

PART 801**SECTION D****STANDARDS FOR PROTECTION AGAINST RADIATION****GENERAL PROVISIONS****801.D.1 Purpose.**

(a) This section establishes standards for protection against ionizing radiation resulting from activities conducted pursuant to licenses or registrations issued by the Agency. These regulations are issued pursuant to the Mississippi Radiation Protection Law of 1976.

(b) The requirements of this section are designed to control the receipt, possession, use, transfer, and disposal of sources of radiation by any licensee or registrant so the total dose to an individual, including doses resulting from all sources of radiation other than background radiation, does not exceed the standards for protection against radiation prescribed in this section. However, nothing in this section shall be construed as limiting actions that may be necessary to protect health and safety.

801.D.2 Scope. Except as specifically provided in other sections of these regulations, this section applies to persons licensed or registered by the Agency to receive, possess, use, transfer, or dispose of sources of radiation. The limits in this section do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose of medical diagnosis or therapy, ~~or to exposure from individuals administered radioactive material and released in accordance with Section 801.G.26 of these regulations, or to exposure from~~ voluntary participation in medical research programs.

801.D.3 Definitions. As used in Section D:

“Air-purifying respirator” means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

"Annual limit on intake" (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems (0.05 sievert) or a committed dose equivalent of 50 rems (0.5 sievert) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table I, Columns 1 and 2, of Appendix B of this section.

“Assigned protection factor (APF)” means the expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. Operationally, the inhaled concentration can be estimated by dividing the ambient airborne concentration by the APF.

“Atmosphere-supplying respirator” means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

"Class" means a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D, Days, of less than 10 days, for Class W, Weeks, from 10 to 100 days, and for Class Y, Years, of greater than 100 days. For purposes of these regulations, "lung class" and "inhalation class" are equivalent terms.

“Constraint (dose constraint)” means a value above which specified licensee actions are required.

"Declared pregnant woman" means a woman who has voluntarily informed ~~her employer~~ **the licensee or registrant**, in writing, of her pregnancy and the estimated date of conception. **The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.**

“Demand respirator” means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

"Derived air concentration" (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work, results in an intake of one ALI. For purposes of these regulations, the condition of light work is an inhalation rate of 1.2 cubic meters of air per hour for 2,000 hours in a year. DAC values are given in Table I, Column 3, of Appendix B of this section.

"Derived air concentration-hour" (DAC-hour) means the product of the concentration of radioactive material in air, expressed as a fraction or multiple of the derived air concentration for each radionuclide, and the time of exposure to that radionuclide, in hours. A licensee or registrant may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 sievert).

“Disposable respirator” means a respirator for which maintenance is not intended and that is designed to be discarded after excessive breathing resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of respirator are a disposable half-mask respirator or a disposable escape-only self-contained breathing apparatus (SCBA).

"Dosimetry processor" means an individual or an organization that processes and evaluates individual monitoring devices in order to determine the radiation dose delivered to the monitoring devices.

"Filtering facepiece (dust mask)" means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.

"Fit factor" means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

"Fit test" means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

"Helmet" means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

"Hood" means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

"Loose-fitting facepiece" means a respiratory inlet covering that is designed to form a partial seal with the face.

"Inhalation class" [see "Class"].

"Lung class" [see "Class"].

"Negative pressure respirator (tight fitting)" means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

"Nonstochastic effect" means a health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect. For purposes of these regulations, "deterministic effect" is an equivalent term.

"Planned special exposure" means an infrequent exposure to radiation, separate from and in addition to the annual occupational dose limits.

"Positive pressure respirator" means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

“Powered air-purifying respirator (PAPR)” means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

“Pressure demand respirator” means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

“Qualitative fit test (QLFT)” means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

“Quantitative fit test (QNFT)” means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

"Quarter" means a period of time equal to one-fourth of the year observed by the licensee, approximately 13 consecutive weeks, providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

"Reference Man" means a hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of the Reference Man is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man."

"Respiratory protective equipment" means an apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials.

"Sanitary sewerage" means a system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee or registrant.

“Self-contained breathing apparatus (SCBA)” means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

"Stochastic effect" means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects. For purposes of these regulations, "probabilistic effect" is an equivalent term.

“Supplied-air respirator (SAR)” or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

“Tight-fitting facepiece” means a respiratory inlet covering that forms a complete seal with the face.

“User seal check (fit check)” means an action conducted by the respirator user to determine if the respirator is properly seated to the face. Examples include negative pressure check, positive pressure check, irritant smoke check, or isoamyl acetate check.

"Very high radiation area" means an area, accessible to individuals, in which radiation levels **from radiation sources external to the body** could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a source of radiation or from any surface that the radiation penetrates.¹

"Weighting factor" w_T for an organ or tissue (T) means the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of w_T are:

<u>ORGAN DOSE WEIGHTING FACTORS</u>	
<u>Organ or Tissue</u>	<u>w_T</u>
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30 ^a
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Whole Body	1.00 ^b

^a 0.30 results from 0.06 for each of 5 "remainder" organs, excluding the skin and the lens of the eye, that receive the highest doses.

^b For the purpose of weighting the external whole body dose, for adding it to the internal dose, a single weighting factor, $w_T = 1.0$, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

801.D.4 Implementation.

At very high doses received at high dose rates, units of absorbed dose, gray and rad, are appropriate, rather than units of dose equivalent, sievert and rem.

(a) Any existing license or registration condition that is more restrictive than Section D remains in force until there is an amendment or renewal of the license or registration.

(b) If a license or registration condition exempts a licensee or registrant from a provision of Section D in effect on or before ~~the effective date of these regulations~~ August 9, 1996, it also exempts the licensee or registrant from the corresponding provision of Section D.

(c) If a license or registration condition cites provisions of Section D in effect prior to ~~the effective date of these regulations~~ August 9, 1996, which do not correspond to any provisions of Section D, the license or registration condition remains in force until there is an amendment or renewal of the license or registration that modifies or removes this condition.

RADIATION PROTECTION PROGRAMS

801.D.101 Radiation Protection Programs.

(a) Each licensee or registrant shall develop, document, and implement a radiation protection program sufficient to ensure compliance with the provisions of this section. See 801.D.1102 for recordkeeping requirements relating to these programs.

(b) The licensee or registrant shall use, to the extent ~~practicable~~ practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA).

(c) The licensee or registrant shall, at intervals not to exceed 12 months, review the radiation protection program content and implementation.

(d) To implement the ALARA requirements of 801.D.101 (b), and notwithstanding the requirements in 801.D.301 of this section, a constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established by licensees, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem (0.1 mSv) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in 801.D.1203 and promptly take appropriate corrective action to ensure against recurrence.

OCCUPATIONAL DOSE LIMITS

801.D.201 Occupational Dose Limits for Adults.

(a) The licensee or registrant shall control the occupational dose to individual adults, except for planned special exposures pursuant to 801.D.206, to the following dose limits:

- (1) An annual limit, which is the more limiting of:

- (i) the total effective dose equivalent being equal to 5 rems (0.05 sievert); or
 - (ii) the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 sievert).
- (2) The annual limits to the lens of the eye, to the skin, and to the extremities which are:
- (i) an **eye lens** dose equivalent of 15 rems (0.15 sievert), and
 - (ii) a shallow dose equivalent of 50 rems (0.5 sievert) to the skin or to any extremity.

(b) Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime. See 801.D.206(e)(1) and (2).

(c) The assigned deep dose equivalent and shallow dose equivalent shall be for the portion of the body receiving the highest exposure determined as follows:

- (1) The deep dose equivalent, **eye lens** dose equivalent and shallow dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure, or the results of individual monitoring are unavailable; or
- (2) Reserved.

(d) Derived air concentration (DAC) and annual limit on intake (ALI) values are presented in Table I of Appendix B of this section and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits. See 801.D.1107.

(e) Notwithstanding the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity. See footnote 3 of Appendix B of this section.

(f) The licensee or registrant shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person. See 801.D.205(e).

801.D.202 Compliance with Requirements for Summation of External and Internal Doses.

(a) If the licensee is required to monitor pursuant to both 801.D.502(a) and (b), the licensee shall demonstrate compliance with the dose limits by summing external and internal doses. If the licensee

or registrant is required to monitor only pursuant to 801.D.502(a) or only pursuant to 801.D.502(b), then summation is not required to demonstrate compliance with the dose limits. The licensee may demonstrate compliance with the requirements for summation of external and internal doses pursuant to 801.D.202(b), (c) and (d). The dose equivalents for the lens of the eye, the skin, and the extremities are not included in the summation, but are subject to separate limits.

(b) Intake by Inhalation. If the only intake of radionuclides is by inhalation, the total effective dose equivalent limit is not exceeded if the sum of the deep dose equivalent divided by the total effective dose equivalent limit, and one of the following, does not exceed unity:

- (1) the sum of the fractions of the inhalation ALI for each radionuclide, or
- (2) the total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by 2,000, or
- (3) the sum of the calculated committed effective dose equivalents to all significantly irradiated organs or tissues (T) calculated from bioassay data using appropriate biological models and expressed as a fraction of the annual limit. For purposes of this requirement, an organ or tissue is deemed to be significantly irradiated if, for that organ or tissue, the product of the weighting factors, w_T , and the committed dose equivalent, $H_{T,50}$, per unit intake is greater than 10 percent of the maximum weighted value of H_{50} , that is, $w_T H_{T,50}$, per unit intake for any organ or tissue.

(c) Intake by Oral Ingestion. If the occupationally exposed individual also receives an intake of radionuclides by oral ingestion greater than 10 percent of the applicable oral ALI, the licensee or registrant shall account for this intake and include it in demonstrating compliance with the limits.

(d) Intake through Wounds or Absorption through Skin. The licensee shall evaluate and, to the extent practical, account for intakes through wounds or skin absorption. The intake through intact skin has been included in the calculation of DAC for hydrogen-3 and does not need to be evaluated or accounted for pursuant to 801.D.202(d).

801.D.203 Determination of External Dose from Airborne Radioactive Material.

(a) Licensees shall, when determining the dose from airborne radioactive material, include the contribution to the deep dose equivalent, **eye lens** dose equivalent, and shallow dose equivalent from external exposure to the radioactive cloud. See Appendix B, footnotes 1 and 2 of this section.

(b) Airborne radioactivity measurements and DAC values shall not be used as the primary means to assess the deep dose equivalent when the airborne radioactive material includes radionuclides other than noble gases or if the cloud of airborne radioactive material is not relatively uniform. The determination of the deep dose equivalent to an individual shall be based upon measurements using instruments or individual monitoring devices.

801.D.204 Determination of Internal Exposure.

(a) For purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee shall, when required pursuant to 801.D.502, take suitable and timely measurements of:

- (1) concentrations of radioactive materials in air in work areas; or
- (2) quantities of radionuclides in the body; or
- (3) quantities of radionuclides excreted from the body; or
- (4) combinations of these measurements.

(b) Unless respiratory protective equipment is used, as provided in 801.D.703, or the assessment of intake is based on bioassays, the licensee shall assume that an individual inhales radioactive material at the airborne concentration in which the individual is present.

(c) When specific information on the physical and biochemical properties of the radionuclides taken into the body or the behavior of the material in an individual is known, the licensee may:

- (1) use that information to calculate the committed effective dose equivalent, and, if used, the licensee shall document that information in the individual's record; and
- (2) upon prior approval of the Agency, adjust the DAC or ALI values to reflect the actual physical and chemical characteristics of airborne radioactive material, for example, aerosol size distribution or density; and
- (3) separately assess the contribution of fractional intakes of Class D, W, or Y compounds of a given radionuclide to the committed effective dose equivalent. See Appendix B of this section.

(d) If the licensee chooses to assess intakes of Class Y material using the measurements given in 801.D.204(a)(2) or (3), the licensee may delay the recording and reporting of the assessments for periods up to 7 months, unless otherwise required by 801.D.1202 or 801.D.1203. This delay permits the licensee to make additional measurements basic to the assessments.

(e) If the identity and concentration of each radionuclide in a mixture are known, the fraction of the DAC applicable to the mixture for use in calculating DAC-hours shall be either:

- (1) the sum of the ratios of the concentration to the appropriate DAC value, that is, D, W, or Y, from Appendix B of this section for each radionuclide in the mixture; or

(2) the ratio of the total concentration for all radionuclides in the mixture to the most restrictive DAC value for any radionuclide in the mixture.

(f) If the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture shall be the most restrictive DAC of any radionuclide in the mixture.

(g) When a mixture of radionuclides in air exists, a licensee may disregard certain radionuclides in the mixture if:

(1) the licensee uses the total activity of the mixture in demonstrating compliance with the dose limits in 801.D.201 and in complying with the monitoring requirements in 801.D.502(b); and

(2) the concentration of any radionuclide disregarded is less than 10 percent of its DAC; and

(3) the sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed 30 percent.

(h) When determining the committed effective dose equivalent, the following information may be considered:

(1) In order to calculate the committed effective dose equivalent, the licensee may assume that the inhalation of one ALI, or an exposure of 2,000 DAC-hours, results in a committed effective dose equivalent of 5 rems (0.05 sievert) for radionuclides that have their ALIs or DACs based on the committed effective dose equivalent.

(2) For an ALI and the associated DAC determined by the nonstochastic organ dose limit of 50 rems (0.5 sievert), the intake of radionuclides that would result in a committed effective dose equivalent of 5 rems (0.05 sievert), that is, the stochastic ALI, is listed in parentheses in Table I of Appendix B of this section. The licensee may, as a simplifying assumption, use the stochastic ALI to determine committed effective dose equivalent. However, if the licensee uses the stochastic ALI, the licensee shall also demonstrate that the limit in 801.D.201(a)(1)(ii) is met.

801.D.205 Determination of Prior Occupational Dose.

(a) For each individual who is likely to receive in a year, an occupational dose requiring monitoring pursuant to 801.D.502, the licensee or registrant shall:

(1) determine the occupational radiation dose received during the current year; and

(2) attempt to obtain the records of lifetime cumulative occupational radiation dose.

(b) Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant shall determine:

- (1) the internal and external doses from all previous planned special exposures; and
- (2) all doses in excess of the limits, including doses received during accidents and emergencies, received during the lifetime of the individual; and
- (3) all lifetime cumulative occupational radiation dose.

(c) In complying with the requirements of 801.D.205(a), a licensee or registrant may:

- (1) accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual received during the current year; and
- (2) accept, as the record of lifetime cumulative radiation dose, an up-to-date Agency Form RH-4 or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant; and
- (3) obtain reports of the individual's dose equivalent from the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant, by telephone, telegram, facsimile, or letter. The licensee or registrant shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

(d)(1) The licensee or registrant shall record the exposure history, as required by 801.D.205(a), on Agency Form RH-4, or other clear and legible record, of all the information required on that form. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee or registrant obtains reports, the licensee or registrant shall use the dose shown in the report in preparing Agency Form RH-4 or equivalent. For any period in which the licensee or registrant does not obtain a report, the licensee or registrant shall place a notation on Agency Form RH-4 or equivalent indicating the periods of time for which data are not available.

(2) Licensees are not required to reevaluate the separate external dose equivalents and internal committed dose equivalents or intakes of radionuclides assessed pursuant to the regulations in this section in effect before ~~the effective date of these regulations~~ August 9, 1996. Further, occupational exposure histories obtained and recorded on Agency Form RH-4 or equivalent before ~~the effective date of these regulations~~ August 9, 1996, would not have included effective

dose equivalent, but may be used in the absence of specific information on the intake of radionuclides by the individual.

(e) If the licensee is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee shall assume:

(1) In establishing administrative controls pursuant to 801.D.201(f) for the current year, that the allowable dose limit for the individual is reduced by 12.5 millisieverts (1.25 rems) for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure; and

(2) That the individual is not available for planned special exposures.

(f) The licensee shall retain the records on Agency Form RH-4 or equivalent until the Agency terminates each pertinent license or registration requiring this record. The licensee shall retain records used in preparing Agency Form RH-4 or equivalent for 3 years after the record is made.

801.D.206 Planned Special Exposures. A licensee or registrant may authorize an adult worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in 801.D.201 provided that each of the following conditions is satisfied:

(a) The licensee or registrant authorizes a planned special exposure only in an exceptional situation when alternatives that might avoid the ~~higher exposure~~ **dose estimated to result from the planned special exposure** are unavailable or impractical.

(b) The licensee or registrant, and employer if the employer is not the licensee or registrant, specifically authorizes the planned special exposure, in writing, before the exposure occurs.

(c) Before a planned special exposure, the licensee or registrant ensures that each individual involved is:

(1) informed of the purpose of the planned operation; and

(2) informed of the estimated doses and associated potential risks and specific radiation levels or other conditions that might be involved in performing the task; and

(3) instructed in the measures to be taken to keep the dose ALARA considering other risks that may be present.

(d) Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant ascertains prior doses as required by 801.D.205(b) during the lifetime of the individual for each individual involved.

(e) Subject to 801.D.201(b), the licensee or registrant shall not authorize a planned special exposure that would cause an individual to receive a dose from all planned special exposures and all doses in excess of the limits to exceed:

- (1) the numerical values of any of the dose limits in 801.D.201(a) in any year; and
- (2) five times the annual dose limits in 801.D.201(a) during the individual's lifetime.

(f) The licensee or registrant maintains records of the conduct of a planned special exposure in accordance with 801.D.1106 and submits a written report in accordance with 801.D.1204.

(g) The licensee or registrant records the best estimate of the dose resulting from the planned special exposure in the individual's record and informs the individual, in writing, of the dose within 30 days from the date of the planned special exposure. The dose from planned special exposures shall not be considered in controlling future occupational dose of the individual pursuant to 801.D.201(a) but shall be included in evaluations required by 801.D.206(d) and (e).

801.D.207 Occupational Dose Limits for Minors. The annual occupational dose limits for minors are 10 percent of the annual occupational dose limits specified for adult workers in 801.D.201.

801.D.208 Dose to an Embryo/Fetus.

(a) The licensee or registrant shall ensure that the dose **equivalent** to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 millisieverts). See 801.D.1107 for recordkeeping requirements.

(b) The licensee or registrant shall make efforts to avoid substantial variation² above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in 801.D.208(a).

(c) The dose **equivalent** to an embryo/fetus shall be taken as the sum of:

- (1) the deep dose equivalent to the declared pregnant woman; and
- (2) the dose **equivalent** to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

(d) If by the time the woman declares pregnancy to the licensee or registrant, the dose **equivalent** to the embryo/fetus has exceeded 4.5 millisieverts (0.45 rems), the licensee or registrant shall be

The National Council on Radiation Protection and Measurements recommended in NCRP Report No. 91 "Recommendations on Limits for Exposure to Ionizing Radiation" (June 1, 1987) that no more than 0.05 rem (0.5 millisievert) to the embryo/fetus be received in any one month.

deemed to be in compliance with 801.D.208(a) if the additional dose to the embryo/fetus does not exceed 0.05 rem (0.5 millisievert) during the remainder of the pregnancy.

RADIATION DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC

801.D.301 Dose Limits for Individual Members of the Public.

(a) Each licensee or registrant shall conduct operations so that:

(1) the total effective dose equivalent to individual members of the public from the licensed or registered operation does not exceed 0.1 rem (1 millisievert) in a year, exclusive of the dose contributions from **background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with 801.G.26 of these regulations from voluntary participation in medical research programs, and** from the licensee's disposal of radioactive material into sanitary sewerage in accordance with 801.D.1003²; and

(2) the dose in any unrestricted area from external sources, **exclusive of the dose contributions from patients administered radioactive material and released in accordance with 801.G.26 of these regulations** does not exceed 0.002 rem (0.02 millisievert) in any one hour.

(b) If the licensee or registrant permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals.

(c) A licensee, registrant, or an applicant for a license or registration may apply for prior Agency authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 millisieverts). This application shall include the following information:

(1) demonstration of the need for and the expected duration of operations in excess of the limit in 801.D.301(a); and

(2) the licensee's or registrant's program to assess and control dose within the 0.5 rem (5 millisieverts) annual limit; and

(3) the procedures to be followed to maintain the dose ALARA.

Retrofit shall not be required for locations within facilities where only radiation machines existed prior to ~~the effective date of these regulations~~ **August 9, 1996**, and met the previous requirements of 0.5 rem (5 millisieverts) in a year.

(d) In addition to the requirements of Section D, a licensee subject to the provisions of the U.S. Environmental Protection Agency's generally applicable environmental radiation standards in 40 CFR 190 shall comply with those standards.

(e) The Agency may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee or registrant may release in effluents in order to restrict the collective dose.

801.D.302 Compliance with Dose Limits for Individual Members of the Public.

(a) The licensee or registrant shall make or cause to be made surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in 801.D.301.

(b) A licensee or registrant shall show compliance with the annual dose limit in 801.D.301 by:

(1) demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed or registered operation does not exceed the annual dose limit; or

(2) demonstrating that:

(i) the annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in Table II of Appendix B of this section; and

(ii) if an individual were continually present in an unrestricted area, the dose from external sources would not exceed 0.002 rem (0.02 millisievert) in an hour and 0.05 rem (0.5 millisievert) in a year.

(c) Upon approval from the Agency, the licensee may adjust the effluent concentration values in Appendix B, Table II, of this section, for members of the public, to take into account the actual physical and chemical characteristics of the effluents, such as, aerosol size distribution, solubility, density, radioactive decay equilibrium, and chemical form.

TESTING FOR LEAKAGE OR CONTAMINATION OF SEALED SOURCES

801.D.401 Testing for Leakage or Contamination of Sealed Sources.

(a) The licensee in possession of any sealed source shall assure that:

(1) Each sealed source, except as specified in 801.D.401(b), is tested for leakage or contamination and the test results are received before the sealed source is put into use unless the licensee has a certificate from the transferor indicating that the sealed source was tested within 6 months before transfer to the licensee.

(2) Each sealed source that is not designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed 6 months or at alternative intervals approved by the Agency, an Agreement State, a Licensing State, or the U.S. Nuclear Regulatory Commission.

(3) Each sealed source that is designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed 3 months or at alternative intervals approved by the Agency, an Agreement State, a Licensing State, or the U.S. Nuclear Regulatory Commission.

(4) For each sealed source that is required to be tested for leakage or contamination, at any other time there is reason to suspect that the sealed source might have been damaged or might be leaking, the licensee shall assure that the sealed source is tested for leakage or contamination before further use.

(5) Tests for leakage for all sealed sources, except brachytherapy sources manufactured to contain radium, shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of radioactive material on a test sample. Test samples shall be taken from the sealed source or from the surfaces of the container in which the sealed source is stored or mounted on which one might expect contamination to accumulate. For a sealed source contained in a device, test samples are obtained when the source is in the "off" position.

(6) The test for leakage for brachytherapy sources manufactured to contain radium shall be capable of detecting an absolute leakage rate of 0.001 microcurie (37 becquerels) of radon-222 in a 24 hour period when the collection efficiency for radon-222 and its daughters has been determined with respect to collection method, volume and time.

(7) Tests for contamination from radium daughters shall be taken on the interior surface of brachytherapy source storage containers and shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of a radium daughter which has a half-life greater than 4 days.

(b) A licensee need not perform test for leakage or contamination on the following sealed sources:

(1) sealed sources containing only radioactive material with a half-life of less than 30 days;

(2) sealed sources containing only radioactive material as a gas;

(3) sealed sources containing 100 microcuries (3.7 megabecquerels) or less of beta or photon-emitting material or 10 microcuries (370 kilobecquerels) or less of alpha-emitting material;

- (4) sealed sources containing only hydrogen-3;
- (5) seeds of iridium-192 encased in nylon ribbon; and
- (6) sealed sources, except teletherapy and brachytherapy sources, which are stored, not being used and identified as in storage. The licensee shall, however, test each such sealed source for leakage or contamination and receive the test results before any use or transfer unless it has been tested for leakage or contamination within 6 months before the date of use or transfer.

(c) Tests for leakage or contamination from sealed sources shall be performed by persons specifically authorized by the Agency, an Agreement State, a Licensing State, or the U.S. Nuclear Regulatory Commission to perform such services.

(d) Test results shall be kept in units of microcurie or becquerel and maintained for inspection by the Agency.

(e) The following shall be considered evidence that a sealed source is leaking:

- (1) The presence of 0.005 microcurie (185 becquerels) or more of removable contamination on any test sample.
- (2) Leakage of 0.001 microcurie (37 becquerels) of radon-222 per 24 hours for brachytherapy sources manufactured to contain radium.
- (3) The presence of removable contamination resulting from the decay of 0.005 microcurie (185 becquerels) or more of radium.

(f) The licensee shall immediately withdraw a leaking sealed source from use and shall take action to prevent the spread of contamination. The leaking sealed source shall be repaired or disposed of in accordance with this section.

(g) Reports of test results for leaking or contaminated sealed sources shall be made pursuant to 801.D.1208.

SURVEYS AND MONITORING

801.D.501 General.

(a) Each licensee or registrant shall make, or cause to be made, surveys that:

- (1) are necessary for the licensee or registrant to comply with Section D; and
- (2) are necessary under the circumstances to evaluate:

- (i) **the magnitude and extent** of radiation levels; and
- (ii) concentrations or quantities of radioactive material; and
- (iii) the potential radiological hazards ~~that could be present~~.

(b) The licensee or registrant shall ensure that instruments and equipment used for quantitative radiation measurements, for example, dose rate and effluent monitoring, are calibrated at intervals not to exceed 12 months unless a more frequent interval is specified in another section of these regulations for the radiation measured.

(c) All personnel dosimeters, except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to any extremity, that require processing to determine the radiation dose and that are used by licensees and registrants to comply with 801.D.201, with other applicable provisions of these regulations, or with conditions specified in a license or registration shall be processed and evaluated by a dosimetry processor:

- (1) holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology; and
- (2) approved in this accreditation process for the type of radiation or radiations included in the NVLAP program that most closely approximates the type of radiation or radiations for which the individual wearing the dosimeter is monitored.

(d) The licensee or registrant shall ensure that adequate precautions are taken to prevent a deceptive exposure of an individual monitoring device.

801.D.502 Conditions Requiring Individual Monitoring of External and Internal Occupational Dose.

