye	0.1
Bone marrow	0.4

Made 7 January 2010
[MOSTI/TST/PTN(R) 100-1/2/18; PN(PU^2)425/V]

DATUK SERI DR. MAXIMUS JOHNITY ONGKILI
Minister of Science, Technology and Innovation

P.U. (A) 47.

AKTA KASTAM 1967

PERINTAH KASTAM (NILAI-NILAI) (MINYAK KELAPA SAWIT) (No. 7) 2010

PADA menjalankan kuasa yang diberikan oleh seksyen 12 Akta Kastam 1967 [*Akta 235*], Menteri membuat perintah yang berikut:

Nama dan permulaan kuat kuasa

1. Perintah ini bolehlah dinamakan **Perintah Kastam (Nilai-Nilai) (Minyak Kelapa Sawit) (No. 7) 2010** dan hendaklah mula berkuat kuasa bagi tempoh 15 Februari 2010 hingga 21 Februari 2010.

Pemungutan dan pembayaran duti kastam

2. Bagi maksud pemungutan dan pembayaran duti-duti kastam, menurut peruntukan-peruntukan Perintah Duti Kastam 2007 [*P.U. (A) 441/2007*], nilai bagi tiap-tiap satu barang berduti yang dinyatakan dalam ruang (1) dan (2) Jadual mengikut unitnya yang tersebut dalam ruang (3) hendaklah nilai yang dinyatakan dalam ruang (4) Jadual tersebut.

CUSTOMS ACT 1967

CUSTOMS (VALUES) (PALM OIL) (No. 7) ORDER 2010

IN exercise of the powers conferred by section 12 of the Customs Act 1967 [*Act 235*], the Minister makes the following order:

Citation and commencement

1. This order may be cited as the **Customs (Values) (Palm Oil) (No. 7) Order 2010** and shall have effect for the period from 15 February 2010 to 21 February 2010.

Levy and payment of customs duties

2. For the purpose of the levy and payment of customs duties, in accordance with the provisions of the Customs Duties Order 2007 [*P.U. (A) 441/2007*], the value of each of dutiable goods specified in columns (1) and (2) of the Schedule in respect of the unit thereof mentioned in column (3) of the Schedule shall be the value specified in column (4) of the said Schedule.

JADUAL/*SCHEDULE*

Barang *(Goods)*	Subkepala *(Subheading)*	Unit *(Unit)*	Nilai *(Value)*
(1)	(2)	(3)	(4)
Crude Palm Oil	1511.10 000	tonne	RM2,483.34

Dibuat 12 Februari 2010
Made 12 February 2010
[KE. HT(94) 819/03-6/klt. 9(8); Perb. (8.20) 116/1-4;
PN(PU^2)338/VIII/klt. 9]

Dengan arahan Menteri Kewangan.
By direction of the Minister of Finance.

Bagi pihak dan atas nama Menteri Kewangan/
On behalf and in the name of the Minister of Finance

KHODIJAH BINTI ABDULLAH
Timbalan Kanan Setiausaha
Bahagian Analisa Cukai

Hakcipta Pencetak (H)
PERCETAKAN NASIONAL MALAYSIA BERHAD
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