Each licensee or registrant shall monitor exposures from sources of radiation at levels sufficient to demonstrate compliance with the occupational dose limits of this section. As a minimum:

- (a) Each licensee or registrant shall monitor occupational exposure to radiation and shall supply and require the use of individual monitoring devices by:
 - (1) adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the limits in 801.D.201(a); and
 - (2) ~~minors and declared pregnant women~~ likely to receive, in 1 year from **sources of radiation** external to the body, a deep dose **equivalent** in excess of ~~10 percent of any of the applicable limits in 801.D.207 or 801.D.208;~~ **of 0.1 rem (1mSv), a lens dose equivalent in excess of 0.15 rem (1.5 mSv), or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem (5 mSv);**

and

(3) declared pregnant women likely to receive during the entire pregnancy, from sources of radiation external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv);⁴ and

(4) individuals entering a high or very high radiation area.

(b) Each licensee shall monitor, to determine compliance with 801.D.204, the occupational intake of radioactive material by and assess the committed effective dose equivalent to:

(1) adults likely to receive, in 1 year, an intake in excess of 10 percent of the applicable ALI in Table I, Columns 1 and 2, of Appendix B of this section; and

(2) minors ~~and declared pregnant women~~ likely to receive, in 1 year, a committed effective dose equivalent in excess of ~~0.05 rem (0.5 millisievert)~~ 0.1 rem (1 mSv); and

(3) declared pregnant women likely to receive, during the entire pregnancy, a committed effective dose equivalent in excess of 0.1 rem (1 mSv).

CONTROL OF EXPOSURE FROM EXTERNAL SOURCES IN RESTRICTED AREAS

801.D.601 Control of Access to High Radiation Areas.

(a) The licensee or registrant shall ensure that each entrance or access point to a high radiation area has one or more of the following features:

(1) a control device that, upon entry into the area, causes the level of radiation to be reduced below that level at which an individual might receive a deep dose equivalent of 0.1 rem (1 millisievert) in 1 hour at 30 centimeters from the source of radiation from any surface that the radiation penetrates; or

(2) a control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; or

(3) entryways that are locked, except during periods when access to the areas is required, with positive control over each individual entry.

All of the occupational doses in 801.D.201 continue to be applicable to the declared pregnant worker as long as the embryo/fetus dose limit is not exceeded.

(b) In place of the controls required by 801.D.601(a) for a high radiation area, the licensee or registrant may substitute continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

(c) The licensee or registrant may apply to the Agency for approval of alternative methods for controlling access to high radiation areas.

(d) The licensee or registrant shall establish the controls required by 801.D.601(a) and (c) in a way that does not prevent individuals from leaving a high radiation area.

(e) The licensee is not required to control each entrance or access point to a room or other area that is a high radiation area solely because of the presence of radioactive materials prepared for transport and packaged and labeled in accordance with the regulations of the U.S. Department of Transportation provided that:

(1) the packages do not remain in the area longer than 3 days; and

(2) the dose rate at 1 meter from the external surface of any package does not exceed 0.01 rem (0.1 millisievert) per hour.

(f) The licensee is not required to control entrance or access to rooms or other areas in hospitals solely because of the presence of patients containing radioactive material, provided that there are personnel in attendance who are taking the necessary precautions to prevent the exposure of individuals to radiation or radioactive material in excess of the established limits in this section and to operate within the ALARA provisions of the licensee's radiation protection program.

(g) The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a high radiation area as described in 801.D.601 if the registrant has met all the specific requirements for access and control specified in other applicable sections of these regulations, such as, Section E for industrial radiography, Section F for x-rays in the healing arts, Section I for particle accelerators and Section X for therapeutic radiation machines.

801.D.602 Control of Access to Very High Radiation Areas.

(a) In addition to the requirements in 801.D.601, the licensee or registrant shall institute measures to ensure that an individual is not able to gain unauthorized or inadvertent access to areas in which radiation levels could be encountered at 500 rads (5 grays) or more in 1 hour at 1 meter from a source of radiation or any surface through which the radiation penetrates. This requirement does not apply to rooms or areas in which diagnostic x-ray systems are the only source of radiation, or to non-self-shielded irradiators.

(b) The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a very high radiation area as described in 801.D.602(a) if

the registrant has met all the specific requirements for access and control specified in other applicable sections of these regulations, such as, Section E for industrial radiography, Section F for x-rays in the healing arts, Section I for particle accelerators and Section X for therapeutic radiation machines.

801.D.603 Control of Access to Very High Radiation Areas -- Irradiators.

(a) Section 801.D.603 applies to licensees with sources of radiation in non-self-shielded irradiators. Section 801.D.603 does not apply to sources of radiation that are used in teletherapy, in industrial radiography, or in completely self-shielded irradiators in which the source of radiation is both stored and operated within the same shielding radiation barrier and, in the designed configuration of the irradiator, is always physically inaccessible to any individual and cannot create high levels of radiation in an area that is accessible to any individual.

(b) Each area in which there may exist radiation levels in excess of 5 grays (500 rads) in 1 hour at 1 meter from a source of radiation that is used to irradiate materials shall meet the following requirements:

- (1) Each entrance or access point shall be equipped with entry control devices which:
 - (i) function automatically to prevent any individual from inadvertently entering a very high radiation area; and
 - (ii) permit deliberate entry into the area only after a control device is actuated that causes the radiation level within the area, from the source of radiation, to be reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour; and
 - (iii) prevent operation of the source of radiation if it would produce radiation levels in the area that could result in a deep dose equivalent to an individual in excess of 0.1 rem (1 millisievert) in 1 hour.
- (2) Additional control devices shall be provided so that, upon failure of the entry control devices to function as required by 801.D.603(b)(1):
 - (i) the radiation level within the area, from the source of radiation, is reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour; and
 - (ii) conspicuous visible and audible alarm signals are generated to make an individual attempting to enter the area aware of the hazard and at least one other authorized individual, who is physically present, familiar with the activity, and prepared to render or summon assistance, aware of the failure of the entry control devices.

- (3) The licensee shall provide control devices so that, upon failure or removal of physical radiation barriers other than the sealed source's shielded storage container:
- (i) the radiation level from the source of radiation is reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour; and
 - (ii) conspicuous visible and audible alarm signals are generated to make potentially affected individuals aware of the hazard and the licensee or at least one other individual, who is familiar with the activity and prepared to render or summon assistance, aware of the failure or removal of the physical barrier.
- (4) When the shield for stored sealed sources is a liquid, the licensee shall provide means to monitor the integrity of the shield and to signal, automatically, loss of adequate shielding.
- (5) Physical radiation barriers that comprise permanent structural components, such as walls, that have no credible probability of failure or removal in ordinary circumstances need not meet the requirements of 801.D.603(b)(3) and (4).
- (6) Each area shall be equipped with devices that will automatically generate conspicuous visible and audible alarm signals to alert personnel in the area before the source of radiation can be put into operation and in time for any individual in the area to operate a clearly identified control device, which must be installed in the area and which can prevent the source of radiation from being put into operation.
- (7) Each area shall be controlled by use of such administrative procedures and such devices as are necessary to ensure that the area is cleared of personnel prior to each use of the source of radiation.
- (8) Each area shall be checked by a radiation measurement to ensure that, prior to the first individual's entry into the area after any use of the source of radiation, the radiation level from the source of radiation in the area is below that at which it would be possible for an individual to receive a deep dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour.
- (9) The entry control devices required in 801.D.603(b)(1) shall be tested for proper functioning. See 801.D.1110 for recordkeeping requirements.
- (i) Testing shall be conducted prior to initial operation with the source of radiation on any day, unless operations were continued uninterrupted from the previous day.
 - (ii) Testing shall be conducted prior to resumption of operation of the source of radiation after any unintentional interruption.

(iii) The licensee shall submit and adhere to a schedule for periodic tests of the entry control and warning systems.

(10) The licensee shall not conduct operations, other than those necessary to place the source of radiation in safe condition or to effect repairs on controls, unless control devices are functioning properly.

(11) Entry and exit portals that are used in transporting materials to and from the irradiation area, and that are not intended for use by individuals, shall be controlled by such devices and administrative procedures as are necessary to physically protect and warn against inadvertent entry by any individual through these portals. Exit portals for irradiated materials shall be equipped to detect and signal the presence of any loose radioactive material that is carried toward such an exit and automatically to prevent loose radioactive material from being carried out of the area.

(c) Licensees, or applicants for licenses for sources of radiation within the purview of 801.D.603(b) which will be used in a variety of positions or in locations, such as open fields or forests, that make it impracticable to comply with certain requirements of 801.D.603(b), such as those for the automatic control of radiation levels, may apply to the Agency for approval of alternative safety measures. Alternative safety measures shall provide personnel protection at least equivalent to those specified in 801.D.603(b). At least one of the alternative measures shall include an entry-preventing interlock control based on a measurement of the radiation that ensures the absence of high radiation levels before an individual can gain access to the area where such sources of radiation are used.

(d) The entry control devices required by 801.D.603(b) and (c) shall be established in such a way that no individual will be prevented from leaving the area.

RESPIRATORY PROTECTION AND CONTROLS TO RESTRICT INTERNAL EXPOSURE IN RESTRICTED AREAS

801.D.701 Use of Process or Other Engineering Controls. The licensee shall use, to the extent practicable, process or other engineering controls, such as, containment, **decontamination**, or ventilation, to control the concentrations of radioactive material in air.

801.D.702 Use of Other Controls.

(a) When it is not practicable to apply process or other engineering controls to control the concentrations of radioactive material in air to values below those that define an airborne radioactivity area, the licensee or registrant shall, consistent with maintaining the total effective dose equivalent ALARA, increase monitoring and limit intakes by one or more of the following means:

(1) control of access; or

- (2) limitation of exposure times; or
- (3) use of respiratory protection equipment; or
- (4) other controls.

(b) If the licensee performs an ALARA analysis to determine whether or not respirators should be used, the licensee may consider safety factors other than radiological factors. The licensee should also consider the impact of respirator use on workers' industrial health and safety.

801.D.703 Use of Individual Respiratory Protection Equipment.

(a) If the licensee uses respiratory protection equipment to limit intakes pursuant to 801.D.702:

(1) Except as provided in 801.D.703(a)(2), the licensee shall use only respiratory protection equipment that is tested and certified or had certification extended by the National Institute for Occupational Safety and Health ~~and the Mine Safety and Health Administration.~~

(2) If the licensee wishes to use equipment that has not been tested or certified by the National Institute for Occupational Safety and Health ~~and the Mine Safety and Health Administration~~ has not had certification extended by the National Institute for Occupational Safety and Health ~~and the Mine Safety and Health Administration~~, or for which there is no schedule for testing or certification, the licensee shall submit an application for authorized use of that equipment, including a demonstration by testing, or a demonstration on the basis of reliable test information, that the material and performance characteristics of the equipment are capable of providing the proposed degree of protection under anticipated conditions of use.

(3) The licensee shall implement and maintain a respiratory protection program that includes:

- (i) air sampling sufficient to identify the potential hazard, permit proper equipment selection, and estimate ~~exposures~~ **doses**; and
- (ii) surveys and bioassays, as appropriate, to evaluate actual intakes; and
- (iii) testing of respirators for operability **(user seal check for face sealing devices and functional check for others)** immediately prior to each use; and
- (iv) written procedures regarding selection, fitting, issuance, maintenance, and testing of respirators, including testing for operability immediately prior to each use; supervision and training of personnel; monitoring, including air sampling and bioassays; and recordkeeping; and

- (v) determination by a physician prior to initial fitting of respirators, and either every 12 months thereafter, or periodically at a frequency determined by a physician that the individual user is medically fit to use the respiratory protection equipment.
 - (vi) Fit testing, with fit factor ≥ 10 times the APF for negative pressure devices, and a fit factor ≥ 500 for any positive pressure, continuous flow, and pressure-demand devices, before the first field use of tight fitting, face-sealing respirators and periodically thereafter at a frequency not to exceed 1 year. Fit testing must be performed with the facepiece operating in the negative pressure mode.
- (4) The licensee shall issue a written policy statement on respirator usage covering:
- (i) the use of process or other engineering controls, instead of respirators; and
 - (ii) the routine, nonroutine, and emergency use of respirators; and
 - (iii) the length of periods of respirator use and relief from respirator use.
- (5) The licensee shall advise each respirator user that the user may leave the area at any time for relief from respirator use in the event of equipment malfunction, physical or psychological distress, procedural or communication failure, significant deterioration of operating conditions, or any other conditions that might require such relief.
- (6) ~~The licensee shall use respiratory protection equipment within the equipment manufacturer's expressed limitations for type and mode of use and shall provide proper visual, communication, and other special capabilities, such as adequate skin protection, when needed.~~ The licensee shall also consider limitations appropriate to the type and mode of use. When selecting respiratory devices the licensee shall provide for vision correction, adequate communication, low temperature work environments, and the concurrent use of other safety or radiological protection equipment. The licensee shall use equipment in such a way as not to interfere with the proper operation of the respirator.
- (7) Standby rescue persons are required whenever one-piece atmosphere-supplying suits, or any combination of supplied air respiratory protection device and personnel protective equipment are used from which an unaided individual would have difficulty extricating himself or herself. The standby persons must be equipped with respiratory protection devices or other apparatus appropriate for the potential hazards. The standby rescue persons shall observe or otherwise maintain continuous communication with the workers (visual, voice, signal line, telephone, radio, or other suitable means), and be immediately available to assist them in case of a failure of the air supply or for any other reason that requires relief from distress. A sufficient number of standby rescue persons must be immediately available to assist all users of this type of equipment and to provide effective emergency rescue if needed.

(8) Atmosphere-supplying respirators must be supplied with respirable air of grade D quality or better as defined by the Compressed Gas Association in publication G-7.1, "Commodity Specification for Air," 1997 and included in the regulations of the Occupational Safety and Health Administration (29 CFR 1910.134(i)(1)(ii)(A) through (E). Grade D quality air criteria include:

- (i) Oxygen content (v/v) of 19.5-23.5%;
- (ii) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
- (iii) Carbon monoxide (CO) content of 10 ppm or less;
- (iv) Carbon dioxide content of 1,000 ppm or less; and
- (v) Lack of noticeable odor.

(9) The licensee shall ensure that no objects, materials or substances, such as facial hair, or any conditions that interfere with the face--facepiece seal or valve function, and that are under the control of the respirator wearer, are present between the skin of the wearer's face and the sealing surface of a tight-fitting respirator facepiece.

~~(b) When estimating exposure of individuals to airborne radioactive materials, the licensee may make allowance for respiratory protection equipment used to limit intakes pursuant to 801.D.702, provided that the following conditions, in addition to those in 801.D.703(a), are satisfied:~~

~~—(1)—The licensee selects respiratory protection equipment that provides a protection factor, specified in Appendix A of this section, greater than the multiple by which peak concentrations of airborne radioactive materials in the working area are expected to exceed the values specified in Appendix B, Table I, Column 3 of this section. However, if the selection of respiratory protection equipment with a protection factor greater than the peak concentration is inconsistent with the goal specified in 801.D.702 of keeping the total effective dose equivalent ALARA, the licensee may select respiratory protection equipment with a lower protection factor provided that such a selection would result in a total effective dose equivalent that is ALARA. The concentration of radioactive material in the air that is inhaled when respirators are worn may be initially estimated by dividing the average concentration in air, during each period of uninterrupted use, by the protection factor. If the exposure is later found to be greater than initially estimated, the corrected value shall be used; if the exposure is later found to be less than initially estimated, the corrected value may be used.~~

(b) In estimating the dose to individuals from intake of airborne radioactive materials, the concentration of radioactive material in the air that is inhaled when respirators are worn is initially assumed to be the ambient concentration in air without respiratory protection, divided by the assigned protection factor. If the dose is later found to be greater than the estimated dose, the

corrected value must be used. If the dose is later found to be less than the estimated dose, the corrected value may be used.

801.D.704 Further Restrictions on the Use of Respiratory Protection Equipment. The Agency may impose restrictions in addition to the provisions of 801.D.702, 801.D.703, and Appendix A of this section in order to:

(a) Ensure that the respiratory protection program of the licensee is adequate to limit doses to individuals from intakes of airborne radioactive materials consistent with maintaining total effective dose equivalent ALARA; and

(b) Limit the extent to which a licensee may use respiratory protection equipment instead of process or other engineering controls.

801.D.705 Application for Use of Higher Assigned Protection Factors. The licensee shall obtain authorization from the Agency before assigning respiratory protection factors in excess of those specified in Appendix A of this section. The Agency may authorize a licensee to use higher assigned protection factors on receipt of an application that:

(a) describes the situation for which a need exists for higher protection factors; and

(b) demonstrates that the respiratory protection equipment provides these higher protection factors under the proposed conditions of use.

~~(c) In an emergency, the licensee shall use as emergency equipment only respiratory protection equipment that has been specifically certified or had certification extended for emergency use by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration.~~

~~(d) The licensee shall notify the Agency in writing at least 30 days before the date that respiratory protection equipment is first used pursuant to either 801.D.703(a) or (b).~~

STORAGE AND CONTROL OF LICENSED OR REGISTERED SOURCES OF RADIATION

801.D.801 Security of Stored Sources of Radiation. The licensee or registrant shall secure from unauthorized removal or access licensed or registered sources of radiation that are stored in controlled or unrestricted areas.

801.D.802 Control of Sources of Radiation not in Storage.

(a) The licensee shall control and maintain constant surveillance of licensed radioactive material that is in a controlled or unrestricted area and that is not in storage or in a patient.

(b) The registrant shall maintain control of radiation machines that are in a controlled or unrestricted area and that are not in storage.

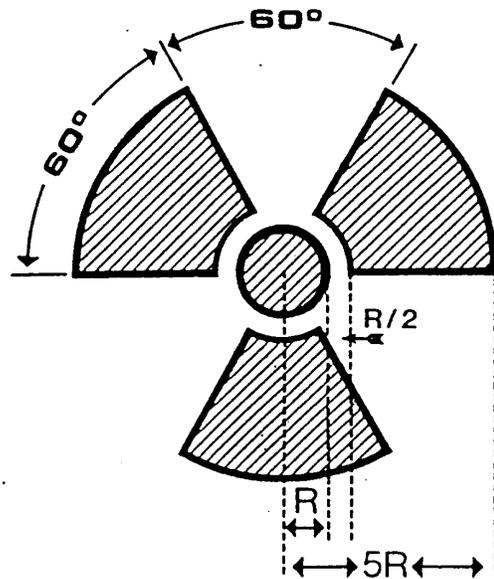
PRECAUTIONARY PROCEDURES

801.D.901 Caution Signs.

(a) Standard Radiation Symbol. Unless otherwise authorized by the Agency, the symbol prescribed by 801.D.901 shall use the colors magenta, or purple, or black on yellow background. The symbol prescribed is the three-bladed design as follows:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta, or purple, or black, and
2. The background is to be yellow.



(b) Exception to Color Requirements for Standard Radiation Symbol. Notwithstanding the requirements of 801.D.901(a), licensees or registrants are authorized to label sources, source holders,

or device components containing sources of radiation that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without a color requirement.

(c) Additional Information on Signs and Labels. In addition to the contents of signs and labels prescribed in this section, the licensee or registrant shall provide, on or near the required signs and labels, additional information, as appropriate, to make individuals aware of potential radiation exposures and to minimize the exposures.

801.D.902 Posting Requirements.

(a) Posting of Radiation Areas. The licensee or registrant shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIATION AREA."

(b) Posting of High Radiation Areas. The licensee or registrant shall post each high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, HIGH RADIATION AREA" or "DANGER, HIGH RADIATION AREA."

(c) Posting of Very High Radiation Areas. The licensee or registrant shall post each very high radiation area with a conspicuous sign or signs bearing the radiation symbol and words "GRAVE DANGER, VERY HIGH RADIATION AREA."

(d) Posting of Airborne Radioactivity Areas. The licensee shall post each airborne radioactivity area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, AIRBORNE RADIOACTIVITY AREA" or "DANGER, AIRBORNE RADIOACTIVITY AREA."

(e) Posting of Areas or Rooms in Which Licensed Material is Used or Stored. The licensee shall post each area or room in which there is used or stored an amount of licensed material exceeding 10 times the quantity of such material specified in Appendix C of this section with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)."

801.D.903 Exceptions to Posting Requirements.

(a) A licensee or registrant is not required to post caution signs in areas or rooms containing sources of radiation for periods of less than 8 hours, if each of the following conditions is met:

- (1) the sources of radiation are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to sources of radiation in excess of the limits established in this section; and
- (2) the area or room is subject to the licensee's or registrant's control.

(b) Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs pursuant to 801.D.902 provided that the patient could be released from ~~confinement~~ licensee control pursuant to 801.G.26 of these regulations.

(c) A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level at 30 centimeters from the surface of the sealed source container or housing does not exceed 0.005 rem (0.05 millisievert) per hour.

(d) A room or area is not required to be posted with a caution sign because of the presence of radiation machines used solely for diagnosis in the healing arts.

801.D.904 Labeling Containers and Radiation Machines.

(a) The licensee shall ensure that each container of licensed material bears a durable, clearly visible label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL." The label shall also provide information, such as the radionuclides present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment, to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

(b) Each licensee shall, prior to removal or disposal of empty uncontaminated containers to unrestricted areas, remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.

(c) Each registrant shall ensure that each radiation machine is labeled in a conspicuous manner which cautions individuals that radiation is produced when it is energized.

801.D.905 Exemptions to Labeling Requirements. A licensee is not required to label:

(a) containers holding licensed material in quantities less than the quantities listed in Appendix C of this section; or

(b) containers holding licensed material in concentrations less than those specified in Table III of Appendix B of this section; or

(c) containers attended by an individual who takes the precautions necessary to prevent the exposure of individuals in excess of the limits established by this section; or

(d) containers when they are in transport and packaged and labeled in accordance with the regulations of the U.S. Department of Transportation;⁵ or

(e) containers that are accessible only to individuals authorized to handle or use them, or to work in the vicinity of the containers, if the contents are identified to these individuals by a readily available written record. Examples of containers of this type are containers in locations such as water-filled canals, storage vaults, or hot cells. The record shall be retained as long as the containers are in use for the purpose indicated on the record; or

(f) installed manufacturing or process equipment, such as piping and tanks.

801.D.906 Procedures for Receiving and Opening Packages.

(a) Each licensee who expects to receive a package containing quantities of radioactive material in excess of a Type A quantity, as defined in 801.T.2 and Appendix A of Section T of these regulations, shall make arrangements to receive:

- (1) the package when the carrier offers it for delivery; or
- (2) the notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.

(b) Each licensee shall:

- (1) monitor the external surfaces of a labeled⁶ package for radioactive contamination unless the package contains only radioactive material in the form of gas or in special form as defined in 801.A.2 of these regulations; and
- (2) monitor the external surfaces of a labeled⁵ package for radiation levels unless the package contains quantities of radioactive material that are less than or equal to the Type A quantity, as defined in 801.T.2 and Appendix A of Section T of these regulations; and
- (3) monitor all packages known to contain radioactive material for radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet, or damaged.

Labeling of packages containing radioactive materials is required by the U.S. Department of Transportation if the amount and type of radioactive material exceeds the limits for an excepted quantity or article as defined and limited by U.S. Department of Transportation regulations 49 CFR 173.403(m) and (w) and 173.421-424.

Labeled with a Radioactive White I, Yellow II, or Yellow III label as specified in U.S. Department of Transportation regulations 49 CFR 172.403 and 172.436.440.

(c) The licensee shall perform the monitoring required by 801.D.906(b) as soon as practicable after receipt of the package, but not later than 3 hours after the package is received at the licensee's facility if it is received during the licensee's normal working hours, or not later than 3 hours from the beginning of the next working day if it is received after working hours.

(d) The licensee shall immediately notify the final delivery carrier and, by telephone ~~and telegram,~~ ~~mailgram,~~ or facsimile, the Agency when:

- (1) removable radioactive surface contamination exceeds the limits of 801.T.15(h) of these regulations; or
- (2) external radiation levels exceed the limits of 801.T.15(i) and (j) of these regulations.

(e) Each licensee shall:

- (1) establish, maintain, and retain written procedures for safely opening packages in which radioactive material is received; and
- (2) ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.

(f) Licensees transferring special form sources in vehicles owned or operated by the licensee to and from a work site are exempt from the contamination monitoring requirements of 801.D.906(b), but are not exempt from the monitoring requirement in 801.D.906(b) for measuring radiation levels that ensures that the source is still properly lodged in its shield.

WASTE DISPOSAL

801.D.1001 General Requirements.

(a) A licensee shall dispose of licensed material only:

- (1) by transfer to an authorized recipient as provided in 801.D.1006 or in Sections C or N of these regulations, or to the U.S. Department of Energy; or
- (2) by decay in storage; or
- (3) by release in effluents within the limits in 801.D.301; or
- (4) as authorized pursuant to 801.D.1002, 801.D.1003, 801.D.1004, or 801.D.1005.

(b) A person shall be specifically licensed to receive waste containing licensed material from other persons for:

- (1) treatment prior to disposal; or
- (2) treatment or disposal by incineration; or
- (3) decay in storage; or
- (4) disposal at a land disposal facility licensed pursuant to these regulations; or
- (5) storage until transferred to a storage or disposal facility authorized to receive the waste.

801.D.1002 Method for Obtaining Approval of Proposed Disposal Procedures. A licensee or applicant for a license may apply to the Agency for approval of proposed procedures, not otherwise authorized in these regulations, to dispose of licensed material generated in the licensee's operations. Each application shall include:

- (a) a description of the waste containing licensed material to be disposed of, including the physical and chemical properties that have an impact on risk evaluation, and the proposed manner and conditions of waste disposal; and
- (b) an analysis and evaluation of pertinent information on the nature of the environment; and
- (c) the nature and location of other potentially affected facilities; and
- (d) analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this section.

801.D.1003 Disposal by Release into Sanitary Sewerage.

- (a) A licensee may discharge licensed material into sanitary sewerage if each of the following conditions is satisfied:
 - (1) the material is readily soluble, or is readily dispersible biological material, in water; and
 - (2) the quantity of licensed radioactive material that the licensee releases into the sewer in 1 month divided by the average monthly volume of water released into the sewer by the licensee does not exceed the concentration listed in Table III of Appendix B of this section; and
 - (3) if more than one radionuclide is released, the following conditions must also be satisfied:

- (i) the licensee shall determine the fraction of the limit in Table III of Appendix B of this section represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee into the sewer by the concentration of that radionuclide listed in Table III of Appendix B of this section; and
 - (ii) the sum of the fractions for each radionuclide required by 801.D.1003(a)(3)(i) does not exceed unity; and
- (4) the total quantity of licensed radioactive material that the licensee releases into the sanitary sewerage in a year does not exceed 5 curies (185 gigabecquerels) of hydrogen-3, 1 curie (37 gigabecquerels) of carbon-14, and 1 curie (37 gigabecquerels) of all other radioactive materials combined.

(b) Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in 801.D.1003(a).

801.D.1004 Treatment or Disposal by Incineration. A licensee may treat or dispose of licensed material by incineration only in the amounts and forms specified in 801.D.1005 or as specifically approved by the Agency pursuant to 801.D.1002.

801.D.1005 Disposal of Specific Wastes.

(a) A licensee may dispose of the following licensed material as if it were not radioactive:

- (1) 0.05 microcurie (1.85 kilobecquerels) or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and
- (2) 0.05 microcurie (1.85 kilobecquerels) or less, of hydrogen-3 or carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.

(b) A licensee shall not dispose of tissue pursuant to 801.D.1005(a)(2) in a manner that would permit its use either as food for humans or as animal feed.

(c) The licensee shall maintain records in accordance with 801.D.1109.

801.D.1006 Transfer for Disposal and Manifests.

(a) The requirements of 801.D.1006 and Appendix D of this section are designed to:

- (1) Control transfers of low-level radioactive waste by any waste generator, waste collector, or waste processor licensee, as defined in this section, who ships low-level waste either directly, or indirectly through a waste collector or waste processor, to a licensed low-level waste land

~~disposal facility (as defined in Appendix D of this section); intended for disposal at a licensed low-level radioactive waste disposal facility, establish a manifest tracking system, and supplement existing requirements concerning transfers and recordkeeping for those wastes.~~

(2) Establish a manifest tracking system; and

(3) Supplement existing requirements concerning transfers and recordkeeping for those wastes.

~~(b) Each shipment of radioactive waste designated for disposal at a licensed low-level radioactive waste disposal facility shall be accompanied by a shipment manifest as specified in Section I of Appendix D of this section.~~

(b) Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility must document the information required on NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee in accordance with Appendix D of this section.

(c) Each shipment manifest shall include a certification by the waste generator as specified in Section II of Appendix D of this section.

(d) Each person involved in the transfer for disposal and disposal of waste, including the waste generator, waste collector, waste processor, and disposal facility operator, shall comply with the requirements specified in Section III of Appendix D of this section.

801.D.1007 Compliance with Environmental and Health Protection Regulations. Nothing in 801.D.1001, 801.D.1002, 801.D.1003, 801.D.1004, 801.D.1005, or 801.D.1006 relieves the licensee from complying with other applicable Federal, State and local regulations governing any other toxic or hazardous properties of materials that may be disposed of to 801.D.1001, 801.D.1002, 801.D.1003, 801.D.1004, 801.D.1005, or 801.D.1006.

RECORDS

801.D.1101 General Provisions.

(a) Each licensee or registrant shall use the special units curie, rad, rem and roentgen, or the SI units becquerel, gray, sievert and coulomb per kilogram, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by this section.

(b) In the records required by this section, the licensee may record quantities in SI units in parentheses following each of the units specified in 801.D.1101(a). However, all quantities must be recorded as stated in 801.D.1101(a).

(c) Notwithstanding the requirements of 801.D.1101(a), when recording information on shipment manifests, as required in 801.D.1006(b), information must be recorded in the International System of Units (SI) or in SI and units as specified in 801.D.1101(a).

(bd) The licensee or registrant shall make a clear distinction among the quantities entered on the records required by this section, such as, total effective dose equivalent, total organ dose equivalent, shallow dose equivalent, eye lens dose equivalent, deep dose equivalent, or committed effective dose equivalent.

801.D.1102 Records of Radiation Protection Programs.

(a) Each licensee or registrant shall maintain records of the radiation protection program, including:

- (1) the provisions of the program; and
- (2) audits and other reviews of program content and implementation.

(b) The licensee or registrant shall retain the records required by 801.D.1102(a)(1) until the Agency terminates each pertinent license or registration requiring the record. The licensee or registrant shall retain the records required by 801.D.1102(a)(2) for 3 years after the record is made.

801.D.1103 Records of Surveys.

(a) Each licensee or registrant shall maintain records showing the results of surveys and calibrations required by 801.D.501 and 801.D.906(b). The licensee or registrant shall retain these records for 3 years after the record is made.

(b) The licensee or registrant shall retain each of the following records until the Agency terminates each pertinent license or registration requiring the record:

- (1) records of the results of surveys to determine the dose from external sources of radiation used, in the absence of or in combination with individual monitoring data, in the assessment of individual dose equivalents; and
- (2) records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose; and
- (3) records showing the results of air sampling, surveys, and bioassays required pursuant to 801.D.703(a)(3)(i) and (ii); and
- (4) records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.

801.D.1104 Records of Tests for Leakage or Contamination of Sealed Sources. Records of tests for leakage or contamination of sealed sources required by 801.D.401 shall be kept in units of microcurie or becquerel and maintained for inspection by the Agency for 5 years after the records are made.

801.D.1105 Records of Prior Occupational Dose. The licensee or registrant shall retain the records of prior occupational dose and exposure history as specified in 801.D.205 on Agency Form RH-4 or equivalent until the Agency terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing Agency Form RH-4 or equivalent for 3 years after the record is made.

801.D.1106 Records of Planned Special Exposures.

(a) For each use of the provisions of 801.D.206 for planned special exposures, the licensee or registrant shall maintain records that describe:

- (1) the exceptional circumstances requiring the use of a planned special exposure; and
- (2) the name of the management official who authorized the planned special exposure and a copy of the signed authorization; and
- (3) what actions were necessary; and
- (4) why the actions were necessary; and
- (5) what precautions were taken to assure that doses were maintained ALARA; and
- (6) what individual and collective doses were expected to result; and
- (7) the doses actually received in the planned special exposure.

(b) The licensee or registrant shall retain the records until the Agency terminates each pertinent license or registration requiring these records.

801.D.1107 Records of Individual Monitoring Results.

(a) Recordkeeping Requirement. Each licensee or registrant shall maintain records of doses received by all individuals for whom monitoring was required pursuant to 801.D.502, and records of doses received during planned special exposures, accidents, and emergency conditions. Assessments of dose equivalent and records made using units in effect before the effective date of this section need not be changed. These records shall include, when applicable:

- (1) the deep dose equivalent to the whole body, **eye lens** dose equivalent, shallow dose equivalent to the skin, and shallow dose equivalent to the extremities; and
- (2) the estimated intake of radionuclides, see 801.D.202; and
- (3) the committed effective dose equivalent assigned to the intake of radionuclides; and
- (4) the specific information used to calculate the committed effective dose equivalent pursuant to 801.D.204(a) and (c); and
- (5) the total effective dose equivalent when required by 801.D.202; and
- (6) the total of the deep dose equivalent and the committed dose to the organ receiving the highest total dose.

(b) Recordkeeping Frequency. The licensee or registrant shall make entries of the records specified in 801.D.1107(a) at intervals not to exceed 1 year.

(c) Recordkeeping Format. The licensee or registrant shall maintain the records specified in 801.D.1107(a) on Agency Form RH-6, in accordance with the instructions for Agency Form RH-6, or in clear and legible records containing all the information required by Agency Form RH-6.

(d) The licensee or registrant shall maintain the records of dose **equivalent** to an embryo/fetus with the records of dose **equivalent** to the declared pregnant woman. The declaration of pregnancy, including the estimated date of conception, shall also be kept on file, but may be maintained separately from the dose records.

(e) The licensee or registrant shall retain each required form or record until the Agency terminates each pertinent license or registration requiring the record.

801.D.1108 Records of Dose to Individual Members of the Public.

(a) Each licensee or registrant shall maintain records sufficient to demonstrate compliance with the dose limit for individual members of the public. See 801.D.301.

(b) The licensee or registrant shall retain the records required by 801.D.1108(a) until the Agency terminates each pertinent license or registration requiring the record.

801.D.1109 Records of Waste Disposal.

(a) Each licensee shall maintain records of the disposal of licensed materials made pursuant to 801.D.1002, 801.D.1003, 801.D.1004, 801.D.1005, Section N of these regulations, and disposal by burial in soil, including burials authorized before May 9, 1986.⁷

(b) The licensee shall retain the records required by 801.D.1109(a) until the Agency terminates each pertinent license requiring the record.

801.D.1110 Records of Testing Entry Control Devices for Very High Radiation Areas.

(a) Each licensee or registrant shall maintain records of tests made pursuant to 801.D.603(b)(9) on entry control devices for very high radiation areas. These records must include the date, time, and results of each such test of function.

(b) The licensee or registrant shall retain the records required by 801.D.1110(a) for 3 years after the record is made.

801.D.1111 Form of Records. Each record required by this section shall be legible throughout the specified retention period. The record shall be the original or a reproduced copy or a microform, provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of producing a clear copy throughout the required retention period or the record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records, such as letters, drawings, and specifications, shall include all pertinent information, such as stamps, initials, and signatures. The licensee or registrant shall maintain adequate safeguards against tampering with and loss of records.

REPORTS

801.D.1201 Reports of Stolen, Lost, or Missing Licensed or Registered Sources of Radiation.

(a) Telephone Reports. Each licensee or registrant shall report to the Agency by telephone as follows:

- (1) immediately after its occurrence becomes known to the licensee, stolen, lost, or missing licensed radioactive material in an aggregate quantity equal to or greater than 1,000 times the quantity specified in Appendix C of this section under such circumstances that it appears to the licensee that an exposure could result to individuals in unrestricted areas; or

A previous 801.D.304 permitted burial of small quantities of licensed materials in soil before May 9, 1986, without specific Agency authorization.

(2) within 30 days after its occurrence becomes known to the licensee, lost, stolen, or missing licensed radioactive material in an aggregate quantity greater than 10 times the quantity specified in Appendix C of this section that is still missing; or

(3) immediately after its occurrence becomes known to the registrant, a stolen, lost, or missing radiation machine.

(b) Written Reports. Each licensee or registrant required to make a report pursuant to 801.D.1201(a) shall, within 30 days after making the telephone report, make a written report to the Agency setting forth the following information:

(1) a description of the licensed or registered source of radiation involved, including, for radioactive material, the kind, quantity, and chemical and physical form; and, for radiation machines, the manufacturer, model and serial number, type and maximum energy of radiation emitted;

(2) a description of the circumstances under which the loss or theft occurred; and

(3) a statement of disposition, or probable disposition, of the licensed or registered source of radiation involved; and

(4) exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas; and

(5) actions that have been taken, or will be taken, to recover the source of radiation; and

(6) procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed or registered sources of radiation.

(c) Subsequent to filing the written report, the licensee or registrant shall also report additional substantive information on the loss or theft within 30 days after the licensee or registrant learns of such information.

(d) The licensee or registrant shall prepare any report filed with the Agency pursuant to 801.D.1201 so that names of individuals who may have received exposure to radiation are stated in a separate and detachable portion of the report.

801.D.1202 Notification of Incidents.

(a) Immediate Notification. Notwithstanding other requirements for notification, each licensee or registrant shall immediately report each event involving a source of radiation possessed by the licensee or registrant that may have caused or threatens to cause any of the following conditions:

- (1) An individual to receive:
 - (i) a total effective dose equivalent of 25 rems (0.25 sievert) or more; or
 - (ii) an eye lens dose equivalent of 75 rems (0.75 sievert) or more; or
 - (iii) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent of 250 rads (2.5 grays) or more; or
- (2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the occupational ALI. This provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

(b) Twenty-Four Hour Notification. Each licensee or registrant shall, within 24 hours of discovery of the event, report to the Agency each event involving loss of control of a licensed or registered source of radiation possessed by the licensee or registrant that may have caused, or threatens to cause, any of the following conditions:

- (1) An individual to receive, in a period of 24 hours:
 - (i) a total effective dose equivalent exceeding 5 rems (0.05 sievert); or
 - (ii) an eye lens dose equivalent exceeding 15 rems (0.15 sievert); or
 - (iii) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 50 rems (0.5 sievert) ; or
- (2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational ALI. This provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

(c) The licensee or registrant shall prepare each report filed with the Agency pursuant to 801.D.1202 so that names of individuals who have received exposure to sources of radiation are stated in a separate and detachable portion of the report.

(d) Licensees or registrants shall make the reports required by 801.D.1202(a) and (b) to the Agency by telephone, ~~telegram, mailgram,~~ or facsimile to the Agency.

(e) The provisions of 801.D.1202 do not apply to doses that result from planned special exposures, provided such doses are within the limits for planned special exposures and are reported pursuant to 801.D.1204.

801.D.1203 Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the **Constraints or Limits**.

(a) Reportable Events. In addition to the notification required by 801.D.1202, each licensee or registrant shall submit a written report within 30 days after learning of any of the following occurrences:

- (1) incidents for which notification is required by 801.D.1202; or
- (2) doses in excess of any of the following:
 - (i) the occupational dose limits for adults in 801.D.201; or
 - (ii) the occupational dose limits for a minor in 801.D.207; or
 - (iii) the limits for an embryo/fetus of a declared pregnant woman in 801.D.208; or
 - (iv) the limits for an individual member of the public in 801.D.301; or
 - (v) any applicable limit in the license or registration; or
 - (vi) **the ALARA constraints for air emissions established under 801.D.101(d); or**
- (3) levels of radiation or concentrations of radioactive material in:
 - (i) a restricted area in excess of applicable limits in the license or registration; or
 - (ii) an unrestricted area in excess of 10 times the applicable limit set forth in this section or in the license or registration, whether or not involving exposure of any individual in excess of the limits in 801.D.301; or
- (4) For licensees subject to the provisions of U.S. Environmental Protection Agency's generally applicable environmental radiation standards in 40 CFR 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

(b) Contents of Reports.

- (1) Each report required by 801.D.1203(a) shall describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:
 - (i) estimates of each individual's dose; and

- (ii) the levels of radiation and concentrations of radioactive material involved; and
- (iii) the cause of the elevated exposures, dose rates, or concentrations; and
- (iv) corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, **ALARA constraints**, generally applicable environmental standards, and associated license or registration conditions.

(2) Each report filed pursuant to 801.D.1203(a) shall include for each **occupationally overexposed** individual ~~exposed~~: the name, Social Security account number, and date of birth. With respect to the limit for the embryo/fetus in 801.D.208, the identifiers should be those of the declared pregnant woman. The report shall be prepared so that this information is stated in a separate and detachable portion of the report.

(c) All licensees or registrants who make reports pursuant to 801.D.1203(a) shall submit the report in writing to the Agency.

801.D.1204 Reports of Planned Special Exposures. The licensee or registrant shall submit a written report to the Agency within 30 days following any planned special exposure conducted in accordance with 801.D.206, informing the Agency that a planned special exposure was conducted and indicating the date the planned special exposure occurred and the information required by 801.D.1106.

801.D.1205 Reports to Individuals of Exceeding Dose Limits. When a licensee is required, pursuant to the provisions of 801.D.1203 or 1204, to report to the Agency any exposure of an identified occupationally exposed individual, or an identified member of the public, to radiation or radioactive material, the licensee shall also provide a copy of the report submitted to the Agency to the individual. This report must be transmitted at a time no later than the transmittal to the Agency.

801.D.1206 Reserved.

801.D.1207 Notifications and Reports to Individuals.

(a) Requirements for notification and reports to individuals of exposure to radiation or radioactive material are specified in 801.J.13 of these regulations.

(b) When a licensee or registrant is required pursuant to 801.D.1203 to report to the Agency any exposure of an individual to radiation or radioactive material, the licensee or registrant shall also notify the individual. Such notice shall be transmitted at a time not later than the transmittal to the Agency, and shall comply with the provisions of 801.J.13(a) of these regulations.

801.D.1208 Reports of Leaking or Contaminated Sealed Sources. The licensee shall file a report within 5 days with the Agency if the test for leakage or contamination required pursuant to 801.D.401 indicates a sealed source is leaking or contaminated. The report shall include the equipment involved, the test results and the corrective action taken.

ADDITIONAL REQUIREMENTS

801.D.1301 Vacating Premises. Each licensee or registrant shall, no less than 30 days before vacating or relinquishing possession or control of premises which may have been contaminated with radioactive material as a result of his activities, notify the Agency in writing of intent to vacate. When deemed necessary by the Agency, the licensee shall decontaminate the premises in such a manner as the Agency may specify.

Radiological Criteria for License Termination

801.D.1401 General Provisions and Scope.

(a) The criteria in this section apply to the decommissioning of facilities licensed under Section C of these regulations.

(b) After a site has been decommissioned and the license terminated in accordance with the criteria in this section, the Agency will require additional cleanup only if, based on new information, it determines that the criteria of this section were not met and residual radioactivity remaining at the site could result in significant threat to public health and safety.

(c) When calculating TEDE to the average member of the critical group the licensee shall determine the peak annual TEDE dose expected within the first 1000 years after decommissioning.

801.D.1402 Radiological Criteria for Unrestricted Use. A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

801.D.1403 Criteria for License Termination Under Restricted Conditions. A site will be considered acceptable for license termination under restricted conditions if:

(a) The licensee can demonstrate that further reductions in residual radioactivity necessary to comply with the provisions of 801.D.1402 would result in net public or environmental harm or were not being made because the residual levels associated with restricted conditions are ALARA. Determination of the levels which are ALARA must take into account consideration of any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal;

(b) The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) per year;

(c) The licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site. Acceptable financial assurance mechanisms are:

- (1) funds placed into an account segregated from the licensee's assets and outside the licensee's administrative control as described in 801.C.25(g)(6)(i) of these regulations;
- (2) surety method, insurance, or other guarantee method as described in 801.C.25(g)(6)(ii) of these regulations;
- (3) a statement of intent in the case of Federal, State, or local Government licensees, as described in 801.C.25(g)(6)(iv) of these regulations; or
- (4) when a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity.

(d) The licensee has submitted a decommissioning plan or License Termination Plan (LTP) to the Agency indicating the licensee's intent to decommission in accordance with 801.C.32(d) of these regulations, and specifying that the licensee intends to decommission by restricting use of the site. The licensee shall document in the LTP or decommissioning plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated, as appropriate, following analysis of that advice.

- (1) Licensees proposing to decommission by restricting use of the site shall seek advice from such affected parties regarding the following matters concerning the proposed decommissioning:
 - (i) whether provisions for institutional controls proposed by the licensee;
 - (a) will provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) TEDE per year;

- (b) will be enforceable; and
 - (c) will not impose undue burdens on the local community or other affected parties.
- (ii) whether the licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site;
- (2) In seeking advice on the issues identified in 801.D.1403(d)(1), the licensee shall provide for:
- (i) participation by representatives of a broad cross section of community interests who may be affected by the decommissioning;
 - (ii) an opportunity for a comprehensive, collective discussion on the issues by the participants represented; and
 - (iii) a publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues; and

(e) Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either:

- (1) 100 mrem (1 mSv) per year; or
- (2) 500 mrem (5 mSv) per year provided the licensee:
 - (i) demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y (1 mSv/y) value of 801.D.1403 (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm;
 - (ii) makes provisions for durable institutional controls;
 - (iii) provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of 801.D.1403(b) and to assume and carry out responsibilities for any necessary

control and maintenance of those controls. Acceptable financial assurance mechanisms are those in 801.D.1403(c).

801.D.1404 Alternate Criteria for License Termination.

(a) The Agency may terminate a license using alternate criteria greater than the dose criterion of 801.D.1402, 801.D.1403(b), and 801.D.1403(d)(1)(i)(a), if the licensee:

(1) provides assurance that public health and safety would continue to be protected, and that it is unlikely that the dose from all man-made sources combined, other than medical, would be more than the 1 mSv/y (100 mrem/y) limit of Section D, by submitting an analysis of possible sources of exposure;

(2) has employed to the extent practical restrictions on site use according to the provisions of 801.D.1403 in minimizing exposures at the site;

(3) reduces doses to ALARA levels, taking into consideration any detriments such as traffic accidents expected to potentially result from decontamination and waste disposal; and

(4) has submitted a decommissioning plan or License Termination Plan (LTP) to the Agency indicating the licensee's intent to decommission in accordance with 801.C.32(d) of these regulations, and specifying that the licensee proposes to decommission by use of alternate criteria. The licensee shall document in the decommissioning plan or LTP how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and addressed, as appropriate, following analysis of that advice. In seeking such advice, the licensee shall provide for:

- (i) participation by representatives of a broad cross section of community interests who may be affected by the decommissioning;
- (ii) an opportunity for a comprehensive, collective discussion on the issues by the participants represented; and
- (iii) a publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues.

(b) The use of alternate criteria to terminate a license requires the approval of the Agency after consideration of the Agency staff's recommendations that will address any comments provided by Federal and other State Agencies and any public comments submitted pursuant to 801.D.1405.

801.D.1405 Public Notification and Public Participation.

Upon the receipt of an LTP or decommissioning plan from the licensee, or a proposal by the licensee for release of a site pursuant to 801.D.1403 or 801.D.1404, or whenever the Agency deems such notice to be in the public interest, the Agency shall:

(a) Notify and solicit comments from:

(1) local and State governments in the vicinity of the site and other individuals that could be affected by the decommissioning; and

(2) the Mississippi Department of Environmental Quality for cases where the licensee proposes to release a site pursuant to 801.D.1404.

(b) Publish a notice in local newspapers, letters to State or local organizations, or other appropriate forum, that is readily accessible to individuals in the vicinity of the site, and solicit comments from affected parties.

801.D.1406 Minimization of Contamination

Applicants for licenses, other than renewals, after the effective date of these regulations, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

PART 801

SECTION D

APPENDIX A

PROTECTION FACTORS FOR RESPIRATORS[†]

Description ²	Modes ³	Protection Factors ⁴			Tested & Certified Equipment
		Particu- lates only	Particu- lates, gases, vapors ⁵		
				National Institute for Occupational Safety and Health & Mine Safety and Health Administration tests for permissibility	

I. AIR-PURIFYING RESPIRATORS⁶

Facepiece, half-mask ⁷	NP	10		30 CFR 11,
Facepiece, full	NP	50		Subpart K.
Facepiece, half-mask full, or hood	PP	1000		

II. ATMOSPHERE-SUPPLYING RESPIRATORS

1. Air-line respirator

Facepiece, half-mask	CF	1000		
Facepiece, half-mask	D	5		
Facepiece, full	CF	2000		
Facepiece, full	D	5		30 CFR 11,
Facepiece, full	PD	2000		Subpart J.
Hood	CF	⁸		
Suit	CF	⁹		¹⁰

2. Self-contained breathing
apparatus (SCBA)

Facepiece, full	D	50		
Facepiece, full	PD	10,000 ¹¹		30 CFR 11,
Facepiece, full	RD	50		Subpart H.
Facepiece, full	RP	5,000 ¹²		

III. COMBINATION RESPIRATORS

Any combination of air-purifying and atmosphere-supplying and respirators		Protection factor for type and mode of operation as listed above		30 CFR 11, Sec. 11.63(b).
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See next page for footnotes.

FOOTNOTES

(1) For use in the selection of respiratory protective equipment to be used only where the contaminants have been identified and the concentrations, or possible concentrations, are known.

(2) Only for shaven faces and where nothing interferes with the seal of tight-fitting facepieces against the skin. Hoods and suits are excepted.

(3) The mode symbols are defined as follows:

CF = continuous flow

D = demand

NP = negative pressure, that is, negative phase during inhalation

PD = pressure demand, that is, always positive pressure

PP = positive pressure

RD = demand, recirculating or closed circuit

RP = pressure demand, recirculating or closed circuit

(4)(a) The protection factor is a measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of airborne radioactive material outside the respiratory protective equipment to that inside the equipment, usually inside the facepiece, under conditions of use. It is applied to the ambient airborne concentration to estimate the concentrations inhaled by the wearer according to the following formula:

$$\text{Concentration inhaled} = \frac{\text{Ambient airborne concentration}}{\text{Protection factor}}$$

(b) The protection factors apply:

(i) Only for individuals trained in using respirators and wearing properly fitted respirators that are used and maintained under supervision in a well-planned respiratory protective program.

(ii) For air-purifying respirators only when high efficiency particulate filters, above 99.97% removal efficiency by thermally generated 0.3 μm dioctyl phthalate (DOP) test or equivalent, are used in atmospheres not deficient in oxygen and not containing radioactive gas or vapor respiratory hazards.

(iii) No adjustment is to be made for the use of sorbents against radioactive material in the form of gases or vapors.

(iv) For atmosphere-supplying respirators only when supplied with adequate respirable air. Respirable air shall be provided of the quality and quantity required in accordance with the National Institute for Occupational Safety and Health and the

~~Mine Safety and Health Administration certification described in 30 CFR 11. Oxygen and air shall not be used in the same apparatus.~~

~~(5) Excluding radioactive contaminants that present an absorption or submersion hazard. For tritium oxide, approximately one-third of the intake occurs by absorption through the skin so that an overall protection factor of less than 2 is appropriate when atmosphere-supplying respirators are used to protect against tritium oxide. If the protection factor for respiratory protective equipment is 5, the effective protection factor for tritium is about 1.4; with protection factors of 10, the effective factor for tritium oxide is about 1.7; and with protection factors of 100 or more, the effective factor for tritium oxide is about 1.9. Air-purifying respirators are not suitable for protection against tritium oxide. See also footnote 9 concerning supplied-air suits.~~

~~(6) Canisters and cartridges shall not be used beyond service-life limitations.~~

~~(7) Under-chin type only. This type of respirator is not satisfactory for use where it might be possible, such as, if an accident or emergency were to occur, for the ambient airborne concentrations to reach instantaneous values greater than 10 times the pertinent values in Table I, Column 3 of Appendix B of this section. This type of respirator is not suitable for protection against plutonium or other high-toxicity materials. The mask is to be tested for fit prior to use, each time it is donned.~~

~~(8)(a) — Equipment shall be operated in a manner that ensures that proper air flow-rates are maintained. A protection factor of no more than 1000 may be utilized for tested-and-certified supplied-air hoods when a minimum air flow of 6 cubic feet per minute (0.17 m³/min) is maintained and calibrated air line pressure gauges or flow measuring devices are used. A protection factor of up to 2000 may be used for tested and certified hoods only when the air flow is maintained at the manufacturer's recommended maximum rate for the equipment, this rate is greater than 6 cubic feet per minute (0.17 m³/min) and calibrated air line pressure gauges or flow measuring devices are used.~~

~~—(b) — The design of the supplied-air hood or helmet, with a minimum flow of 6 cubic feet per minute (0.17 m³/min) of air, may determine its overall efficiency and the protection it provides. For example, some hoods aspirate contaminated air into the breathing zone when the wearer works with hands-over-head. This aspiration may be overcome if a short cape-like extension to the hood is worn under a coat or overalls. Other limitations specified by the approval agency shall be considered before using a hood in certain types of atmospheres. See footnote 9.~~

~~(9) Appropriate protection factors shall be determined, taking into account the design of the suit and its permeability to the contaminant under conditions of use. There shall be a standby rescue person equipped with a respirator or other apparatus appropriate for the potential hazards and communications equipment whenever supplied-air suits are used.~~

~~(10) — No approval schedules are currently available for this equipment. Equipment is to be evaluated by testing or on the basis of reliable test information.~~

~~(11) — This type of respirator may provide greater protection and be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure, such as skin absorption, must be taken into account in such circumstances.~~

~~(12) — Quantitative fit testing shall be performed on each individual, and no more than 0.02% leakage is allowed with this type of apparatus. Perceptible outward leakage of gas from this or any positive pressure self-contained breathing apparatus is unacceptable because service life will be reduced substantially. Special training in the use of this type of apparatus shall be provided to the wearer.~~

~~**Note 1:** Protection factors for respirators approved by the U.S. Bureau of Mines and the National Institute for Occupational Safety and Health, according to applicable approvals for respirators for type and mode of use to protect against airborne radionuclides, may be used to the extent that they do not exceed the protection factors listed in this table. The protection factors listed in this table may not be appropriate to circumstances where chemical or other respiratory hazards exist in addition to radioactive hazards. The selection and use of respirators for such circumstances should take into account applicable approvals of the U.S. Bureau of Mines and the National Institute for Occupational Safety and Health.~~

~~**Note 2:** Radioactive contaminants, for which the concentration values in Table I, Column 3 of Appendix B of this section are based on internal dose due to inhalation, may present external exposure hazards at higher concentrations. Under these circumstances, limitations on occupancy may have to be governed by external dose limits.~~

PART 801

SECTION D

APPENDIX A

PROTECTION FACTORS FOR RESPIRATORS¹

	Operating mode	Assigned Protection Factors
I. Air Purifying Respirators [Particulate 1A ² only] 1A ³		
Filtering facepiece disposable ⁴	Negative Pressure	(⁴)
Facepiece, half ⁵	Negative Pressure	10
Facepiece, full	Negative Pressure	100
Facepiece, half	Powered air-purifying respirators	50
Facepiece, full	Powered air-purifying respirators	1000
Helmet/hood	Powered air-purifying respirators	1000
Facepiece, loose-fitting	Powered air-purifying respirators	25
II. Atmosphere supplying respirators [particulate, gasses and vapors 1A ⁶]:		
1. Air-line respirators:		
Facepiece, half	Demand	10
Facepiece, half	Continuous Flow	50
Facepiece, half	Pressure Demand	50
Facepiece, full	Demand	100
Facepiece, full	Continuous Flow	1000
Facepiece, full	Pressure Demand	1000
Helmet/hood	Continuous Flow	1000
Facepiece, loose-fitting	Continuous Flow	25
Suit	Continuous Flow	(⁷)
2. Self-contained breathing Apparatus (SCBA):		
Facepiece, full	Demand	⁸ 100
Facepiece, full	Pressure Demand	⁹ 10,000
Facepiece, full	Demand, Recirculating	⁸ 100

Facepiece, full	Positive Pressure Recirculating	⁹ 10,000
III. Combination Respirators:		
Any combination of air-purifying and atmosphere-supplying respirators	(1) Assigned protection factor for type and mode of operation as listed above.	

FOOTNOTES

(1) These assigned protection factors apply only in a respiratory protection program that meets the requirements of this section. They are applicable only to airborne radiological hazards and may not be appropriate to circumstances when chemical or other respiratory hazards exist instead of, or in addition to, radioactive hazards. Selection and use of respirators for such circumstances must also comply with Department of Labor regulations.

Radioactive contaminants for which the concentration values in Table 1, Column 3 of Appendix B to Section D are based on internal dose due to inhalation may, in addition, present external exposure hazards at higher concentrations. Under these circumstances, limitations on occupancy may have to be governed by external dose limits.

(2) Air purifying respirators with APF <100 must be equipped with particulate filters that are at least 95 percent efficient. Air purifying respirators with APF = 100 must be equipped with particulate filters that are at least 99 percent efficient. Air purifying respirators with APFs >100 must be equipped with particulate filters that are at least 99.97 percent efficient.

(3) The licensee may apply to the Agency for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors (e.g., radioiodine).

(4) Licensees may permit individuals to use this type of respirator who have not been medically screened or fit tested on the device provided that no credit be taken for their use in estimating intake or dose. It is also recognized that it is difficult to perform an effective positive or negative pressure pre-use user seal check on this type of device. All other respiratory protection program requirements listed in 801.D.703 apply. An assigned protection factor has not been assigned for these devices. However, an APF equal to 10 may be used if the licensee can demonstrate a fit factor of at least 100 by use of a validated or evaluated, qualitative or quantitative fit test.

(5) Under-chin type only. No distinction is made in this Appendix between elastomeric half-masks with replaceable cartridges and those designed with the filter medium as an integral part of the facepiece (e.g., disposable or reusable disposable). Both types are acceptable so long as the seal area of the latter contains some substantial type of seal-enhancing material such as rubber or plastic, the two or more suspension straps

are adjustable, the filter medium is at least 95 percent efficient and all other requirements of this section are met.

(6) The assigned protection factors for gases and vapors are not applicable to radioactive contaminants that present an absorption or submersion hazard. For tritium oxide vapor, approximately one-third of the intake occurs by absorption through the skin so that an overall protection factor of 3 is appropriate when atmosphere-supplying respirators are used to protect against tritium oxide. Exposure to radioactive noble gases is not considered a significant respiratory hazard, and protective actions for these contaminants should be based on external (submersion) dose considerations.

(7) No NIOSH approval schedule is currently available for atmosphere supplying suits. This equipment may be used in an acceptable respiratory protection program as long as all the other minimum program requirements, with the exception of fit testing, are met.

(8) The licensee should implement institutional controls to assure that these devices are not used in areas immediately dangerous to life or health (IDLH).

(9) This type of respirator may be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure such as skin absorption shall be taken into account in these circumstances. This device may not be used by any individual who experiences perceptible outward leakage of breathing gas while wearing the device.

PART 801

SECTION D

APPENDIX B

ANNUAL LIMITS ON INTAKE (ALIs) AND DERIVED AIR CONCENTRATIONS (DACs) OF RADIONUCLIDES FOR OCCUPATIONAL EXPOSURE; EFFLUENT CONCENTRATIONS; CONCENTRATIONS FOR RELEASE TO SANITARY SEWERAGE

Introduction

For each radionuclide, Table I indicates the chemical form which is to be used for selecting the appropriate ALI or DAC value. The ALIs and DACs for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of 1 μm , micron, and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D if less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days. Table II provides concentration limits for airborne and liquid effluents released to the general environment. Table III provides concentration limits for discharges to sanitary sewerage.

Note:

The values in Tables I, II, and III are presented in the computer "E" notation. In this notation a value of 6E-02 represents a value of 6×10^{-2} or 0.06, 6E+2 represents 6×10^2 or 600, and 6E+0 represents 6×10^0 or 6.

Table I "Occupational Values"

Note that the columns in Table I of this appendix captioned "Oral Ingestion ALI," "Inhalation ALI," and "DAC," are applicable to occupational exposure to radioactive material.

The ALIs in this appendix are the annual intakes of given radionuclide by "Reference Man" which would result in either (1) a committed effective dose equivalent of 5 rems (0.05 sievert), stochastic ALI, or (2) a committed dose equivalent of 50 rems (0.5 sievert) to an organ or tissue, non-stochastic ALI. The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of 5 rems (0.05 sievert). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, w_T . This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of w_T are listed

under the definition of weighting factor in 801.D.3. The non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

A value of $w_T = 0.06$ is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalents, and the dose equivalents of all other remaining tissues may be disregarded. The following portions of the GI tract -- stomach, small intestine, upper large intestine, and lower large intestine -- are to be treated as four separate organs.

Note that the dose equivalents for an extremity, skin and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

When an ALI is defined by the stochastic dose limit, this value alone is given. When an ALI is determined by the non-stochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. Abbreviated organ or tissue designations are used:

LLI wall = lower large intestine wall;
St. wall = stomach wall;
Blad wall = bladder wall; and
Bone surf = bone surface.

The use of the ALIs listed first, the more limiting of the stochastic and non-stochastic ALIs, will ensure that non-stochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the non-stochastic ALI is limiting, use of that non-stochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 50 rems (0.5 sievert) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose equivalent to that organ, not the effective dose. For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic ALIs (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is, Σ (intake (in μCi) of each radionuclide/ ALI_{ns}) ≤ 1.0 . If there is an external deep dose equivalent contribution of H_d , then this sum must be less than $1 - (H_d/50)$, instead of ≤ 1.0 .

Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

The derived air concentration (DAC) values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by:

$$\text{DAC} = \text{ALI}(\text{in } \mu\text{Ci}) / (2000 \text{ hours per working year} \times 60 \text{ minutes/hour} \times 2 \times 10^4 \text{ ml per minute}) = [\text{ALI} / 2.4 \times 10^9] \mu\text{Ci/ml},$$

where 2×10^4 ml is the volume of air breathed per minute at work by Reference Man under working conditions of light work.

The DAC values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. DACs based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

The ALI and DAC values include contributions to exposure by the single radionuclide named and any in-growth of daughter radionuclides produced in the body by decay of the parent. However, intakes that include both the parent and daughter radionuclides should be treated by the general method appropriate for mixtures.

The values of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external irradiation. See 801.D.202. When an individual is exposed to radioactive materials which fall under several of the translocation classifications of the same radionuclide, such as, Class D, Class W, or Class Y, the exposure may be evaluated as if it were a mixture of different radionuclides.

It should be noted that the classification of a compound as Class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radionuclides. For this reason, values are given for Class D, W, and Y compounds, even for very short-lived radionuclides.

Table II "Effluent Concentrations"

The columns in Table II of this appendix captioned "Effluents," "Air" and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of 801.D.302. The concentration values given in Columns 1 and 2 of Table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (0.5 millisievert).

Consideration of non-stochastic limits has not been included in deriving the air and water effluent concentration limits because non-stochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the non-stochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in Table II. For this reason, the DAC and airborne effluent limits are not always proportional as was the case in the previous Appendix A of Section D.

The air concentration values listed in Table II, Column 1 were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by 2.4×10^9 , relating the inhalation ALI to the DAC, as explained above, and then divided by a factor of 300. The factor of 300 includes the following components: a factor of 50 to relate the 5 rems (0.05 sievert) annual occupational dose limit to the 0.1 rem (1 millisievert) limit for members of the public, a factor of 3 to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of 2 to adjust the occupational values, derived for adults, so that they are applicable to other age groups.

For those radionuclides for which submersion, that is external dose, is limiting, the occupational DAC in Table I, Column 3 was divided by 219. The factor of 219 is composed of a factor of 50, as described above, and a factor of 4.38 relating occupational exposure for 2,000 hours per year to full-time exposure (8,760 hours per year). Note that an additional factor of 2 for age considerations is not warranted in the submersion case.

The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^7 . The factor of 7.3×10^7 (ml) includes the following components: the factors of 50 and 2 described above and a factor of 7.3×10^5 (ml) which is the annual water intake of Reference Man.

Note 2 of this appendix provides groupings of radionuclides which are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation ALIs and DACs, air and water effluent concentrations and releases to sewer, require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded as being present either from knowledge of the radionuclide composition of the source or from actual measurements.

Table III "Releases to Sewers"

The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in 801.D.1003. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^6 (ml). The factor of 7.3×10^6 (ml) is composed of a factor of 7.3×10^5 (ml), the annual water intake by Reference Man, and a

factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a Reference Man during a year, would result in a committed effective dose equivalent of 0.5 rem (5 millisieverts).

LIST OF ELEMENTS

Name	Symbol	Atomic Number	Name	Symbol	Atomic Number
Actinium	Ac	89	Mercury	Hg	80
Aluminum	Al	13	Molybdenum	Mo	42
Americium	Am	95	Neodymium	Nd	60
Antimony	Sb	51	Neptunium	Np	93
Argon	Ar	18	Nickel	Ni	28
Arsenic	As	33	Niobium	Nb	41
Astatine	At	85	Osmium	Os	76
Barium	Ba	56	Palladium	Pd	46
Berkelium	Bk	97	Phosphorus	P	15
Beryllium	Be	4	Platinum	Pt	78
Bismuth	Bi	83	Plutonium	Pu	94
Bromine	Br	35	Polonium	Po	84
Cadmium	Cd	48	Potassium	K	19
Calcium	Ca	20	Praseodymium	Pr	59
Californium	Cf	98	Promethium	Pm	61
Carbon	C	6	Protactinium	Pa	91
Cerium	Ce	58	Radium	Ra	88
Cesium	Cs	55	Radon	Rn	86
Chlorine	Cl	17	Rhenium	Re	75
Chromium	Cr	24	Rhodium	Rh	45
Cobalt	Co	27	Rubidium	Rb	37
Copper	Cu	29	Ruthenium	Ru	44
Curium	Cm	96	Samarium	Sm	62
Dysprosium	Dy	66	Scandium	Sc	21
Einsteinium	Es	99	Selenium	Se	34
Erbium	Er	68	Silicon	Si	14
Europium	Eu	63	Silver	Ag	47
Fermium	Fm	100	Sodium	Na	11
Fluorine	F	9	Strontium	Sr	38
Francium	Fr	87	Sulfur	S	16
Gadolinium	Gd	64	Tantalum	Ta	73
Gallium	Ga	31	Technetium	Tc	43
Germanium	Ge	32	Tellurium	Te	52
Gold	Au	79	Terbium	Tb	65
Hafnium	Hf	72	Thallium	Tl	81
Holmium	Ho	67	Thorium	Th	90
Hydrogen	H	1	Thulium	Tm	69
Indium	In	49	Tin	Sn	50
Iodine	I	53	Titanium	Ti	22
Iridium	Ir	77	Tungsten	W	74
Iron	Fe	26	Uranium	U	92
Krypton	Kr	36	Vanadium	V	23
Lanthanum	La	57	Xenon	Xe	54
Lead	Pb	82	Ytterbium	Yb	70
Lutetium	Lu	71	Yttrium	Y	39
Magnesium	Mg	12	Zinc	Zn	30
Manganese	Mn	25	Zirconium	Zr	40
Mendelevium	Md	101			

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)	
		Oral Ingestion ALI (μCi)	Inhalation		Air (μCi/ml)	Water (μCi/ml)		
		ALI (μCi)	DAC (μCi/ml)					
1	Hydrogen-3	Water, DAC includes skin absorption	8E+4	8E+4	2E-5	1E-7	1E-3	1E-2
		Gas (HT or T ₂) Submersion ¹ : Use above values as HT and T ₂ oxidize in air and in the body to HTO.						
4	Beryllium-7	W, all compounds except those given for Y	4E+4	2E+4	9E-6	3E-8	6E-4	6E-3
		Y, oxides, halides, and nitrates	-	2E+4	8E-6	3E-8	-	-
4	Beryllium-10	W, see ⁷ Be	1E+3	2E+2	6E-8	2E-10	-	-
		LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
		Y, see ⁷ Be	-	1E+1	6E-9	2E-11	-	-
6	Carbon-11 ²	Monoxide	-	1E+6	5E-4	2E-6	-	-
		Dioxide	-	6E+5	3E-4	9E-7	-	-
		Compounds	4E+5	4E+5	2E-4	6E-7	6E-3	6E-2
6	Carbon-14	Monoxide	-	2E+6	7E-4	2E-6	-	-
		Dioxide	-	2E+5	9E-5	3E-7	-	-
		Compounds	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
9	Fluorine-18 ²	D, fluorides of H, Li, Na, K, Rb, Cs, and Fr	5E+4	7E+4	3E-5	1E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
		W, fluorides of Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn, Tc, and Re	-	9E+4	4E-5	1E-7	-	-
		Y, lanthanum fluoride	-	8E+4	3E-5	1E-7	-	-
11	Sodium-22	D, all compounds	4E+2	6E+2	3E-7	9E-10	6E-6	6E-5
11	Sodium-24	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
12	Magnesium-28	D, all compounds except those given for W	7E+2	2E+3	7E-7	2E-9	9E-6	9E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	1E+3	5E-7	2E-9	-	-
13	Aluminum-26	D, all compounds except those given for W	4E+2	6E+1	3E-8	9E-11	6E-6	6E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	9E+1	4E-8	1E-10	-	-
14	Silicon-31	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and nitrates	-	3E+4	1E-5	5E-8	-	-
		Y, aluminosilicate glass	-	3E+4	1E-5	4E-8	-	-
14	Silicon-32	D, see ³¹ Si	2E+3	2E+2	1E-7	3E-10	-	-
		LLI wall (3E+3)	-	-	-	-	4E-5	4E-4
		W, see ³¹ Si	-	1E+2	5E-8	2E-10	-	-
		Y, see ³¹ Si	-	5E+0	2E-9	7E-12	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
15	Phosphorus-32	D, all compounds except phosphates given for W W, phosphates of Zn ²⁺ , S ³⁺ , Mg ²⁺ , Fe ³⁺ , Bi ³⁺ , and lanthanides	6E+2 -	9E+2 4E+2	4E-7 2E-7	1E-9 5E-10	9E-6 -	9E-5 -
15	Phosphorus-33	D, see ³² P W, see ³² P	6E+3 -	8E+3 3E+3	4E-6 1E-6	1E-8 4E-9	8E-5 -	8E-4 -
16	Sulfur-35	Vapor D, sulfides and sulfates except those given for W LLI wall (8E+3) W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi-	1E+4 2E+4 - 6E+3	1E+4 2E+4 - 2E+3	6E-6 7E-6 - 9E-7	2E-8 2E-8 - 3E-9	- - 1E-4 -	- - 1E-3 -
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and Fr W, chlorides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, and Re-	2E+3 2E+3	2E+3 2E+2	1E-6 1E-7	3E-9 3E-10	2E-5 -	2E-4 -
17	Chlorine-38 ²	D, see ³⁶ Cl W, see ³⁶ Cl	2E+4 St wall (3E+4) -	4E+4 - 5E+4	2E-5 - 2E-5	6E-8 - 6E-8	- 3E-4 -	- 3E-3 -
17	Chlorine-39 ²	D, see ³⁶ Cl W, see ³⁶ Cl	2E+4 St wall (4E+4) -	5E+4 - 6E+4	2E-5 - 2E-5	7E-8 - 8E-8	- 5E-4 -	- 5E-3 -
18	Argon-37	Submersion ¹	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion ¹	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion ¹	-	-	3E-6	1E-8	-	-
19	Potassium-40	D, all compounds	3E+2	4E+2	2E-7	6E-10	4E-6	4E-5
19	Potassium-42	D, all compounds	5E+3	5E+3	2E-6	7E-9	6E-5	6E-4
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44 ²	D, all compounds	2E+4 St wall (4E+4) -	7E+4 - -	3E-5 - -	9E-8 - -	- 5E-4 -	- 5E-3 -
19	Potassium-45 ²	D, all compounds	3E+4 St wall (5E+4) -	1E+5 - -	5E-5 - -	2E-7 - -	- 7E-4 -	- 7E-3 -
20	Calcium-41	W, all compounds	3E+3 Bone surf (4E+3)	4E+3 Bone surf (4E+3)	2E-6 -	- 5E-9	- 6E-5	- 6E-4
20	Calcium-45	W, all compounds	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
20	Calcium-47	W, all compounds	8E+2	9E+2	4E-7	1E-9	1E-5	1E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)	
		Oral Ingestion ALI (μCi)	ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)		
21	Scandium-43	Y, all compounds	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
21	Scandium-44m	Y, all compounds	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
21	Scandium-44	Y, all compounds	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
21	Scandium-46	Y, all compounds	9E+2	2E+2	1E-7	3E-10	1E-5	1E-4
21	Scandium-47	Y, all compounds	2E+3 LLI wall (3E+3)	3E+3 -	1E-6 -	4E-9 -	- 4E-5	- 4E-4
21	Scandium-48	Y, all compounds	8E+2	1E+3	6E-7	2E-9	1E-5	1E-4
21	Scandium-49 ²	Y, all compounds	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
22	Titanium-44	D, all compounds except those given for W and Y W, oxides, hydroxides, carbides, halides, and nitrates Y, SrTiO	3E+2 - -	1E+1 3E+1 6E+0	5E-9 1E-8 2E-9	2E-11 4E-11 8E-12	4E-6 - -	4E-5 - -
22	Titanium-45	D, see ⁴⁴ Ti W, see ⁴⁴ Ti Y, see ⁴⁴ Ti	9E+3 - -	3E+4 4E+4 3E+4	1E-5 1E-5 1E-5	3E-8 5E-8 4E-8	1E-4 - -	1E-3 - -
23	Vanadium-47 ²	D, all compounds except those given for W W, oxides, hydroxides, carbides, and halides	3E+4 St wall (3E+4) -	8E+4 - 1E+5	3E-5 - 4E-5	1E-7 - 1E-7	- 4E-4 -	- 4E-3 -
23	Vanadium-48	D, see ⁴⁷ V W, see ⁴⁷ V	6E+2 -	1E+3 6E+2	5E-7 3E-7	2E-9 9E-10	9E-6 -	9E-5 -
23	Vanadium-49	D, see ⁴⁷ V W, see ⁴⁷ V	7E+4 LLI wall (9E+4) -	3E+4 Bone surf (3E+4) 2E+4	1E-5 - 8E-6	- 5E-8 2E-8	- 1E-3 -	- 1E-2 -
24	Chromium-48	D, all compounds except those given for W and Y W, halides and nitrates Y, oxides and hydroxides	6E+3 - -	1E+4 7E+3 7E+3	5E-6 3E-6 3E-6	2E-8 1E-8 1E-8	8E-5 - -	8E-4 - -
24	Chromium-49 ²	D, see ⁴⁸ Cr W, see ⁴⁸ Cr Y, see ⁴⁸ Cr	3E+4 - -	8E+4 1E+5 9E+4	4E-5 4E-5 4E-5	1E-7 1E-7 1E-7	4E-4 - -	4E-3 - -
24	Chromium-51	D, see ⁴⁸ Cr W, see ⁴⁸ Cr Y, see ⁴⁸ Cr	4E+4 - -	5E+4 2E+4 2E+4	2E-5 1E-5 8E-6	6E-8 3E-8 3E-8	5E-4 - -	5E-3 - -
25	Manganese-51 ²	D, all compounds except those given for W W, oxides, hydroxides, halides, and nitrates	2E+4 -	5E+4 6E+4	2E-5 3E-5	7E-8 8E-8	3E-4 -	3E-3 -
25	Manganese-52m ²	D, see ⁵¹ Mn W, see ⁵¹ Mn	3E+4 St wall (4E+4) -	9E+4 - 1E+5	4E-5 - 4E-5	1E-7 - 1E-7	- 5E-4 -	- 5E-3 -
25	Manganese-52	D, see ⁵¹ Mn W, see ⁵¹ Mn	7E+2 -	1E+3 9E+2	5E-7 4E-7	2E-9 1E-9	1E-5 -	1E-4 -
25	Manganese-53	D, see ⁵¹ Mn	5E+4	1E+4 Bone surf	5E-6	-	7E-4	7E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
	W, see ⁵¹ Mn	-	(2E+4)	-	3E-8	-	-	
		-	1E+4	5E-6	2E-8	-	-	
25	Manganese-54	D, see ⁵¹ Mn	2E+3	9E+2	4E-7	1E-9	3E-5	3E-4
		W, see ⁵¹ Mn	-	8E+2	3E-7	1E-9	-	-
25	Manganese-56	D, see ⁵¹ Mn	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ⁵¹ Mn	-	2E+4	9E-6	3E-8	-	-
26	Iron-52	D, all compounds except those given for W	9E+2	3E+3	1E-6	4E-9	1E-5	1E-4
		W, oxides, hydroxides, and halides	-	2E+3	1E-6	3E-9	-	-
26	Iron-55	D, see ⁵² Fe	9E+3	2E+3	8E-7	3E-9	1E-4	1E-3
		W, see ⁵² Fe	-	4E+3	2E-6	6E-9	-	-
26	Iron-59	D, see ⁵² Fe	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		W, see ⁵² Fe	-	5E+2	2E-7	7E-10	-	-
26	Iron-60	D, see ⁵² Fe	3E+1	6E+0	3E-9	9E-12	4E-7	4E-6
		W, see ⁵² Fe	-	2E+1	8E-9	3E-11	-	-
27	Cobalt-55	W, all compounds except those given for Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
27	Cobalt-56	W, see ⁵⁵ Co	5E+2	3E+2	1E-7	4E-10	6E-6	6E-5
		Y, see ⁵⁵ Co	4E+2	2E+2	8E-8	3E-10	-	-
27	Cobalt-57	W, see ⁵⁵ Co	8E+3	3E+3	1E-6	4E-9	6E-5	6E-4
		Y, see ⁵⁵ Co	4E+3	7E+2	3E-7	9E-10	-	-
27	Cobalt-58m	W, see ⁵⁵ Co	6E+4	9E+4	4E-5	1E-7	8E-4	8E-3
		Y, see ⁵⁵ Co	-	6E+4	3E-5	9E-8	-	-
27	Cobalt-58	W, see ⁵⁵ Co	2E+3	1E+3	5E-7	2E-9	2E-5	2E-4
		Y, see ⁵⁵ Co	1E+3	7E+2	3E-7	1E-9	-	-
27	Cobalt-60m ²	W, see ⁵⁵ Co	1E+6	4E+6	2E-3	6E-6	-	-
		St wall (1E+6)	-	-	-	-	2E-2	2E-1
		Y, see ⁵⁵ Co	-	3E+6	1E-3	4E-6	-	-
27	Cobalt-60	W, see ⁵⁵ Co	5E+2	2E+2	7E-8	2E-10	3E-6	3E-5
		Y, see ⁵⁵ Co	2E+2	3E+1	1E-8	5E-11	-	-
27	Cobalt-61 ²	W, see ⁵⁵ Co	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ⁵⁵ Co	2E+4	6E+4	2E-5	8E-8	-	-
27	Cobalt-62m ²	W, see ⁵⁵ Co	4E+4	2E+5	7E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
		Y, see ⁵⁵ Co	-	2E+5	6E-5	2E-7	-	-
28	Nickel-56	D, all compounds except those given for W	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		W, oxides, hydroxides, and carbides	-	1E+3	5E-7	2E-9	-	-
		Vapor	-	1E+3	5E-7	2E-9	-	-
28	Nickel-57	D, see ⁵⁶ Ni	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ⁵⁶ Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	6E+3	3E-6	9E-9	-	-
28	Nickel-59	D, see ⁵⁶ Ni	2E+4	4E+3	2E-6	5E-9	3E-4	3E-3
		W, see ⁵⁶ Ni	-	7E+3	3E-6	1E-8	-	-
		Vapor	-	2E+3	8E-7	3E-9	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
28	Nickel-63	D, see ⁵⁶ Ni W, see ⁵⁶ Ni Vapor	9E+3 - -	2E+3 3E+3 8E+2	7E-7 1E-6 3E-7	2E-9 4E-9 1E-9	1E-4 - -	1E-3 - -
28	Nickel-65	D, see ⁵⁶ Ni W, see ⁵⁶ Ni Vapor	8E+3 - -	2E+4 3E+4 2E+4	1E-5 1E-5 7E-6	3E-8 4E-8 2E-8	1E-4 - -	1E-3 - -
28	Nickel-66	D, see ⁵⁶ Ni W, see ⁵⁶ Ni Vapor	4E+2 LLI wall (5E+2) - -	2E+3 - 6E+2 3E+3	7E-7 - 3E-7 1E-6	2E-9 - 9E-10 4E-9	- 6E-6 - -	- 6E-5 - -
29	Copper-60 ²	D, all compounds except those given for W and Y W, sulfides, halides, and nitrates Y, oxides and hydroxides	3E+4 St wall (3E+4) - -	9E+4 - 1E+5 1E+5	4E-5 - 5E-5 4E-5	1E-7 - 2E-7 1E-7	- 4E-4 - -	- 4E-3 - -
29	Copper-61	D, see ⁶⁰ Cu W, see ⁶⁰ Cu Y, see ⁶⁰ Cu	1E+4 - -	3E+4 4E+4 4E+4	1E-5 2E-5 1E-5	4E-8 6E-8 5E-8	2E-4 - -	2E-3 - -
29	Copper-64	D, see ⁶⁰ Cu W, see ⁶⁰ Cu Y, see ⁶⁰ Cu	1E+4 - -	3E+4 2E+4 2E+4	1E-5 1E-5 9E-6	4E-8 3E-8 3E-8	2E-4 - -	2E-3 - -
29	Copper-67	D, see ⁶⁰ Cu W, see ⁶⁰ Cu Y, see ⁶⁰ Cu	5E+3 - -	8E+3 5E+3 5E+3	3E-6 2E-6 2E-6	1E-8 7E-9 6E-9	6E-5 - -	6E-4 - -
30	Zinc-62	Y, all compounds	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
30	Zinc-63 ²	Y, all compounds	2E+4 St wall (3E+4)	7E+4 - -	3E-5 - -	9E-8 - -	- 3E-4 -	- 3E-3 -
30	Zinc-65	Y, all compounds	4E+2	3E+2	1E-7	4E-10	5E-6	5E-5
30	Zinc-69m	Y, all compounds	4E+3	7E+3	3E-6	1E-8	6E-5	6E-4
30	Zinc-69 ²	Y, all compounds	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
30	Zinc-71m	Y, all compounds	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
30	Zinc-72	Y, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
31	Gallium-65 ²	D, all compounds except those given for W W, oxides, hydroxides, carbides, halides, and nitrates	5E+4 St wall (6E+4) -	2E+5 - 2E+5	7E-5 - 8E-5	2E-7 - 3E-7	- 9E-4 -	- 9E-3 -
31	Gallium-66	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	1E+3 -	4E+3 3E+3	1E-6 1E-6	5E-9 4E-9	1E-5 -	1E-4 -
31	Gallium-67	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	7E+3 -	1E+4 1E+4	6E-6 4E-6	2E-8 1E-8	1E-4 -	1E-3 -
31	Gallium-68 ²	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	2E+4 -	4E+4 5E+4	2E-5 2E-5	6E-8 7E-8	2E-4 -	2E-3 -
31	Gallium-70 ²	D, see ⁶⁵ Ga	5E+4 St wall (7E+4)	2E+5 -	7E-5 -	2E-7 -	- 1E-3	- 1E-2

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2 ALI (μCi)	Col. 3 Inhalation DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
	W, see ^{65}Ga	-	2E+5	8E-5	3E-7	-	-
31 Gallium-72	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
	W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31 Gallium-73	D, see ^{65}Ga	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
	W, see ^{65}Ga	-	2E+4	6E-6	2E-8	-	-
32 Germanium-66	D, all compounds except those given for W	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
	W, oxides, sulfides, and halides	-	2E+4	8E-6	3E-8	-	-
32 Germanium-67 ²	D, see ^{66}Ge	3E+4	9E+4	4E-5	1E-7	-	-
	St wall (4E+4)	-	-	-	-	6E-4	6E-3
	W, see ^{66}Ge	-	1E+5	4E-5	1E-7	-	-
32 Germanium-68	D, see ^{66}Ge	5E+3	4E+3	2E-6	5E-9	6E-5	6E-4
	W, see ^{66}Ge	-	1E+2	4E-8	1E-10	-	-
32 Germanium-69	D, see ^{66}Ge	1E+4	2E+4	6E-6	2E-8	2E-4	2E-3
	W, see ^{66}Ge	-	8E+3	3E-6	1E-8	-	-
32 Germanium-71	D, see ^{66}Ge	5E+5	4E+5	2E-4	6E-7	7E-3	7E-2
	W, see ^{66}Ge	-	4E+4	2E-5	6E-8	-	-
32 Germanium-75 ²	D, see ^{66}Ge	4E+4	8E+4	3E-5	1E-7	-	-
	St wall (7E+4)	-	-	-	-	9E-4	9E-3
	W, see ^{66}Ge	-	8E+4	4E-5	1E-7	-	-
32 Germanium-77	D, see ^{66}Ge	9E+3	1E+4	4E-6	1E-8	1E-4	1E-3
	W, see ^{66}Ge	-	6E+3	2E-6	8E-9	-	-
32 Germanium-78 ²	D, see ^{66}Ge	2E+4	2E+4	9E-6	3E-8	-	-
	St wall (2E+4)	-	-	-	-	3E-4	3E-3
	W, see ^{66}Ge	-	2E+4	9E-6	3E-8	-	-
33 Arsenic-69 ²	W, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
	St wall (4E+4)	-	-	-	-	6E-4	6E-3
33 Arsenic-70 ²	W, all compounds	1E+4	5E+4	2E-5	7E-8	2E-4	2E-3
33 Arsenic-71	W, all compounds	4E+3	5E+3	2E-6	6E-9	5E-5	5E-4
33 Arsenic-72	W, all compounds	9E+2	1E+3	6E-7	2E-9	1E-5	1E-4
33 Arsenic-73	W, all compounds	8E+3	2E+3	7E-7	2E-9	1E-4	1E-3
33 Arsenic-74	W, all compounds	1E+3	8E+2	3E-7	1E-9	2E-5	2E-4
33 Arsenic-76	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
33 Arsenic-77	W, all compounds	4E+3	5E+3	2E-6	7E-9	-	-
	LLI wall (5E+3)	-	-	-	-	6E-5	6E-4
33 Arsenic-78 ²	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34 Selenium-70 ²	D, all compounds except those given for W	2E+4	4E+4	2E-5	5E-8	1E-4	1E-3
	W, oxides, hydroxides, carbides, and elemental Se	1E+4	4E+4	2E-5	6E-8	-	-
34 Selenium-73m ²	D, see ^{70}Se	6E+4	2E+5	6E-5	2E-7	4E-4	4E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
	W, see ⁷⁰ Se	3E+4	1E+5	6E-5	2E-7	-	-	
34	Selenium-73	D, see ⁷⁰ Se	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
	W, see ⁷⁰ Se	-	2E+4	7E-6	2E-8	-	-	
34	Selenium-75	D, see ⁷⁰ Se	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
	W, see ⁷⁰ Se	-	6E+2	3E-7	8E-10	-	-	
34	Selenium-79	D, see ⁷⁰ Se	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
	W, see ⁷⁰ Se	-	6E+2	2E-7	8E-10	-	-	
34	Selenium-81m ²	D, see ⁷⁰ Se	4E+4	7E+4	3E-5	9E-8	3E-4	3E-3
	W, see ⁷⁰ Se	2E+4	7E+4	3E-5	1E-7	-	-	
34	Selenium-81 ²	D, see ⁷⁰ Se	6E+4	2E+5	9E-5	3E-7	-	-
	St wall (8E+4)	-	-	-	-	1E-3	1E-2	
	W, see ⁷⁰ Se	-	2E+5	1E-4	3E-7	-	-	
34	Selenium-83 ²	D, see ⁷⁰ Se	4E+4	1E+5	5E-5	2E-7	4E-4	4E-3
	W, see ⁷⁰ Se	3E+4	1E+5	5E-5	2E-7	-	-	
35	Bromine-74m ²	D, bromides of H, Li, Na, K, Rb, Cs, and Fr	1E+4	4E+4	2E-5	5E-8	-	-
	St wall (2E+4)	-	-	-	-	3E-4	3E-3	
	W, bromides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Mn, Tc, and Re	-	4E+4	2E-5	6E-8	-	-	
35	Bromine-74 ²	D, see ^{74m} Br	2E+4	7E+4	3E-5	1E-7	-	-
	St wall (4E+4)	-	-	-	-	5E-4	5E-3	
	W, see ^{74m} Br	-	8E+4	4E-5	1E-7	-	-	
35	Bromine-75 ²	D, see ^{74m} Br	3E+4	5E+4	2E-5	7E-8	-	-
	St wall (4E+4)	-	-	-	-	5E-4	5E-3	
	W, see ^{74m} Br	-	5E+4	2E-5	7E-8	-	-	
35	Bromine-76	D, see ^{74m} Br	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
	W, see ^{74m} Br	-	4E+3	2E-6	6E-9	-	-	
35	Bromine-77	D, see ^{74m} Br	2E+4	2E+4	1E-5	3E-8	2E-4	2E-3
	W, see ^{74m} Br	-	2E+4	8E-6	3E-8	-	-	
35	Bromine-80m	D, see ^{74m} Br	2E+4	2E+4	7E-6	2E-8	3E-4	3E-3
	W, see ^{74m} Br	-	1E+4	6E-6	2E-8	-	-	
35	Bromine-80 ²	D, see ^{74m} Br	5E+4	2E+5	8E-5	3E-7	-	-
	St wall (9E+4)	-	-	-	-	1E-3	1E-2	
	W, see ^{74m} Br	-	2E+5	9E-5	3E-7	-	-	
35	Bromine-82	D, see ^{74m} Br	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
	W, see ^{74m} Br	-	4E+3	2E-6	5E-9	-	-	
35	Bromine-83	D, see ^{74m} Br	5E+4	6E+4	3E-5	9E-8	-	-
	St wall (7E+4)	-	-	-	-	9E-4	9E-3	
	W, see ^{74m} Br	-	6E+4	3E-5	9E-8	-	-	
35	Bromine-84 ²	D, see ^{74m} Br	2E+4	6E+4	2E-5	8E-8	-	-
	St wall	-	-	-	-	-	-	

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)	
		Oral Ingestion ALI (μCi)	Inhalation		Air (μCi/ml)	Water (μCi/ml)		
		ALI (μCi)	DAC (μCi/ml)					
	W, see ^{74m} Br	(3E+4)	-	-	-	4E-4	4E-3	
36	Krypton-74 ²	-	6E+4	3E-5	9E-8	-	-	
36	Krypton-76	-	-	9E-6	4E-8	-	-	
36	Krypton-77 ²	-	-	4E-6	2E-8	-	-	
36	Krypton-79	-	-	2E-5	7E-8	-	-	
36	Krypton-81	-	-	7E-4	3E-6	-	-	
36	Krypton-83m ²	-	-	1E-2	5E-5	-	-	
36	Krypton-85m	-	-	2E-5	1E-7	-	-	
36	Krypton-85	-	-	1E-4	7E-7	-	-	
36	Krypton-87 ²	-	-	5E-6	2E-8	-	-	
36	Krypton-88	-	-	2E-6	9E-9	-	-	
37	Rubidium-79 ²	D, all compounds	4E+4 St wall (6E+4)	1E+5	5E-5	2E-7	-	-
37	Rubidium-81m ²	D, all compounds	2E+5 St wall (3E+5)	3E+5	1E-4	5E-7	-	-
37	Rubidium-81	D, all compounds	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
37	Rubidium-82m	D, all compounds	1E+4	2E+4	7E-6	2E-8	2E-4	2E-3
37	Rubidium-83	D, all compounds	6E+2	1E+3	4E-7	1E-9	9E-6	9E-5
37	Rubidium-84	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-86	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-87	D, all compounds	1E+3	2E+3	6E-7	2E-9	1E-5	1E-4
37	Rubidium-88 ²	D, all compounds	2E+4 St wall (3E+4)	6E+4	3E-5	9E-8	-	-
37	Rubidium-89 ²	D, all compounds	4E+4 St wall (6E+4)	1E+5	6E-5	2E-7	-	-
38	Strontium-80 ²	D, all soluble compounds except SrTiO ₃	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble compounds and SrTiO ₃	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81 ²	D, see ⁸⁰ Sr	3E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ⁸⁰ Sr	2E+4	8E+4	3E-5	1E-7	-	-
38	Strontium-82	D, see ⁸⁰ Sr	3E+2 LLI wall (2E+2)	4E+2	2E-7	6E-10	-	-
		Y, see ⁸⁰ Sr	2E+2	9E+1	4E-8	1E-10	3E-6	3E-5
38	Strontium-83	D, see ⁸⁰ Sr	3E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ⁸⁰ Sr	2E+3	4E+3	1E-6	5E-9	-	-
38	Strontium-85m ²	D, see ⁸⁰ Sr	2E+5	6E+5	3E-4	9E-7	3E-3	3E-2
		Y, see ⁸⁰ Sr	-	8E+5	4E-4	1E-6	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)		
		ALI (µCi)	DAC (µCi/ml)					
38	Strontium-85	D, see ⁸⁰ Sr	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
		Y, see ⁸⁰ Sr	-	2E+3	6E-7	2E-9	-	-
38	Strontium-87m	D, see ⁸⁰ Sr	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ⁸⁰ Sr	4E+4	2E+5	6E-5	2E-7	-	-
38	Strontium-89	D, see ⁸⁰ Sr	6E+2	8E+2	4E-7	1E-9	-	-
		Y, see ⁸⁰ Sr	LLI wall (6E+2) 5E+2	- 1E+2	- 6E-8	- 2E-10	8E-6	8E-5
38	Strontium-90	D, see ⁸⁰ Sr	3E+1	2E+1	8E-9	-	-	-
		Y, see ⁸⁰ Sr	Bone surf (4E+1) -	Bone surf (2E+1) 4E+0	- 2E-9	3E-11 6E-12	5E-7	5E-6
38	Strontium-91	D, see ⁸⁰ Sr	2E+3	6E+3	2E-6	8E-9	2E-5	2E-4
		Y, see ⁸⁰ Sr	-	4E+3	1E-6	5E-9	-	-
38	Strontium-92	D, see ⁸⁰ Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ⁸⁰ Sr	-	7E+3	3E-6	9E-9	-	-
39	Yttrium-86m ²	W, all compounds except those given for Y	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		Y, oxides and hydroxides	-	-	5E+4	2E-5	8E-8	-
39	Yttrium-86	W, see ^{86m} Y	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ^{86m} Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-87	W, see ^{86m} Y	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		Y, see ^{86m} Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-88	W, see ^{86m} Y	1E+3	3E+2	1E-7	3E-10	1E-5	1E-4
		Y, see ^{86m} Y	-	2E+2	1E-7	3E-10	-	-
39	Yttrium-90m	W, see ^{86m} Y	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
		Y, see ^{86m} Y	-	1E+4	5E-6	2E-8	-	-
39	Yttrium-90	W, see ^{86m} Y	4E+2	7E+2	3E-7	9E-10	-	-
		Y, see ^{86m} Y	LLI wall (5E+2) -	- 6E+2	- 3E-7	- 9E-10	7E-6	7E-5
39	Yttrium-91m ²	W, see ^{86m} Y	1E+5	2E+5	1E-4	3E-7	2E-3	2E-2
		Y, see ^{86m} Y	-	2E+5	7E-5	2E-7	-	-
39	Yttrium-91	W, see ^{86m} Y	5E+2	2E+2	7E-8	2E-10	-	-
		Y, see ^{86m} Y	LLI wall (6E+2) -	- 1E+2	- 5E-8	- 2E-10	8E-6	8E-5
39	Yttrium-92	W, see ^{86m} Y	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{86m} Y	-	8E+3	3E-6	1E-8	-	-
39	Yttrium-93	W, see ^{86m} Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{86m} Y	-	2E+3	1E-6	3E-9	-	-
39	Yttrium-94 ²	W, see ^{86m} Y	2E+4	8E+4	3E-5	1E-7	-	-
		Y, see ^{86m} Y	St wall (3E+4) -	- 8E+4	- 3E-5	- 1E-7	4E-4	4E-3
39	Yttrium-95 ²	W, see ^{86m} Y	4E+4	2E+5	6E-5	2E-7	-	-
		Y, see ^{86m} Y	St wall (5E+4) -	- 1E+5	- 6E-5	- 2E-7	7E-4	7E-3
40	Zirconium-86	D, all compounds except those given for W and Y	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)		
		ALI (µCi)	DAC (µCi/ml)					
	W, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-	
	Y, carbide	-	2E+3	1E-6	3E-9	-	-	
40	Zirconium-88	D, see ⁸⁶ Zr	4E+3	2E+2	9E-8	3E-10	5E-5	5E-4
		W, see ⁸⁶ Zr	-	5E+2	2E-7	7E-10	-	-
		Y, see ⁸⁶ Zr	-	3E+2	1E-7	4E-10	-	-
40	Zirconium-89	D, see ⁸⁶ Zr	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ⁸⁶ Zr	-	2E+3	1E-6	3E-9	-	-
		Y, see ⁸⁶ Zr	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-93	D, see ⁸⁶ Zr	1E+3	6E+0	3E-9	-	-	-
		Bone surf (3E+3)	-	Bone surf (2E+1)	-	2E-11	4E-5	4E-4
		W, see ⁸⁶ Zr	-	2E+1	1E-8	-	-	-
		Y, see ⁸⁶ Zr	-	Bone surf (6E+1)	-	9E-11	-	-
			-	6E+1	2E-8	-	-	-
			-	Bone surf (7E+1)	-	9E-11	-	-
40	Zirconium-95	D, see ⁸⁶ Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
		W, see ⁸⁶ Zr	-	Bone surf (3E+2)	-	4E-10	-	-
		Y, see ⁸⁶ Zr	-	4E+2	2E-7	5E-10	-	-
			-	3E+2	1E-7	4E-10	-	-
40	Zirconium-97	D, see ⁸⁶ Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
		W, see ⁸⁶ Zr	-	1E+3	6E-7	2E-9	-	-
		Y, see ⁸⁶ Zr	-	1E+3	5E-7	2E-9	-	-
41	Niobium-88 ²	W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
		St wall (7E+4)	-	-	-	-	1E-3	1E-2
		Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
41	Niobium-89 ² (66 min)	W, see ⁸⁸ Nb	1E+4	4E+4	2E-5	6E-8	1E-4	1E-3
		Y, see ⁸⁸ Nb	-	4E+4	2E-5	5E-8	-	-
41	Niobium-89 (122 min)	W, see ⁸⁸ Nb	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ⁸⁸ Nb	-	2E+4	6E-6	2E-8	-	-
41	Niobium-90	W, see ⁸⁸ Nb	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		Y, see ⁸⁸ Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-93m	W, see ⁸⁸ Nb	9E+3	2E+3	8E-7	3E-9	-	-
		LLI wall (1E+4)	-	-	-	-	2E-4	2E-3
		Y, see ⁸⁸ Nb	-	2E+2	7E-8	2E-10	-	-
41	Niobium-94	W, see ⁸⁸ Nb	9E+2	2E+2	8E-8	3E-10	1E-5	1E-4
		Y, see ⁸⁸ Nb	-	2E+1	6E-9	2E-11	-	-
41	Niobium-95m	W, see ⁸⁸ Nb	2E+3	3E+3	1E-6	4E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		Y, see ⁸⁸ Nb	-	2E+3	9E-7	3E-9	-	-
41	Niobium-95	W, see ⁸⁸ Nb	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		Y, see ⁸⁸ Nb	-	1E+3	5E-7	2E-9	-	-
41	Niobium-96	W, see ⁸⁸ Nb	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ⁸⁸ Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-97 ²	W, see ⁸⁸ Nb	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ⁸⁸ Nb	-	7E+4	3E-5	1E-7	-	-
41	Niobium-98 ²	W, see ⁸⁸ Nb	1E+4	5E+4	2E-5	8E-8	2E-4	2E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
	Y, see ⁸⁸ Nb	-	5E+4	2E-5	7E-8	-	-	
42	Molybdenum-90	D, all compounds except those given for Y	4E+3	7E+3	3E-6	1E-8	3E-5	3E-4
	Y, oxides, hydroxides, and MoS		2E+3	5E+3	2E-6	6E-9	-	-
42	Molybdenum-93m	D, see ⁹⁰ Mo	9E+3	2E+4	7E-6	2E-8	6E-5	6E-4
	Y, see ⁹⁰ Mo		4E+3	1E+4	6E-6	2E-8	-	-
42	Molybdenum-93	D, see ⁹⁰ Mo	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
	Y, see ⁹⁰ Mo		2E+4	2E+2	8E-8	2E-10	-	-
42	Molybdenum-99	D, see ⁹⁰ Mo	2E+3	3E+3	1E-6	4E-9	-	-
		LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
	Y, see ⁹⁰ Mo		1E+3	1E+3	6E-7	2E-9	-	-
42	Molybdenum-101 ²	D, see ⁹⁰ Mo	4E+4	1E+5	6E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
	Y, see ⁹⁰ Mo		-	1E+5	6E-5	2E-7	-	-
43	Technetium-93m ²	D, all compounds except those given for W	7E+4	2E+5	6E-5	2E-7	1E-3	1E-2
	W, oxides, hydroxides, halides, and nitrates		-	3E+5	1E-4	4E-7	-	-
43	Technetium-93	D, see ^{93m} Tc	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
	W, see ^{93m} Tc		-	1E+5	4E-5	1E-7	-	-
43	Technetium-94m ²	D, see ^{93m} Tc	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
	W, see ^{93m} Tc		-	6E+4	2E-5	8E-8	-	-
43	Technetium-94	D, see ^{93m} Tc	9E+3	2E+4	8E-6	3E-8	1E-4	1E-3
	W, see ^{93m} Tc		-	2E+4	1E-5	3E-8	-	-
43	Technetium-95m	D, see ^{93m} Tc	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
	W, see ^{93m} Tc		-	2E+3	8E-7	3E-9	-	-
43	Technetium-95	D, see ^{93m} Tc	1E+4	2E+4	9E-6	3E-8	1E-4	1E-3
	W, see ^{93m} Tc		-	2E+4	8E-6	3E-8	-	-
43	Technetium-96m ²	D, see ^{93m} Tc	2E+5	3E+5	1E-4	4E-7	2E-3	2E-2
	W, see ^{93m} Tc		-	2E+5	1E-4	3E-7	-	-
43	Technetium-96	D, see ^{93m} Tc	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
	W, see ^{93m} Tc		-	2E+3	9E-7	3E-9	-	-
43	Technetium-97m	D, see ^{93m} Tc	5E+3	7E+3	3E-6	-	6E-5	6E-4
		St wall	-	(7E+3)	-	1E-8	-	-
	W, see ^{93m} Tc		-	1E+3	5E-7	2E-9	-	-
43	Technetium-97	D, see ^{93m} Tc	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
	W, see ^{93m} Tc		-	6E+3	2E-6	8E-9	-	-
43	Technetium-98	D, see ^{93m} Tc	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
	W, see ^{93m} Tc		-	3E+2	1E-7	4E-10	-	-
43	Technetium-99m	D, see ^{93m} Tc	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
	W, see ^{93m} Tc		-	2E+5	1E-4	3E-7	-	-
43	Technetium-99	D, see ^{93m} Tc	4E+3	5E+3	2E-6	-	6E-5	6E-4
		St wall	-	(6E+3)	-	8E-9	-	-
	W, see ^{93m} Tc		-	7E+2	3E-7	9E-10	-	-
43	Technetium-101 ²	D, see ^{93m} Tc	9E+4	3E+5	1E-4	5E-7	-	-
		St wall (1E+5)	-	-	-	-	2E-3	2E-2

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
43	Technetium-104 ²	W, see ^{93m} Tc D, see ^{93m} Tc St wall (3E+4)	- 2E+4 -	4E+5 7E+4 9E+4	2E-4 3E-5 4E-5	5E-7 1E-7 1E-7	- - 4E-4	- - 4E-3
44	Ruthenium-94 ²	D, all compounds except those given for W and Y W, halides Y, oxides and hydroxides	2E+4 - -	4E+4 6E+4 6E+4	2E-5 3E-5 2E-5	6E-8 9E-8 8E-8	2E-4 - -	2E-3 - -
44	Ruthenium-97	D, see ⁹⁴ Ru W, see ⁹⁴ Ru Y, see ⁹⁴ Ru	8E+3 - -	2E+4 1E+4 1E+4	8E-6 5E-6 5E-6	3E-8 2E-8 2E-8	1E-4 - -	1E-3 - -
44	Ruthenium-103	D, see ⁹⁴ Ru W, see ⁹⁴ Ru Y, see ⁹⁴ Ru	2E+3 - -	2E+3 1E+3 6E+2	7E-7 4E-7 3E-7	2E-9 1E-9 9E-10	3E-5 - -	3E-4 - -
44	Ruthenium-105	D, see ⁹⁴ Ru W, see ⁹⁴ Ru Y, see ⁹⁴ Ru	5E+3 - -	1E+4 1E+4 1E+4	6E-6 6E-6 5E-6	2E-8 2E-8 2E-8	7E-5 - -	7E-4 - -
44	Ruthenium-106	D, see ⁹⁴ Ru W, see ⁹⁴ Ru Y, see ⁹⁴ Ru	2E+2 LLI wall (2E+2) -	9E+1 - 5E+1	4E-8 - 2E-8	1E-10 - 8E-11	- 3E-6 -	- 3E-5 -
45	Rhodium-99m	D, all compounds except those given for W and Y W, halides Y, oxides and hydroxides	2E+4 - -	6E+4 8E+4 7E+4	2E-5 3E-5 3E-5	8E-8 1E-7 9E-8	2E-4 - -	2E-3 - -
45	Rhodium-99	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	2E+3 - -	3E+3 2E+3 2E+3	1E-6 9E-7 8E-7	4E-9 3E-9 3E-9	3E-5 - -	3E-4 - -
45	Rhodium-100	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	2E+3 - -	5E+3 4E+3 4E+3	2E-6 2E-6 2E-6	7E-9 6E-9 5E-9	2E-5 - -	2E-4 - -
45	Rhodium-101m	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	6E+3 - -	1E+4 8E+3 8E+3	5E-6 4E-6 3E-6	2E-8 1E-8 1E-8	8E-5 - -	8E-4 - -
45	Rhodium-101	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	2E+3 - -	5E+2 8E+2 2E+2	2E-7 3E-7 6E-8	7E-10 1E-9 2E-10	3E-5 - -	3E-4 - -
45	Rhodium-102m	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	1E+3 LLI wall (1E+3) -	5E+2 - 4E+2	2E-7 - 2E-7	7E-10 - 5E-10	- 2E-5 -	- 2E-4 -
45	Rhodium-102	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	6E+2 - -	9E+1 2E+2 6E+1	4E-8 7E-8 2E-8	1E-10 2E-10 8E-11	8E-6 - -	8E-5 - -
45	Rhodium-103m ²	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	4E+5 - -	1E+6 1E+6 1E+6	5E-4 5E-4 5E-4	2E-6 2E-6 2E-6	6E-3 - -	6E-2 - -
45	Rhodium-105	D, see ^{99m} Rh W, see ^{99m} Rh Y, see ^{99m} Rh	4E+3 LLI wall (4E+3) -	1E+4 - 6E+3	5E-6 - 3E-6	2E-8 - 9E-9	- 5E-5 -	- 5E-4 -

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
45 Rhodium-106m	D, see ^{99m} Rh	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
	W, see ^{99m} Rh	-	4E+4	2E-5	5E-8	-	-
	Y, see ^{99m} Rh	-	4E+4	1E-5	5E-8	-	-
45 Rhodium-107 ²	D, see ^{99m} Rh	7E+4 St wall (9E+4)	2E+5	1E-4	3E-7	-	-
	W, see ^{99m} Rh	-	3E+5	1E-4	4E-7	1E-3	1E-2
	Y, see ^{99m} Rh	-	3E+5	1E-4	3E-7	-	-
46 Palladium-100	D, all compounds except those given for W and Y	1E+3	1E+3	6E-7	2E-9	2E-5	2E-4
	W, nitrates	-	1E+3	5E-7	2E-9	-	-
	Y, oxides and hydroxides	-	1E+3	6E-7	2E-9	-	-
46 Palladium-101	D, see ¹⁰⁰ Pd	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
	W, see ¹⁰⁰ Pd	-	3E+4	1E-5	5E-8	-	-
	Y, see ¹⁰⁰ Pd	-	3E+4	1E-5	4E-8	-	-
46 Palladium-103	D, see ¹⁰⁰ Pd	6E+3 LLI wall (7E+3)	6E+3	3E-6	9E-9	-	-
	W, see ¹⁰⁰ Pd	-	4E+3	2E-6	6E-9	1E-4	1E-3
	Y, see ¹⁰⁰ Pd	-	4E+3	1E-6	5E-9	-	-
46 Palladium-107	D, see ¹⁰⁰ Pd	3E+4 LLI wall (4E+4)	2E+4 Kidneys (2E+4)	9E-6	-	-	-
	W, see ¹⁰⁰ Pd	-	7E+3	3E-6	3E-8	5E-4	5E-3
	Y, see ¹⁰⁰ Pd	-	4E+2	2E-7	6E-10	-	-
46 Palladium-109	D, see ¹⁰⁰ Pd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
	W, see ¹⁰⁰ Pd	-	5E+3	2E-6	8E-9	-	-
	Y, see ¹⁰⁰ Pd	-	5E+3	2E-6	6E-9	-	-
47 Silver-102 ²	D, all compounds except those given for W and Y	5E+4 St wall (6E+4)	2E+5	8E-5	2E-7	-	-
	W, nitrates and sulfides	-	2E+5	9E-5	3E-7	9E-4	9E-3
	Y, oxides and hydroxides	-	2E+5	8E-5	3E-7	-	-
47 Silver-103 ²	D, see ¹⁰² Ag	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
	W, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
	Y, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
47 Silver-104m ²	D, see ¹⁰² Ag	3E+4	9E+4	4E-5	1E-7	4E-4	4E-3
	W, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
	Y, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
47 Silver-104 ²	D, see ¹⁰² Ag	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
	W, see ¹⁰² Ag	-	1E+5	6E-5	2E-7	-	-
	Y, see ¹⁰² Ag	-	1E+5	6E-5	2E-7	-	-
47 Silver-105	D, see ¹⁰² Ag	3E+3	1E+3	4E-7	1E-9	4E-5	4E-4
	W, see ¹⁰² Ag	-	2E+3	7E-7	2E-9	-	-
	Y, see ¹⁰² Ag	-	2E+3	7E-7	2E-9	-	-
47 Silver-106m	D, see ¹⁰² Ag	8E+2	7E+2	3E-7	1E-9	1E-5	1E-4
	W, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
	Y, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
47 Silver-106 ²	D, see ¹⁰² Ag	6E+4 St. wall (6E+4)	2E+5	8E-5	3E-7	-	-
	W, see ¹⁰² Ag	-	2E+5	9E-5	3E-7	9E-4	9E-3
	Y, see ¹⁰² Ag	-	2E+5	8E-5	3E-7	-	-
47 Silver-108m	D, see ¹⁰² Ag	6E+2	2E+2	8E-8	3E-10	9E-6	9E-5

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
	W, see ¹⁰² Ag	-	3E+2	1E-7	4E-10	-	-
	Y, see ¹⁰² Ag	-	2E+1	1E-8	3E-11	-	-
47 Silver-110m	D, see ¹⁰² Ag	5E+2	1E+2	5E-8	2E-10	6E-6	6E-5
	W, see ¹⁰² Ag	-	2E+2	8E-8	3E-10	-	-
	Y, see ¹⁰² Ag	-	9E+1	4E-8	1E-10	-	-
47 Silver-111	D, see ¹⁰² Ag	9E+2	2E+3	6E-7	-	-	-
		LLI wall (1E+3)	Liver (2E+3)	-	2E-9	2E-5	2E-4
	W, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
	Y, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
47 Silver-112	D, see ¹⁰² Ag	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
	W, see ¹⁰² Ag	-	1E+4	4E-6	1E-8	-	-
	Y, see ¹⁰² Ag	-	9E+3	4E-6	1E-8	-	-
47 Silver-115 ²	D, see ¹⁰² Ag	3E+4	9E+4	4E-5	1E-7	-	-
		St wall (3E+4)	-	-	-	4E-4	4E-3
	W, see ¹⁰² Ag	-	9E+4	4E-5	1E-7	-	-
	Y, see ¹⁰² Ag	-	8E+4	3E-5	1E-7	-	-
48 Cadmium-104 ²	D, all compounds except those given for W and Y	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
	W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
	Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
48 Cadmium-107	D, see ¹⁰⁴ Cd	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
	W, see ¹⁰⁴ Cd	-	6E+4	2E-5	8E-8	-	-
	Y, see ¹⁰⁴ Cd	-	5E+4	2E-5	7E-8	-	-
48 Cadmium-109	D, see ¹⁰⁴ Cd	3E+2	4E+1	1E-8	-	-	-
		Kidneys (4E+2)	Kidneys (5E+1)	-	7E-11	6E-6	6E-5
	W, see ¹⁰⁴ Cd	-	1E+2	5E-8	-	-	-
		-	Kidneys (1E+2)	-	2E-10	-	-
	Y, see ¹⁰⁴ Cd	-	1E+2	5E-8	2E-10	-	-
48 Cadmium-113m	D, see ¹⁰⁴ Cd	2E+1	2E+0	1E-9	-	-	-
		Kidneys (4E+1)	Kidneys (4E+0)	-	5E-12	5E-7	5E-6
	W, see ¹⁰⁴ Cd	-	8E+0	4E-9	-	-	-
		-	Kidneys (1E+1)	-	2E-11	-	-
	Y, see ¹⁰⁴ Cd	-	1E+1	5E-9	2E-11	-	-
48 Cadmium-113	D, see ¹⁰⁴ Cd	2E+1	2E+0	9E-10	-	-	-
		Kidneys (3E+1)	Kidneys (3E+0)	-	5E-12	4E-7	4E-6
	W, see ¹⁰⁴ Cd	-	8E+0	3E-9	-	-	-
		-	Kidneys (1E+1)	-	2E-11	-	-
	Y, see ¹⁰⁴ Cd	-	1E+1	6E-9	2E-11	-	-
48 Cadmium-115m	D, see ¹⁰⁴ Cd	3E+2	5E+1	2E-8	-	4E-6	4E-5
		-	Kidneys (8E+1)	-	1E-10	-	-
	W, see ¹⁰⁴ Cd	-	1E+2	5E-8	2E-10	-	-
	Y, see ¹⁰⁴ Cd	-	1E+2	6E-8	2E-10	-	-
48 Cadmium-115	D, see ¹⁰⁴ Cd	9E+2	1E+3	6E-7	2E-9	-	-
		LLI wall (1E+3)	-	-	-	1E-5	1E-4
	W, see ¹⁰⁴ Cd	-	1E+3	5E-7	2E-9	-	-
	Y, see ¹⁰⁴ Cd	-	1E+3	6E-7	2E-9	-	-
48 Cadmium-117m	D, see ¹⁰⁴ Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)	
			Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)		
		ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)					
	W, see ^{104}Cd	-	2E+4	7E-6	2E-8	-	-	
	Y, see ^{104}Cd	-	1E+4	6E-6	2E-8	-	-	
48	Cadmium-117	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8	-	-
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8	-	-
49	Indium-110 ² (69.1 min)	D, see ^{109}In	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	6E+4	2E-5	8E-8	-	-
49	Indium-110 (4.9 h)	D, see ^{109}In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		W, see ^{109}In	-	2E+4	8E-6	3E-8	-	-
49	Indium-111	D, see ^{109}In	4E+3	6E+3	3E-6	9E-9	6E-5	6E-4
		W, see ^{109}In	-	6E+3	3E-6	9E-9	-	-
49	Indium-112 ²	D, see ^{109}In	2E+5	6E+5	3E-4	9E-7	2E-3	2E-2
		W, see ^{109}In	-	7E+5	3E-4	1E-6	-	-
49	Indium-113m ²	D, see ^{109}In	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		W, see ^{109}In	-	2E+5	8E-5	3E-7	-	-
49	Indium-114m	D, see ^{109}In	3E+2	6E+1	3E-8	9E-11	-	-
		LLI wall (4E+2)	-	-	-	-	5E-6	5E-5
		W, see ^{109}In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115m	D, see ^{109}In	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	5E+4	2E-5	7E-8	-	-
49	Indium-115	D, see ^{109}In	4E+1	1E+0	6E-10	2E-12	5E-7	5E-6
		W, see ^{109}In	-	5E+0	2E-9	8E-12	-	-
49	Indium-116m ²	D, see ^{109}In	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{109}In	-	1E+5	5E-5	2E-7	-	-
49	Indium-117m ²	D, see ^{109}In	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{109}In	-	4E+4	2E-5	6E-8	-	-
49	Indium-117 ²	D, see ^{109}In	6E+4	2E+5	7E-5	2E-7	8E-4	8E-3
		W, see ^{109}In	-	2E+5	9E-5	3E-7	-	-
49	Indium-119m ²	D, see ^{109}In	4E+4	1E+5	5E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
		W, see ^{109}In	-	1E+5	6E-5	2E-7	-	-
50	Tin-110	D, all compounds except those given for W	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+4	5E-6	2E-8	-	-
50	Tin-111 ²	D, see ^{110}Sn	7E+4	2E+5	9E-5	3E-7	1E-3	1E-2
		W, see ^{110}Sn	-	3E+5	1E-4	4E-7	-	-
50	Tin-113	D, see ^{110}Sn	2E+3	1E+3	5E-7	2E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
50 Tin-117m	D, see ¹¹⁰ Sn	2E+3 LLI wall (2E+3)	1E+3 Bone surf (2E+3)	5E-7	-	-	-
	W, see ¹¹⁰ Sn	-	1E+3	6E-7	3E-9 2E-9	3E-5	3E-4
50 Tin-119m	D, see ¹¹⁰ Sn	3E+3 LLI wall (4E+3)	2E+3	1E-6	3E-9	-	-
	W, see ¹¹⁰ Sn	-	1E+3	4E-7	1E-9	6E-5	6E-4
50 Tin-121m	D, see ¹¹⁰ Sn	3E+3 LLI wall (4E+3)	9E+2	4E-7	1E-9	-	-
	W, see ¹¹⁰ Sn	-	5E+2	2E-7	8E-10	5E-5	5E-4
50 Tin-121	D, see ¹¹⁰ Sn	6E+3 LLI wall (6E+3)	2E+4	6E-6	2E-8	-	-
	W, see ¹¹⁰ Sn	-	1E+4	5E-6	2E-8	8E-5	8E-4
50 Tin-123m ²	D, see ¹¹⁰ Sn	5E+4	1E+5	5E-5	2E-7	7E-4	7E-3
	W, see ¹¹⁰ Sn	-	1E+5	6E-5	2E-7	-	-
50 Tin-123	D, see ¹¹⁰ Sn	5E+2 LLI wall (6E+2)	6E+2	3E-7	9E-10	-	-
	W, see ¹¹⁰ Sn	-	2E+2	7E-8	2E-10	9E-6	9E-5
50 Tin-125	D, see ¹¹⁰ Sn	4E+2 LLI wall (5E+2)	9E+2	4E-7	1E-9	-	-
	W, see ¹¹⁰ Sn	-	4E+2	1E-7	5E-10	6E-6	6E-5
50 Tin-126	D, see ¹¹⁰ Sn	3E+2	6E+1	2E-8	8E-11	4E-6	4E-5
	W, see ¹¹⁰ Sn	-	7E+1	3E-8	9E-11	-	-
50 Tin-127	D, see ¹¹⁰ Sn	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
	W, see ¹¹⁰ Sn	-	2E+4	8E-6	3E-8	-	-
50 Tin-128 ²	D, see ¹¹⁰ Sn	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
	W, see ¹¹⁰ Sn	-	4E+4	1E-5	5E-8	-	-
51 Antimony-115 ²	D, all compounds except those given for W	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
	W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	-	3E+5	1E-4	4E-7	-	-
51 Antimony-116m ²	D, see ¹¹⁵ Sb	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
	W, see ¹¹⁵ Sb	-	1E+5	6E-5	2E-7	-	-
51 Antimony-116 ²	D, see ¹¹⁵ Sb	7E+4 St wall (9E+4)	3E+5	1E-4	4E-7	-	-
	W, see ¹¹⁵ Sb	-	3E+5	1E-4	5E-7	1E-3	1E-2
51 Antimony-117	D, see ¹¹⁵ Sb	7E+4	2E+5	9E-5	3E-7	9E-4	9E-3
	W, see ¹¹⁵ Sb	-	3E+5	1E-4	4E-7	-	-
51 Antimony-118m	D, see ¹¹⁵ Sb	6E+3	2E+4	8E-6	3E-8	7E-5	7E-4
	W, see ¹¹⁵ Sb	5E+3	2E+4	9E-6	3E-8	-	-
51 Antimony-119	D, see ¹¹⁵ Sb	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
	W, see ¹¹⁵ Sb	2E+4	3E+4	1E-5	4E-8	-	-
51 Antimony-120 ² (16 min)	D, see ¹¹⁵ Sb	1E+5 St wall (2E+5)	4E+5	2E-4	6E-7	-	-
	W, see ¹¹⁵ Sb	-	5E+5	2E-4	7E-7	2E-3	2E-2

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)	
		Oral Ingestion ALI (μCi)	Inhalation		Air (μCi/ml)	Water (μCi/ml)		
	ALI (μCi)	DAC (μCi/ml)						
51	Antimony-120 (5.76 d)	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	1E+3 9E+2	2E+3 1E+3	9E-7 5E-7	3E-9 2E-9	1E-5 -	1E-4 -
51	Antimony-122	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	8E+2 LLI wall (8E+2) 7E+2	2E+3 - 1E+3	1E-6 - 4E-7	3E-9 - 2E-9	- 1E-5 -	- 1E-4 -
51	Antimony-124m ²	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	3E+5 2E+5	8E+5 6E+5	4E-4 2E-4	1E-6 8E-7	3E-3 -	3E-2 -
51	Antimony-124	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	6E+2 5E+2	9E+2 2E+2	4E-7 1E-7	1E-9 3E-10	7E-6 -	7E-5 -
51	Antimony-125	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	2E+3 -	2E+3 5E+2	1E-6 2E-7	3E-9 7E-10	3E-5 -	3E-4 -
51	Antimony-126m ²	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	5E+4 St wall (7E+4) -	2E+5 - 2E+5	8E-5 - 8E-5	3E-7 - 3E-7	- 9E-4 -	- 9E-3 -
51	Antimony-126	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	6E+2 5E+2	1E+3 5E+2	5E-7 2E-7	2E-9 7E-10	7E-6 -	7E-5 -
51	Antimony-127	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	8E+2 LLI wall (8E+2) 7E+2	2E+3 - 9E+2	9E-7 - 4E-7	3E-9 - 1E-9	- 1E-5 -	- 1E-4 -
51	Antimony-128 ² (10.4 min)	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	8E+4 St wall (1E+5) -	4E+5 - 4E+5	2E-4 - 2E-4	5E-7 - 6E-7	- 1E-3 -	- 1E-2 -
51	Antimony-128 (9.01 h)	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	1E+3 -	4E+3 3E+3	2E-6 1E-6	6E-9 5E-9	2E-5 -	2E-4 -
51	Antimony-129	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	3E+3 -	9E+3 9E+3	4E-6 4E-6	1E-8 1E-8	4E-5 -	4E-4 -
51	Antimony-130 ²	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	2E+4 -	6E+4 8E+4	3E-5 3E-5	9E-8 1E-7	3E-4 -	3E-3 -
51	Antimony-131 ²	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	1E+4 Thyroid (2E+4) -	2E+4 Thyroid (4E+4) 2E+4 Thyroid (4E+4)	1E-5 - 1E-5 -	- 6E-8 -	- 2E-4 -	- 2E-3 -
52	Tellurium-116	D, all compounds except those given for W W, oxides, hydroxides, and nitrates	8E+3 -	2E+4 3E+4	9E-6 1E-5	3E-8 4E-8	1E-4 -	1E-3 -
52	Tellurium-121m	D, see ¹¹⁶ Te W, see ¹¹⁶ Te	5E+2 Bone surf (7E+2) -	2E+2 Bone surf (4E+2) 4E+2	8E-8 - 2E-7	- 5E-10 6E-10	- 1E-5 -	- 1E-4 -
52	Tellurium-121	D, see ¹¹⁶ Te W, see ¹¹⁶ Te	3E+3 -	4E+3 3E+3	2E-6 1E-6	6E-9 4E-9	4E-5 -	4E-4 -
52	Tellurium-123m	D, see ¹¹⁶ Te W, see ¹¹⁶ Te	6E+2 Bone surf (1E+3) -	2E+2 Bone surf (5E+2) 5E+2	9E-8 - 2E-7	- 8E-10 8E-10	- 1E-5 -	- 1E-4 -
52	Tellurium-123	D, see ¹¹⁶ Te	5E+2	2E+2	8E-8	-	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
	W, see ¹¹⁶ Te	Bone surf (1E+3)	Bone surf (5E+2)	-	7E-10	2E-5	2E-4
		-	4E+2	2E-7	-	-	-
		-	Bone surf (1E+3)	-	2E-9	-	-
52	Tellurium-125m D, see ¹¹⁶ Te	1E+3	4E+2	2E-7	-	-	-
	W, see ¹¹⁶ Te	Bone surf (1E+3)	Bone surf (1E+3)	-	1E-9	2E-5	2E-4
		-	7E+2	3E-7	1E-9	-	-
52	Tellurium-127m D, see ¹¹⁶ Te	6E+2	3E+2	1E-7	-	9E-6	9E-5
	W, see ¹¹⁶ Te	-	Bone surf (4E+2)	-	6E-10	-	-
		-	3E+2	1E-7	4E-10	-	-
52	Tellurium-127 D, see ¹¹⁶ Te	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
	W, see ¹¹⁶ Te	-	2E+4	7E-6	2E-8	-	-
52	Tellurium-129m D, see ¹¹⁶ Te	5E+2	6E+2	3E-7	9E-10	7E-6	7E-5
	W, see ¹¹⁶ Te	-	2E+2	1E-7	3E-10	-	-
52	Tellurium-129 ² D, see ¹¹⁶ Te	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
	W, see ¹¹⁶ Te	-	7E+4	3E-5	1E-7	-	-
52	Tellurium-131m D, see ¹¹⁶ Te	3E+2	4E+2	2E-7	-	-	-
	W, see ¹¹⁶ Te	Thyroid (6E+2)	Thyroid (1E+3)	-	2E-9	8E-6	8E-5
		-	4E+2	2E-7	-	-	-
		-	Thyroid (9E+2)	-	1E-9	-	-
52	Tellurium-131 ² D, see ¹¹⁶ Te	3E+3	5E+3	2E-6	-	-	-
	W, see ¹¹⁶ Te	Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	8E-5	8E-4
		-	5E+3	2E-6	-	-	-
		-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-132 D, see ¹¹⁶ Te	2E+2	2E+2	9E-8	-	-	-
	W, see ¹¹⁶ Te	Thyroid (7E+2)	Thyroid (8E+2)	-	1E-9	9E-6	9E-5
		-	2E+2	9E-8	-	-	-
		-	Thyroid (6E+2)	-	9E-10	-	-
52	Tellurium-133m ² D, see ¹¹⁶ Te	3E+3	5E+3	2E-6	-	-	-
	W, see ¹¹⁶ Te	Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	9E-5	9E-4
		-	5E+3	2E-6	-	-	-
		-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-133 ² D, see ¹¹⁶ Te	1E+4	2E+4	9E-6	-	-	-
	W, see ¹¹⁶ Te	Thyroid (3E+4)	Thyroid (6E+4)	-	8E-8	4E-4	4E-3
		-	2E+4	9E-6	-	-	-
		-	Thyroid (6E+4)	-	8E-8	-	-
52	Tellurium-134 ² D, see ¹¹⁶ Te	2E+4	2E+4	1E-5	-	-	-
	W, see ¹¹⁶ Te	Thyroid (2E+4)	Thyroid (5E+4)	-	7E-8	3E-4	3E-3
		-	2E+4	1E-5	-	-	-
		-	Thyroid (5E+4)	-	7E-8	-	-
53	Iodine-120m ² D, all compounds	1E+4	2E+4	9E-6	3E-8	-	-
		Thyroid (1E+4)	-	-	-	2E-4	2E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2 ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)	
		Inhalation						
53	Iodine-120 ²	D, all compounds	4E+3 Thyroid (8E+3)	9E+3 Thyroid (1E+4)	4E-6 - -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-121	D, all compounds	1E+4 Thyroid (3E+4)	2E+4 Thyroid (5E+4)	8E-6 - -	- 7E-8	- 4E-4	- 4E-3
53	Iodine-123	D, all compounds	3E+3 Thyroid (1E+4)	6E+3 Thyroid (2E+4)	3E-6 - -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-124	D, all compounds	5E+1 Thyroid (2E+2)	8E+1 Thyroid (3E+2)	3E-8 - -	- 4E-10	- 2E-6	- 2E-5
53	Iodine-125	D, all compounds	4E+1 Thyroid (1E+2)	6E+1 Thyroid (2E+2)	3E-8 - -	- 3E-10	- 2E-6	- 2E-5
53	Iodine-126	D, all compounds	2E+1 Thyroid (7E+1)	4E+1 Thyroid (1E+2)	1E-8 - -	- 2E-10	- 1E-6	- 1E-5
53	Iodine-128 ²	D, all compounds	4E+4 St wall (6E+4)	1E+5 - -	5E-5 - -	2E-7 - -	- 8E-4	- 8E-3
53	Iodine-129	D, all compounds	5E+0 Thyroid (2E+1)	9E+0 Thyroid (3E+1)	4E-9 - -	- 4E-11	- 2E-7	- 2E-6
53	Iodine-130	D, all compounds	4E+2 Thyroid (1E+3)	7E+2 Thyroid (2E+3)	3E-7 - -	- 3E-9	- 2E-5	- 2E-4
53	Iodine-131	D, all compounds	3E+1 Thyroid (9E+1)	5E+1 Thyroid (2E+2)	2E-8 - -	- 2E-10	- 1E-6	- 1E-5
53	Iodine-132m ²	D, all compounds	4E+3 Thyroid (1E+4)	8E+3 Thyroid (2E+4)	4E-6 - -	- 3E-8	- 1E-4	- 1E-3
53	Iodine-132	D, all compounds	4E+3 Thyroid (9E+3)	8E+3 Thyroid (1E+4)	3E-6 - -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-133	D, all compounds	1E+2 Thyroid (5E+2)	3E+2 Thyroid (9E+2)	1E-7 - -	- 1E-9	- 7E-6	- 7E-5
53	Iodine-134 ²	D, all compounds	2E+4 Thyroid (3E+4)	5E+4 - -	2E-5 - -	6E-8 - -	- 4E-4	- 4E-3
53	Iodine-135	D, all compounds	8E+2 Thyroid (3E+3)	2E+3 Thyroid (4E+3)	7E-7 - -	- 6E-9	- 3E-5	- 3E-4
54	Xenon-120 ²	Submersion ¹	-	-	1E-5	4E-8	-	-
54	Xenon-121 ²	Submersion ¹	-	-	2E-6	1E-8	-	-
54	Xenon-122	Submersion ¹	-	-	7E-5	3E-7	-	-
54	Xenon-123	Submersion ¹	-	-	6E-6	3E-8	-	-
54	Xenon-125	Submersion ¹	-	-	2E-5	7E-8	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
54 Xenon-127	Submersion ¹	-	-	1E-5	6E-8	-	-
54 Xenon-129m	Submersion ¹	-	-	2E-4	9E-7	-	-
54 Xenon-131m	Submersion ¹	-	-	4E-4	2E-6	-	-
54 Xenon-133m	Submersion ¹	-	-	1E-4	6E-7	-	-
54 Xenon-133	Submersion ¹	-	-	1E-4	5E-7	-	-
54 Xenon-135m ²	Submersion ¹	-	-	9E-6	4E-8	-	-
54 Xenon-135	Submersion ¹	-	-	1E-5	7E-8	-	-
54 Xenon-138 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
55 Cesium-125 ²	D, all compounds	5E+4 St wall (9E+4)	1E+5	6E-5	2E-7	-	-
55 Cesium-127	D, all compounds	6E+4	9E+4	4E-5	1E-7	9E-4	9E-3
55 Cesium-129	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
55 Cesium-130 ²	D, all compounds	6E+4 St wall (1E+5)	2E+5	8E-5	3E-7	-	-
55 Cesium-131	D, all compounds	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
55 Cesium-132	D, all compounds	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
55 Cesium-134m	D, all compounds	1E+5 St wall (1E+5)	1E+5	6E-5	2E-7	-	-
55 Cesium-134	D, all compounds	7E+1	1E+2	4E-8	2E-10	9E-7	9E-6
55 Cesium-135m ²	D, all compounds	1E+5	2E+5	8E-5	3E-7	1E-3	1E-2
55 Cesium-135	D, all compounds	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
55 Cesium-136	D, all compounds	4E+2	7E+2	3E-7	9E-10	6E-6	6E-5
55 Cesium-137	D, all compounds	1E+2	2E+2	6E-8	2E-10	1E-6	1E-5
55 Cesium-138 ²	D, all compounds	2E+4 St wall (3E+4)	6E+4	2E-5	8E-8	-	-
56 Barium-126 ²	D, all compounds	6E+3	2E+4	6E-6	2E-8	8E-5	8E-4
56 Barium-128	D, all compounds	5E+2	2E+3	7E-7	2E-9	7E-6	7E-5
56 Barium-131m ²	D, all compounds	4E+5 St wall (5E+5)	1E+6	6E-4	2E-6	-	-
56 Barium-131	D, all compounds	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
56 Barium-133m	D, all compounds	2E+3 LLI wall (3E+3)	9E+3	4E-6	1E-8	-	-
56 Barium-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5	2E-4
56 Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56 Barium-139 ²	D, all compounds	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2 ALI (μCi)	Col. 3 Inhalation DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)	
56	Barium-140	D, all compounds	5E+2 LLI wall (6E+2)	1E+3	6E-7	2E-9	-	-
56	Barium-141 ²	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131 ²	D, all compounds except those given for W	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		W, oxides and hydroxides	-	2E+5	7E-5	2E-7	-	-
57	Lanthanum-132	D, see ¹³¹ La	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
		W, see ¹³¹ La	-	1E+4	5E-6	2E-8	-	-
57	Lanthanum-135	D, see ¹³¹ La	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ¹³¹ La	-	9E+4	4E-5	1E-7	-	-
57	Lanthanum-137	D, see ¹³¹ La	1E+4	6E+1 Liver (7E+1)	3E-8	-	2E-4	2E-3
		W, see ¹³¹ La	-	3E+2 Liver (3E+2)	1E-7	1E-10	-	-
			-	-	-	4E-10	-	-
57	Lanthanum-138	D, see ¹³¹ La	9E+2	4E+0	1E-9	5E-12	1E-5	1E-4
		W, see ¹³¹ La	-	1E+1	6E-9	2E-11	-	-
57	Lanthanum-140	D, see ¹³¹ La	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ¹³¹ La	-	1E+3	5E-7	2E-9	-	-
57	Lanthanum-141	D, see ¹³¹ La	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		W, see ¹³¹ La	-	1E+4	5E-6	2E-8	-	-
57	Lanthanum-142 ²	D, see ¹³¹ La	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ¹³¹ La	-	3E+4	1E-5	5E-8	-	-
57	Lanthanum-143 ²	D, see ¹³¹ La	4E+4 St wall (4E+4)	1E+5	4E-5	1E-7	-	-
		W, see ¹³¹ La	-	9E+4	4E-5	1E-7	5E-4	5E-3
58	Cerium-134	W, all compounds except those given for Y	5E+2 LLI wall (6E+2)	7E+2	3E-7	1E-9	-	-
		Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	8E-6	8E-5
58	Cerium-135	W, see ¹³⁴ Ce	2E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		Y, see ¹³⁴ Ce	-	4E+3	1E-6	5E-9	-	-
58	Cerium-137m	W, see ¹³⁴ Ce	2E+3 LLI wall (2E+3)	4E+3	2E-6	6E-9	-	-
		Y, see ¹³⁴ Ce	-	4E+3	2E-6	5E-9	3E-5	3E-4
58	Cerium-137	W, see ¹³⁴ Ce	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		Y, see ¹³⁴ Ce	-	1E+5	5E-5	2E-7	-	-
58	Cerium-139	W, see ¹³⁴ Ce	5E+3	8E+2	3E-7	1E-9	7E-5	7E-4
		Y, see ¹³⁴ Ce	-	7E+2	3E-7	9E-10	-	-
58	Cerium-141	W, see ¹³⁴ Ce	2E+3 LLI wall (2E+3)	7E+2	3E-7	1E-9	-	-
			-	-	-	-	3E-5	3E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
58	Cerium-143	Y, see ¹³⁴ Ce W, see ¹³⁴ Ce LLI wall (1E+3)	- 6E+2 2E+3	2E-7 8E-7	8E-10 3E-9	- -	- -
58	Cerium-144	Y, see ¹³⁴ Ce W, see ¹³⁴ Ce LLI wall (3E+2)	- 2E+2 3E+1	- 1E-8	2E-9 4E-11	2E-5 -	2E-4 -
59	Praseodymium-136 ² W, all compounds except those given for Y	Y, oxides, hydroxides, carbides, and fluorides	5E+4 St wall (7E+4) -	2E+5 -	1E-4 -	3E-7 -	- 1E-2
59	Praseodymium-137 ² W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	4E+4 -	2E+5 1E+5	6E-5 6E-5	2E-7 2E-7	5E-4 -
59	Praseodymium-138m W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	1E+4 -	5E+4 4E+4	2E-5 2E-5	8E-8 6E-8	1E-4 -
59	Praseodymium-139 W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	4E+4 -	1E+5 1E+5	5E-5 5E-5	2E-7 2E-7	6E-4 -
59	Praseodymium-142m ² W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	8E+4 -	2E+5 1E+5	7E-5 6E-5	2E-7 2E-7	1E-3 -
59	Praseodymium-142 W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	1E+3 -	2E+3 2E+3	9E-7 8E-7	3E-9 3E-9	1E-5 -
59	Praseodymium-143 W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	9E+2 LLI wall (1E+3) -	8E+2 -	3E-7 -	1E-9 -	- 2E-4
59	Praseodymium-144 ² W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	3E+4 St wall (4E+4) -	1E+5 -	5E-5 -	2E-7 -	- 6E-4
59	Praseodymium-145 W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	3E+3 -	9E+3 8E+3	4E-6 3E-6	1E-8 1E-8	4E-5 -
59	Praseodymium-147 ² W, see ¹³⁶ Pr	Y, see ¹³⁶ Pr	5E+4 St wall (8E+4) -	2E+5 -	8E-5 -	3E-7 -	- 1E-3
60	Neodymium-136 ² W, all compounds except those given for Y	Y, oxides, hydroxides, carbides, and fluorides	1E+4 -	6E+4 5E+4	2E-5 2E-5	8E-8 8E-8	2E-4 -
60	Neodymium-138 W, see ¹³⁶ Nd	Y, see ¹³⁶ Nd	2E+3 -	6E+3 5E+3	3E-6 2E-6	9E-9 7E-9	3E-5 -
60	Neodymium-139mW, see ¹³⁶ Nd	Y, see ¹³⁶ Nd	5E+3 -	2E+4 1E+4	7E-6 6E-6	2E-8 2E-8	7E-5 -
60	Neodymium-139 ² W, see ¹³⁶ Nd	Y, see ¹³⁶ Nd	9E+4 -	3E+5 3E+5	1E-4 1E-4	5E-7 4E-7	1E-3 -
60	Neodymium-141 W, see ¹³⁶ Nd	Y, see ¹³⁶ Nd	2E+5 -	7E+5 6E+5	3E-4 3E-4	1E-6 9E-7	2E-3 -
60	Neodymium-147 W, see ¹³⁶ Nd		1E+3	9E+2	4E-7	1E-9	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
		LLI wall (1E+3)	-	-	-	2E-5	2E-4
	Y, see ¹³⁶ Nd	-	8E+2	4E-7	1E-9	-	-
60	Neodymium-149 ²	W, see ¹³⁶ Nd	1E+4	3E+4	1E-5	4E-8	1E-3
	Y, see ¹³⁶ Nd	-	-	2E+4	1E-5	3E-8	-
60	Neodymium-151 ²	W, see ¹³⁶ Nd	7E+4	2E+5	8E-5	3E-7	9E-3
	Y, see ¹³⁶ Nd	-	-	2E+5	8E-5	3E-7	-
61	Promethium-141 ²	W, all compounds except those given for Y	5E+4	2E+5	8E-5	3E-7	-
		St wall (6E+4)	-	-	-	8E-4	8E-3
	Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	7E-5	2E-7	-	-
61	Promethium-143	W, see ¹⁴¹ Pm	5E+3	6E+2	2E-7	8E-10	7E-4
	Y, see ¹⁴¹ Pm	-	-	7E+2	3E-7	1E-9	-
61	Promethium-144	W, see ¹⁴¹ Pm	1E+3	1E+2	5E-8	2E-10	2E-4
	Y, see ¹⁴¹ Pm	-	-	1E+2	5E-8	2E-10	-
61	Promethium-145	W, see ¹⁴¹ Pm	1E+4	2E+2	7E-8	-	1E-3
				Bone surf (2E+2)	-	3E-10	-
	Y, see ¹⁴¹ Pm	-	-	2E+2	8E-8	3E-10	-
61	Promethium-146	W, see ¹⁴¹ Pm	2E+3	5E+1	2E-8	7E-11	2E-4
	Y, see ¹⁴¹ Pm	-	-	4E+1	2E-8	6E-11	-
61	Promethium-147	W, see ¹⁴¹ Pm	4E+3	1E+2	5E-8	-	-
			LLI wall (5E+3)	Bone surf (2E+2)	-	3E-10	7E-4
	Y, see ¹⁴¹ Pm	-	-	1E+2	6E-8	2E-10	-
61	Promethium-148m	W, see ¹⁴¹ Pm	7E+2	3E+2	1E-7	4E-10	1E-4
	Y, see ¹⁴¹ Pm	-	-	3E+2	1E-7	5E-10	-
61	Promethium-148	W, see ¹⁴¹ Pm	4E+2	5E+2	2E-7	8E-10	-
			LLI wall (5E+2)	-	-	-	7E-5
	Y, see ¹⁴¹ Pm	-	5E+2	2E-7	7E-10	-	-
61	Promethium-149	W, see ¹⁴¹ Pm	1E+3	2E+3	8E-7	3E-9	-
			LLI wall (1E+3)	-	-	-	2E-5
	Y, see ¹⁴¹ Pm	-	2E+3	8E-7	2E-9	-	2E-4
61	Promethium-150	W, see ¹⁴¹ Pm	5E+3	2E+4	8E-6	3E-8	7E-4
	Y, see ¹⁴¹ Pm	-	-	2E+4	7E-6	2E-8	-
61	Promethium-151	W, see ¹⁴¹ Pm	2E+3	4E+3	1E-6	5E-9	2E-4
	Y, see ¹⁴¹ Pm	-	-	3E+3	1E-6	4E-9	-
62	Samarium-141m ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-3
62	Samarium-141 ²	W, all compounds	5E+4	2E+5	8E-5	2E-7	-
			St wall (6E+4)	-	-	-	8E-4
							8E-3
62	Samarium-142 ²	W, all compounds	8E+3	3E+4	1E-5	4E-8	1E-3
62	Samarium-145	W, all compounds	6E+3	5E+2	2E-7	7E-10	8E-4
62	Samarium-146	W, all compounds	1E+1	4E2	1E-11	-	-
			Bone surf (3E+1)	Bone surf (6E-2)	-	9E-14	3E-6

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
62	Samarium-147	W, all compounds	2E+1 Bone surf (3E+1)	4E-2 Bone surf (7E-2)	2E-11 -	- 1E-13	- 4E-7 4E-6
62	Samarium-151	W, all compounds	1E+4 LLI wall (1E+4)	1E+2 Bone surf (2E+2)	4E-8 -	- 2E-10	- 2E-4 2E-3
62	Samarium-153	W, all compounds	2E+3 LLI wall (2E+3)	3E+3 -	1E-6 -	4E-9 -	- 3E-5 3E-4
62	Samarium-155 ²	W, all compounds	6E+4 St wall (8E+4)	2E+5 -	9E-5 -	3E-7 -	- 1E-3 1E-2
62	Samarium-156	W, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5 7E-4
63	Europium-145	W, all compounds	2E+3	2E+3	8E-7	3E-9	2E-5 2E-4
63	Europium-146	W, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5 1E-4
63	Europium-147	W, all compounds	3E+3	2E+3	7E-7	2E-9	4E-5 4E-4
63	Europium-148	W, all compounds	1E+3	4E+2	1E-7	5E-10	1E-5 1E-4
63	Europium-149	W, all compounds	1E+4	3E+3	1E-6	4E-9	2E-4 2E-3
63	Europium-150 (12.62 h)	W, all compounds	3E+3	8E+3	4E-6	1E-8	4E-5 4E-4
63	Europium-150 (34.2 y)	W, all compounds	8E+2	2E+1	8E-9	3E-11	1E-5 1E-4
63	Europium-152m	W, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5 4E-4
63	Europium-152	W, all compounds	8E+2	2E+1	1E-8	3E-11	1E-5 1E-4
63	Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6 7E-5
63	Europium-155	W, all compounds	4E+3	9E+1 Bone surf (1E+2)	4E-8 -	- 2E-10	5E-5 -
63	Europium-156	W, all compounds	6E+2	5E+2	2E-7	6E-10	8E-6 8E-5
63	Europium-157	W, all compounds	2E+3	5E+3	2E-6	7E-9	3E-5 3E-4
63	Europium-158 ²	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4 3E-3
64	Gadolinium-145 ²	D, all compounds except those given for W	5E+4 St wall (5E+4)	2E+5 -	6E-5 -	2E-7 -	- 6E-4 6E-3
		W, oxides, hydroxides, and fluorides	-	2E+5	7E-5	2E-7	-
64	Gadolinium-146	D, see ¹⁴⁵ Gd W, see ¹⁴⁵ Gd	1E+3 -	1E+2 3E+2	5E-8 1E-7	2E-10 4E-10	2E-5 -
64	Gadolinium-147	D, see ¹⁴⁵ Gd W, see ¹⁴⁵ Gd	2E+3 -	4E+3 4E+3	2E-6 1E-6	6E-9 5E-9	3E-5 -
64	Gadolinium-148	D, see ¹⁴⁵ Gd W, see ¹⁴⁵ Gd	1E+1 Bone surf (2E+1) - -	8E+3 Bone surf (2E+2) 3E-2 Bone surf (6E-2)	3E-12 - 1E-11 -	- 2E-14 - 8E-14	- 3E-7 - -

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2 ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)	
								Inhalation
64	Gadolinium-149	D, see ^{145}Gd W, see ^{145}Gd	3E+3 -	2E+3 2E+3	9E-7 1E-6	3E-9 3E-9	4E-5 -	4E-4 -
64	Gadolinium-151	D, see ^{145}Gd W, see ^{145}Gd	6E+3 -	4E+2 Bone surf (6E+2) 1E+3	2E-7 - 5E-7	- 9E-10 2E-9	9E-5 -	9E-4 -
64	Gadolinium-152	D, see ^{145}Gd W, see ^{145}Gd	2E+1 Bone surf (3E+1) -	1E-2 Bone surf (2E-2) 4E-2 Bone surf (8E-2)	4E-12 - 2E-11 -	- 3E-14 -	- 4E-7 -	- 4E-6 -
64	Gadolinium-153	D, see ^{145}Gd W, see ^{145}Gd	5E+3 -	1E+2 Bone surf (2E+2) 6E+2	6E-8 - 2E-7	- 3E-10 8E-10	6E-5 -	6E-4 -
64	Gadolinium-159	D, see ^{145}Gd W, see ^{145}Gd	3E+3 -	8E+3 6E+3	3E-6 2E-6	1E-8 8E-9	4E-5 -	4E-4 -
65	Terbium-147 ²	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3
65	Terbium-149	W, all compounds	5E+3	7E+2	3E-7	1E-9	7E-5	7E-4
65	Terbium-150	W, all compounds	5E+3	2E+4	9E-6	3E-8	7E-5	7E-4
65	Terbium-151	W, all compounds	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
65	Terbium-153	W, all compounds	5E+3	7E+3	3E-6	1E-8	7E-5	7E-4
65	Terbium-154	W, all compounds	2E+3	4E+3	2E-6	6E-9	2E-5	2E-4
65	Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5	8E-4
65	Terbium-156m (5.0 h)	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4	2E-3
65	Terbium-156m (24.4 h)	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4	1E-3
65	Terbium-156	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
65	Terbium-157	W, all compounds	5E+4 LLI wall (5E+4)	3E+2 Bone surf (6E+2)	1E-7 - -	- 8E-10 -	- 7E-4 -	- 7E-3 -
65	Terbium-158	W, all compounds	1E+3	2E+1	8E-9	3E-11	2E-5	2E-4
65	Terbium-160	W, all compounds	8E+2	2E+2	9E-8	3E-10	1E-5	1E-4
65	Terbium-161	W, all compounds	2E+3 LLI wall (2E+3)	2E+3 -	7E-7 -	2E-9 -	- 3E-5	- 3E-4
66	Dysprosium-155	W, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
66	Dysprosium-157	W, all compounds	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
66	Dysprosium-159	W, all compounds	1E+4	2E+3	1E-6	3E-9	2E-4	2E-3
66	Dysprosium-165	W, all compounds	1E+4	5E+4	2E-5	6E-8	2E-4	2E-3
66	Dysprosium-166	W, all compounds	6E+2 LLI wall (8E+2)	7E+2 -	3E-7 -	1E-9 -	- 1E-5	- 1E-4
67	Holmium-155 ²	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2 ALI (μCi)	Col. 3 Inhalation DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)	
67	Holmium-157 ²	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159 ²	W, all compounds	2E+5	1E+6	4E-4	1E-6	3E-3	3E-2
67	Holmium-161	W, all compounds	1E+5	4E+5	2E-4	6E-7	1E-3	1E-2
67	Holmium-162m ²	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162 ²	W, all compounds	5E+5 St wall (8E+5)	2E+6 -	1E-3 -	3E-6 -	- 1E-2	- 1E-1
67	Holmium-164m ²	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164 ²	W, all compounds	2E+5 St wall (2E+5)	6E+5 -	3E-4 -	9E-7 -	- 3E-3	- 3E-2
67	Holmium-166m	W, all compounds	6E+2	7E+0	3E-9	9E-12	9E-6	9E-5
67	Holmium-166	W, all compounds	9E+2 LLI wall (9E+2)	2E+3 -	7E-7 -	2E-9 -	- 1E-5	- 1E-4
67	Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
68	Erbium-161	W, all compounds	2E+4	6E+4	3E-5	9E-8	2E-4	2E-3
68	Erbium-165	W, all compounds	6E+4	2E+5	8E-5	3E-7	9E-4	9E-3
68	Erbium-169	W, all compounds	3E+3 LLI wall (4E+3)	3E+3 -	1E-6 -	4E-9 -	- 5E-5	- 5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4
68	Erbium-172	W, all compounds	1E+3 LLI wall (E+3)	1E+3 -	6E-7 -	2E-9 -	- 2E-5	- 2E-4
69	Thulium-162 ²	W, all compounds	7E+4 St wall (7E+4)	3E+5 -	1E-4 -	4E-7 -	- 1E-3	- 1E-2
69	Thulium-166	W, all compounds	4E+3	1E+4	6E-6	2E-8	6E-5	6E-4
69	Thulium-167	W, all compounds	2E+3 LLI wall (2E+3)	2E+3 -	8E-7 -	3E-9 -	- 3E-5	- 3E-4
69	Thulium-170	W, all compounds	8E+2 LLI wall (1E+3)	2E+2 -	9E-8 -	3E-10 -	- 1E-5	- 1E-4
69	Thulium-171	W, all compounds	1E+4 LLI wall (1E+4)	3E+2 Bone surf (6E+2)	1E-7 -	- 8E-10	- 2E-4	- 2E-3
69	Thulium-172	W, all compounds	7E+2 LLI wall (8E+2)	1E+3 -	5E-7 -	2E-9 -	- 1E-5	- 1E-4
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175 ²	W, all compounds	7E+4 St wall (9E+4)	3E+5 -	1E-4 -	4E-7 -	- 1E-3	- 1E-2
70	Ytterbium-162 ²	W, all compounds except those given for Y	7E+4	3E+5	1E-4	4E-7	1E-3	1E-2

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
	Y, oxides, hydroxides, and fluorides	-	3E+5	1E-4	4E-7	-	-	
70	Ytterbium-166	W, see ¹⁶² Yb Y, see ¹⁶² Yb	1E+3 -	2E+3 2E+3	8E-7 8E-7	3E-9 3E-9	2E-5 -	2E-4 -
70	Ytterbium-167 ²	W, see ¹⁶² Yb Y, see ¹⁶² Yb	3E+5 -	8E+5 7E+5	3E-4 3E-4	1E-6 1E-6	4E-3 -	4E-2 -
70	Ytterbium-169	W, see ¹⁶² Yb Y, see ¹⁶² Yb	2E+3 -	8E+2 7E+2	4E-7 3E-7	1E-9 1E-9	2E-5 -	2E-4 -
70	Ytterbium-175	W, see ¹⁶² Yb Y, see ¹⁶² Yb	3E+3 LLI wall (3E+3) -	4E+3 - 3E+3	1E-6 - 1E-6	5E-9 - 5E-9	- 4E-5 -	- 4E-4 -
70	Ytterbium-177 ²	W, see ¹⁶² Yb Y, see ¹⁶² Yb	2E+4 -	5E+4 5E+4	2E-5 2E-5	7E-8 6E-8	2E-4 -	2E-3 -
70	Ytterbium-178 ²	W, see ¹⁶² Yb Y, see ¹⁶² Yb	1E+4 -	4E+4 4E+4	2E-5 2E-5	6E-8 5E-8	2E-4 -	2E-3 -
71	Lutetium-169	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	3E+3 -	4E+3 4E+3	2E-6 2E-6	6E-9 6E-9	3E-5 -	3E-4 -
71	Lutetium-170	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	1E+3 -	2E+3 2E+3	9E-7 8E-7	3E-9 3E-9	2E-5 -	2E-4 -
71	Lutetium-171	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	2E+3 -	2E+3 2E+3	8E-7 8E-7	3E-9 3E-9	3E-5 -	3E-4 -
71	Lutetium-172	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	1E+3 -	1E+3 1E+3	5E-7 5E-7	2E-9 2E-9	1E-5 -	1E-4 -
71	Lutetium-173	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	5E+3 - -	3E+2 Bone surf (5E+2) 3E+2	1E-7 - 1E-7	- 6E-10 4E-10	7E-5 - -	7E-4 - -
71	Lutetium-174m	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	2E+3 LLI wall (3E+3) -	2E+2 Bone surf (3E+2) 2E+2	1E-7 - 9E-8	- 5E-10 3E-10	- 4E-5 -	- 4E-4 -
71	Lutetium-174	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	5E+3 - -	1E+2 Bone surf (2E+2) 2E+2	5E-8 - 6E-8	- 3E-10 2E-10	7E-5 - -	7E-4 - -
71	Lutetium-176m	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	8E+3 -	3E+4 2E+4	1E-5 9E-6	3E-8 3E-8	1E-4 -	1E-3 -
71	Lutetium-176	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	7E+2 - -	5E+0 Bone surf (1E+1) 8E+0	2E-9 - 3E-9	- 2E-11 1E-11	1E-5 - -	1E-4 - -
71	Lutetium-177m	W, see ¹⁶⁹ Lu Y, see ¹⁶⁹ Lu	7E+2 - -	1E+2 Bone surf (1E+2) 8E+1	5E-8 - 3E-8	- 2E-10 1E-10	1E-5 - -	1E-4 - -
71	Lutetium-177	W, see ¹⁶⁹ Lu	2E+3 LLI wall (3E+3)	2E+3 -	9E-7 -	3E-9 -	- 4E-5	- 4E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
	Y, see ¹⁶⁹ Lu	-	2E+3	9E-7	3E-9	-	-
71	Lutetium-178m ² W, see ¹⁶⁹ Lu	5E+4	2E+5	8E-5	3E-7	-	-
		St. wall (6E+4)	-	-	-	8E-4	8E-3
	Y, see ¹⁶⁹ Lu	-	2E+5	7E-5	2E-7	-	-
71	Lutetium-178 ² W, see ¹⁶⁹ Lu	4E+4	1E+5	5E-5	2E-7	-	-
		St wall (4E+4)	-	-	-	6E-4	6E-3
	Y, see ¹⁶⁹ Lu	-	1E+5	5E-5	2E-7	-	-
71	Lutetium-179 W, see ¹⁶⁹ Lu	6E+3	2E+4	8E-6	3E-8	9E-5	9E-4
	Y, see ¹⁶⁹ Lu	-	2E+4	6E-6	3E-8	-	-
72	Hafnium-170 D, all compounds except those given for W	3E+3	6E+3	2E-6	8E-9	4E-5	4E-4
	W, oxides, hydroxides, carbides, and nitrates	-	5E+3	2E-6	6E-9	-	-
72	Hafnium-172 D, see ¹⁷⁰ Hf	1E+3	9E+0	4E-9	-	2E-5	2E-4
		-	Bone surf (2E+1)	-	3E-11	-	-
	W, see ¹⁷⁰ Hf	-	4E+1	2E-8	-	-	-
		-	Bone surf (6E+1)	-	8E-11	-	-
72	Hafnium-173 D, see ¹⁷⁰ Hf	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
	W, see ¹⁷⁰ Hf	-	1E+4	5E-6	2E-8	-	-
72	Hafnium-175 D, see ¹⁷⁰ Hf	3E+3	9E+2	4E-7	-	4E-5	4E-4
		-	Bone surf (1E+3)	-	1E-9	-	-
	W, see ¹⁷⁰ Hf	-	1E+3	5E-7	2E-9	-	-
72	Hafnium-177m ² D, see ¹⁷⁰ Hf	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
	W, see ¹⁷⁰ Hf	-	9E+4	4E-5	1E-7	-	-
72	Hafnium-178m D, see ¹⁷⁰ Hf	3E+2	1E+0	5E-10	-	3E-6	3E-5
		-	Bone surf (2E+0)	-	3E-12	-	-
	W, see ¹⁷⁰ Hf	-	5E+0	2E-9	-	-	-
		-	Bone surf (9E+0)	-	1E-11	-	-
72	Hafnium-179m D, see ¹⁷⁰ Hf	1E+3	3E+2	1E-7	-	1E-5	1E-4
		-	Bone surf (6E+2)	-	8E-10	-	-
	W, see ¹⁷⁰ Hf	-	6E+2	3E-7	8E-10	-	-
72	Hafnium-180m D, see ¹⁷⁰ Hf	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
	W, see ¹⁷⁰ Hf	-	3E+4	1E-5	4E-8	-	-
72	Hafnium-181 D, see ¹⁷⁰ Hf	1E+3	2E+2	7E-8	-	2E-5	2E-4
		-	Bone surf (4E+2)	-	6E-10	-	-
	W, see ¹⁷⁰ Hf	-	4E+2	2E-7	6E-10	-	-
72	Hafnium-182m ² D, see ¹⁷⁰ Hf	4E+4	9E+4	4E-5	1E-7	5E-4	5E-3
	W, see ¹⁷⁰ Hf	-	1E+5	6E-5	2E-7	-	-
72	Hafnium-182 D, see ¹⁷⁰ Hf	2E+2	8E-1	3E-10	-	-	-
		Bone surf (4E+2)	Bone surf (2E+0)	-	2E-12	5E-6	5E-5
	W, see ¹⁷⁰ Hf	-	3E+0	1E-9	-	-	-
		-	Bone surf (7E+0)	-	1E-11	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)		
		ALI (µCi)	DAC (µCi/ml)					
72	Hafnium-183 ²	D, see ¹⁷⁰ Hf W, see ¹⁷⁰ Hf	2E+4 -	5E+4 6E+4	2E-5 2E-5	6E-8 8E-8	3E-4 -	3E-3 -
72	Hafnium-184	D, see ¹⁷⁰ Hf W, see ¹⁷⁰ Hf	2E+3 -	8E+3 6E+3	3E-6 3E-6	1E-8 9E-9	3E-5 -	3E-4 -
73	Tantalum-172 ²	W, all compounds except those given for Y Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	4E+4 -	1E+5 1E+5	5E-5 4E-5	2E-7 1E-7	5E-4 -	5E-3 -
73	Tantalum-173	W, see ¹⁷² Ta Y, see ¹⁷² Ta	7E+3 -	2E+4 2E+4	8E-6 7E-6	3E-8 2E-8	9E-5 -	9E-4 -
73	Tantalum-174 ²	W, see ¹⁷² Ta Y, see ¹⁷² Ta	3E+4 -	1E+5 9E+4	4E-5 4E-5	1E-7 1E-7	4E-4 -	4E-3 -
73	Tantalum-175	W, see ¹⁷² Ta Y, see ¹⁷² Ta	6E+3 -	2E+4 1E+4	7E-6 6E-6	2E-8 2E-8	8E-5 -	8E-4 -
73	Tantalum-176	W, see ¹⁷² Ta Y, see ¹⁷² Ta	4E+3 -	1E+4 1E+4	5E-6 5E-6	2E-8 2E-8	5E-5 -	5E-4 -
73	Tantalum-177	W, see ¹⁷² Ta Y, see ¹⁷² Ta	1E+4 -	2E+4 2E+4	8E-6 7E-6	3E-8 2E-8	2E-4 -	2E-3 -
73	Tantalum-178	W, see ¹⁷² Ta Y, see ¹⁷² Ta	2E+4 -	9E+4 7E+4	4E-5 3E-5	1E-7 1E-7	2E-4 -	2E-3 -
73	Tantalum-179	W, see ¹⁷² Ta Y, see ¹⁷² Ta	2E+4 -	5E+3 9E+2	2E-6 4E-7	8E-9 1E-9	3E-4 -	3E-3 -
73	Tantalum-180m	W, see ¹⁷² Ta Y, see ¹⁷² Ta	2E+4 -	7E+4 6E+4	3E-5 2E-5	9E-8 8E-8	3E-4 -	3E-3 -
73	Tantalum-180	W, see ¹⁷² Ta Y, see ¹⁷² Ta	1E+3 -	4E+2 2E+1	2E-7 1E-8	6E-10 3E-11	2E-5 -	2E-4 -
73	Tantalum-182m ²	W, see ¹⁷² Ta	2E+5 St wall (2E+5)	5E+5 -	2E-4 -	8E-7 -	- 3E-3	- 3E-2
		Y, see ¹⁷² Ta	-	4E+5	2E-4	6E-7	-	-
73	Tantalum-182	W, see ¹⁷² Ta Y, see ¹⁷² Ta	8E+2 -	3E+2 1E+2	1E-7 6E-8	5E-10 2E-10	1E-5 -	1E-4 -
73	Tantalum-183	W, see ¹⁷² Ta	9E+2 LLI wall (1E+3)	1E+3 -	5E-7 -	2E-9 -	- 2E-5	- 2E-4
		Y, see ¹⁷² Ta	-	1E+3	4E-7	1E-9	-	-
73	Tantalum-184	W, see ¹⁷² Ta Y, see ¹⁷² Ta	2E+3 -	5E+3 5E+3	2E-6 2E-6	8E-9 7E-9	3E-5 -	3E-4 -
73	Tantalum-185 ²	W, see ¹⁷² Ta Y, see ¹⁷² Ta	3E+4 -	7E+4 6E+4	3E-5 3E-5	1E-7 9E-8	4E-4 -	4E-3 -
73	Tantalum-186 ²	W, see ¹⁷² Ta	5E+4 St wall (7E+4)	2E+5 -	1E-4 -	3E-7 -	- 1E-3	- 1E-2
		Y, see ¹⁷² Ta	-	2E+5	9E-5	3E-7	-	-
74	Tungsten-176	D, all compounds	1E+4	5E+4	2E-5	7E-8	1E-4	1E-3
74	Tungsten-177	D, all compounds	2E+4	9E+4	4E-5	1E-7	3E-4	3E-3
74	Tungsten-178	D, all compounds	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
74	Tungsten-179 ²	D, all compounds	5E+5	2E+6	7E-4	2E-6	7E-3	7E-2
74	Tungsten-181	D, all compounds	2E+4	3E+4	1E-5	5E-8	2E-4	2E-3
74	Tungsten-185	D, all compounds	2E+3 LLI wall (3E+3)	7E+3	3E-6	9E-9	- 4E-5	- 4E-4
74	Tungsten-187	D, all compounds	2E+3	9E+3	4E-6	1E-8	3E-5	3E-4
74	Tungsten-188	D, all compounds	4E+2 LLI wall (5E+2)	1E+3	5E-7	2E-9	- 7E-6	- 7E-5
75	Rhenium-177 ²	D, all compounds except those given for W	9E+4 St wall (1E+5)	3E+5	1E-4	4E-7	- 2E-3	- 2E-2
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-	-
75	Rhenium-178 ²	D, see ¹⁷⁷ Re	7E+4 St wall (1E+5)	3E+5	1E-4	4E-7	- 1E-3	- 1E-2
		W, see ¹⁷⁷ Re	-	3E+5	1E-4	4E-7	-	-
75	Rhenium-181	D, see ¹⁷⁷ Re	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
		W, see ¹⁷⁷ Re	-	9E+3	4E-6	1E-8	-	-
75	Rhenium-182 (12.7 h)	D, see ¹⁷⁷ Re	7E+3	1E+4	5E-6	2E-8	9E-5	9E-4
		W, see ¹⁷⁷ Re	-	2E+4	6E-6	2E-8	-	-
75	Rhenium-182 (64.0 h)	D, see ¹⁷⁷ Re	1E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	2E+3	9E-7	3E-9	-	-
75	Rhenium-184m	D, see ¹⁷⁷ Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ¹⁷⁷ Re	-	4E+2	2E-7	6E-10	-	-
75	Rhenium-184	D, see ¹⁷⁷ Re	2E+3	4E+3	1E-6	5E-9	3E-5	3E-4
		W, see ¹⁷⁷ Re	-	1E+3	6E-7	2E-9	-	-
75	Rhenium-186m	D, see ¹⁷⁷ Re	1E+3 St wall (2E+3)	2E+3 St wall (2E+3)	7E-7	-	-	-
		W, see ¹⁷⁷ Re	-	2E+2	6E-8	3E-9 2E-10	2E-5	2E-4
75	Rhenium-186	D, see ¹⁷⁷ Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ¹⁷⁷ Re	-	2E+3	7E-7	2E-9	-	-
75	Rhenium-187	D, see ¹⁷⁷ Re	6E+5 St wall	8E+5	4E-4	-	8E-3	8E-2
		W, see ¹⁷⁷ Re	-	(9E+5) 1E+5	- 4E-5	1E-6 1E-7	-	-
75	Rhenium-188m ²	D, see ¹⁷⁷ Re	8E+4	1E+5	6E-5	2E-7	1E-3	1E-2
		W, see ¹⁷⁷ Re	-	1E+5	6E-5	2E-7	-	-
75	Rhenium-188	D, see ¹⁷⁷ Re	2E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	3E+3	1E-6	4E-9	-	-
75	Rhenium-189	D, see ¹⁷⁷ Re	3E+3	5E+3	2E-6	7E-9	4E-5	4E-4
		W, see ¹⁷⁷ Re	-	4E+3	2E-6	6E-9	-	-
76	Osmium-180 ²	D, all compounds except those given for W and Y	1E+5	4E+5	2E-4	5E-7	1E-3	1E-2
		W, halides and nitrates	-	5E+5	2E-4	7E-7	-	-
		Y, oxides and hydroxides	-	5E+5	2E-4	6E-7	-	-
76	Osmium-181 ²	D, see ¹⁸⁰ Os	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ¹⁸⁰ Os	-	5E+4	2E-5	6E-8	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
	Y, see ¹⁸⁰ Os	-	4E+4	2E-5	6E-8	-	-	
76	Osmium-182	D, see ¹⁸⁰ Os	2E+3	6E+3	2E-6	8E-9	3E-5	3E-4
		W, see ¹⁸⁰ Os	-	4E+3	2E-6	6E-9	-	-
		Y, see ¹⁸⁰ Os	-	4E+3	2E-6	6E-9	-	-
76	Osmium-185	D, see ¹⁸⁰ Os	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ¹⁸⁰ Os	-	8E+2	3E-7	1E-9	-	-
		Y, see ¹⁸⁰ Os	-	8E+2	3E-7	1E-9	-	-
76	Osmium-189m	D, see ¹⁸⁰ Os	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, see ¹⁸⁰ Os	-	2E+5	9E-5	3E-7	-	-
		Y, see ¹⁸⁰ Os	-	2E+5	7E-5	2E-7	-	-
76	Osmium-191m	D, see ¹⁸⁰ Os	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ¹⁸⁰ Os	-	2E+4	8E-6	3E-8	-	-
		Y, see ¹⁸⁰ Os	-	2E+4	7E-6	2E-8	-	-
76	Osmium-191	D, see ¹⁸⁰ Os	2E+3	2E+3	9E-7	3E-9	-	-
		LLI wall (3E+3)	-	-	-	-	3E-5	3E-4
		W, see ¹⁸⁰ Os	-	2E+3	7E-7	2E-9	-	-
		Y, see ¹⁸⁰ Os	-	1E+3	6E-7	2E-9	-	-
76	Osmium-193	D, see ¹⁸⁰ Os	2E+3	5E+3	2E-6	6E-9	-	-
		LLI wall (2E+3)	-	-	-	-	2E-5	2E-4
		W, see ¹⁸⁰ Os	-	3E+3	1E-6	4E-9	-	-
		Y, see ¹⁸⁰ Os	-	3E+3	1E-6	4E-9	-	-
76	Osmium-194	D, see ¹⁸⁰ Os	4E+2	4E+1	2E-8	6E-11	-	-
		LLI wall (6E+2)	-	-	-	-	8E-6	8E-5
		W, see ¹⁸⁰ Os	-	6E+1	2E-8	8E-11	-	-
		Y, see ¹⁸⁰ Os	-	8E+0	3E-9	1E-11	-	-
77	Iridium-182 ²	D, all compounds except those given for W and Y	4E+4	1E+5	6E-5	2E-7	-	-
		St wall (4E+4)	-	-	-	-	6E-4	6E-3
		W, halides, nitrates, and metallic iridium	-	2E+5	6E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
77	Iridium-184	D, see ¹⁸² Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ¹⁸² Ir	-	3E+4	1E-5	5E-8	-	-
		Y, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-185	D, see ¹⁸² Ir	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ¹⁸² Ir	-	1E+4	5E-6	2E-8	-	-
		Y, see ¹⁸² Ir	-	1E+4	4E-6	1E-8	-	-
77	Iridium-186	D, see ¹⁸² Ir	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ¹⁸² Ir	-	6E+3	3E-6	9E-9	-	-
		Y, see ¹⁸² Ir	-	6E+3	2E-6	8E-9	-	-
77	Iridium-187	D, see ¹⁸² Ir	1E+4	3E+4	1E-5	5E-8	1E-4	1E-3
		W, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-188	D, see ¹⁸² Ir	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		W, see ¹⁸² Ir	-	4E+3	1E-6	5E-9	-	-
		Y, see ¹⁸² Ir	-	3E+3	1E-6	5E-9	-	-
77	Iridium-189	D, see ¹⁸² Ir	5E+3	5E+3	2E-6	7E-9	-	-
		LLI wall (5E+3)	-	-	-	-	7E-5	7E-4
		W, see ¹⁸² Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ¹⁸² Ir	-	4E+3	1E-6	5E-9	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
77 Iridium-190m ²	D, see ¹⁸² Ir	2E+5	2E+5	8E-5	3E-7	2E-3	2E-2
	W, see ¹⁸² Ir	-	2E+5	9E-5	3E-7	-	-
	Y, see ¹⁸² Ir	-	2E+5	8E-5	3E-7	-	-
77 Iridium-190	D, see ¹⁸² Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
	W, see ¹⁸² Ir	-	1E+3	4E-7	1E-9	-	-
	Y, see ¹⁸² Ir	-	9E+2	4E-7	1E-9	-	-
77 Iridium-192m	D, see ¹⁸² Ir	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
	W, see ¹⁸² Ir	-	2E+2	9E-8	3E-10	-	-
	Y, see ¹⁸² Ir	-	2E+1	6E-9	2E-11	-	-
77 Iridium-192	D, see ¹⁸² Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
	W, see ¹⁸² Ir	-	4E+2	2E-7	6E-10	-	-
	Y, see ¹⁸² Ir	-	2E+2	9E-8	3E-10	-	-
77 Iridium-194m	D, see ¹⁸² Ir	6E+2	9E+1	4E-8	1E-10	9E-6	9E-5
	W, see ¹⁸² Ir	-	2E+2	7E-8	2E-10	-	-
	Y, see ¹⁸² Ir	-	1E+2	4E-8	1E-10	-	-
77 Iridium-194	D, see ¹⁸² Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
	W, see ¹⁸² Ir	-	2E+3	9E-7	3E-9	-	-
	Y, see ¹⁸² Ir	-	2E+3	8E-7	3E-9	-	-
77 Iridium-195m	D, see ¹⁸² Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
	W, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
	Y, see ¹⁸² Ir	-	2E+4	9E-6	3E-8	-	-
77 Iridium-195	D, see ¹⁸² Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
	W, see ¹⁸² Ir	-	5E+4	2E-5	7E-8	-	-
	Y, see ¹⁸² Ir	-	4E+4	2E-5	6E-8	-	-
78 Platinum-186	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78 Platinum-188	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78 Platinum-189	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78 Platinum-191	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
78 Platinum-193m	D, all compounds	3E+3 LLI wall (3E+4)	6E+3 -	3E-6 -	8E-9 -	- 4E-5	- 4E-4
78 Platinum-193	D, all compounds	4E+4 LLI wall (5E+4)	2E+4 -	1E-5 -	3E-8 -	- 6E-4	- 6E-3
78 Platinum-195m	D, all compounds	2E+3 LLI wall (2E+3)	4E+3 -	2E-6 -	6E-9 -	- 3E-5	- 3E-4
78 Platinum-197m ²	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78 Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
78 Platinum-199 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
78 Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
79 Gold-193	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
	W, halides and nitrates	-	2E+4	9E-6	3E-8	-	-
	Y, oxides and hydroxides	-	2E+4	8E-6	3E-8	-	-
79 Gold-194	D, see ¹⁹³ Au	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
	W, see ¹⁹³ Au	-	5E+3	2E-6	8E-9	-	-
	Y, see ¹⁹³ Au	-	5E+3	2E-6	7E-9	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)				
79 Gold-195	D, see ¹⁹³ Au	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
	W, see ¹⁹³ Au	-	1E+3	6E-7	2E-9	-	-
	Y, see ¹⁹³ Au	-	4E+2	2E-7	6E-10	-	-
79 Gold-198m	D, see ¹⁹³ Au	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
	W, see ¹⁹³ Au	-	1E+3	5E-7	2E-9	-	-
	Y, see ¹⁹³ Au	-	1E+3	5E-7	2E-9	-	-
79 Gold-198	D, see ¹⁹³ Au	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
	W, see ¹⁹³ Au	-	2E+3	8E-7	3E-9	-	-
	Y, see ¹⁹³ Au	-	2E+3	7E-7	2E-9	-	-
79 Gold-199	D, see ¹⁹³ Au	3E+3	9E+3	4E-6	1E-8	-	-
	W, see ¹⁹³ Au	-	4E+3	2E-6	6E-9	4E-5	4E-4
	Y, see ¹⁹³ Au	-	4E+3	2E-6	5E-9	-	-
79 Gold-200m	D, see ¹⁹³ Au	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
	W, see ¹⁹³ Au	-	3E+3	1E-6	4E-9	-	-
	Y, see ¹⁹³ Au	-	2E+4	1E-6	3E-9	-	-
79 Gold-200 ²	D, see ¹⁹³ Au	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
	W, see ¹⁹³ Au	-	8E+4	3E-5	1E-7	-	-
	Y, see ¹⁹³ Au	-	7E+4	3E-5	1E-7	-	-
79 Gold-201 ²	D, see ¹⁹³ Au	7E+4	2E+5	9E-5	3E-7	-	-
	W, see ¹⁹³ Au	-	2E+5	1E-4	3E-7	1E-3	1E-2
	Y, see ¹⁹³ Au	-	2E+5	9E-5	3E-7	-	-
80 Mercury-193m	Vapor	-	8E+3	4E-6	1E-8	-	-
	Organic D	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
	D, sulfates	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
	W, oxides, hydroxides, halides, nitrates, and sulfides	-	8E+3	3E-6	1E-8	-	-
80 Mercury-193	Vapor	-	3E+4	1E-5	4E-8	-	-
	Organic D	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
	D, see ^{193m} Hg	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
	W, see ^{193m} Hg	-	4E+4	2E-5	6E-8	-	-
80 Mercury-194	Vapor	-	3E+1	1E-8	4E-11	-	-
	Organic D	2E+1	3E+1	1E-8	4E-11	2E-7	2E-6
	D, see ^{193m} Hg	8E+2	4E+1	2E-8	6E-11	1E-5	1E-4
	W, see ^{193m} Hg	-	1E+2	5E-8	2E-10	-	-
80 Mercury-195m	Vapor	-	4E+3	2E-6	6E-9	-	-
	Organic D	3E+3	6E+3	3E-6	8E-9	4E-5	4E-4
	D, see ^{193m} Hg	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
	W, see ^{193m} Hg	-	4E+3	2E-6	5E-9	-	-
80 Mercury-195	Vapor	-	3E+4	1E-5	4E-8	-	-
	Organic D	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
	D, see ^{193m} Hg	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
	W, see ^{193m} Hg	-	3E+4	1E-5	5E-8	-	-
80 Mercury-197m	Vapor	-	5E+3	2E-6	7E-9	-	-
	Organic D	4E+3	9E+3	4E-6	1E-8	5E-5	4E-4
	D, see ^{193m} Hg	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4
	W, see ^{193m} Hg	-	5E+3	2E-6	7E-9	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)		
80	Mercury-197	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	7E+3	1E+4	6E-6	2E-8	9E-5	9E-4
		D, see ^{193m} Hg	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{193m} Hg	-	9E+3	4E-6	1E-8	-	-
80	Mercury-199m ²	Vapor	-	8E+4	3E-5	1E-7	-	-
		Organic D	6E+4	2E+5	7E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		D, see ^{193m} Hg	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
		W, see ^{193m} Hg	-	2E+5	7E-5	2E-7	-	-
80	Mercury-203	Vapor	-	8E+2	4E-7	1E-9	-	-
		Organic D	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
		D, see ^{193m} Hg	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		W, see ^{193m} Hg	-	1E+3	5E-7	2E-9	-	-
81	Thallium-194m ²	D, all compounds	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
81	Thallium-194 ²	D, all compounds	3E+5	6E+5	2E-4	8E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
81	Thallium-195 ²	D, all compounds	6E+4	1E+5	5E-5	2E-7	9E-4	9E-3
81	Thallium-197	D, all compounds	7E+4	1E+5	5E-5	2E-7	1E-3	1E-2
81	Thallium-198m ²	D, all compounds	3E+4	5E+4	2E-5	8E-8	4E-4	4E-3
81	Thallium-198	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
81	Thallium-199	D, all compounds	6E+4	8E+4	4E-5	1E-7	9E-4	9E-3
81	Thallium-200	D, all compounds	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
81	Thallium-201	D, all compounds	2E+4	2E+4	9E-6	3E-8	2E-4	2E-3
81	Thallium-202	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5	2E-4
82	Lead-195m ²	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4	8E-3
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
82	Lead-199 ²	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4	1E-3
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6	2E-5
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5	5E-4
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
82	Lead-210	D, all compounds	6E1	2E1	1E-10	-	-	-
			Bone surf (1E+0)	Bone surf (4E-1)	-	6E-13	1E-8	1E-7
82	Lead-211 ²	D, all compounds	1E+4	6E+2	3E-7	9E-10	2E-4	2E-3
82	Lead-212	D, all compounds	8E+1	3E+1	1E-8	5E-11	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)		
		ALI (µCi)	DAC (µCi/ml)					
		Bone surf (1E+2)	-	-	-	2E-6	2E-5	
82	Lead-214 ²	D, all compounds	9E+3	8E+2	3E-7	1E-9	1E-4	1E-3
83	Bismuth-200 ²	D, nitrates	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, all other compounds	-	1E+5	4E-5	1E-7	-	-
83	Bismuth-201 ²	D, see ²⁰⁰ Bi	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ²⁰⁰ Bi	-	4E+4	2E-5	5E-8	-	-
83	Bismuth-202 ²	D, see ²⁰⁰ Bi	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ²⁰⁰ Bi	-	8E+4	3E-5	1E-7	-	-
83	Bismuth-203	D, see ²⁰⁰ Bi	2E+3	7E+3	3E-6	9E-9	3E-5	3E-4
		W, see ²⁰⁰ Bi	-	6E+3	3E-6	9E-9	-	-
83	Bismuth-205	D, see ²⁰⁰ Bi	1E+3	3E+3	1E-6	3E-9	2E-5	2E-4
		W, see ²⁰⁰ Bi	-	1E+3	5E-7	2E-9	-	-
83	Bismuth-206	D, see ²⁰⁰ Bi	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ²⁰⁰ Bi	-	9E+2	4E-7	1E-9	-	-
83	Bismuth-207	D, see ²⁰⁰ Bi	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ²⁰⁰ Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-210m	D, see ²⁰⁰ Bi	4E+1	5E+0	2E-9	-	-	-
		Kidneys (6E+1)	-	Kidneys (6E+0)	-	9E-12	8E-7	8E-6
		W, see ²⁰⁰ Bi	-	7E-1	3E-10	9E-13	-	-
83	Bismuth-210	D, see ²⁰⁰ Bi	8E+2	2E+2	1E-7	-	1E-5	1E-4
		Kidneys (4E+2)	-	-	-	5E-10	-	-
		W, see ²⁰⁰ Bi	-	3E+1	1E-8	4E-11	-	-
83	Bismuth-212 ²	D, see ²⁰⁰ Bi	5E+3	2E+2	1E-7	3E-10	7E-5	7E-4
		W, see ²⁰⁰ Bi	-	3E+2	1E-7	4E-10	-	-
83	Bismuth-213 ²	D, see ²⁰⁰ Bi	7E+3	3E+2	1E-7	4E-10	1E-4	1E-3
		W, see ²⁰⁰ Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-214 ²	D, see ²⁰⁰ Bi	2E+4	8E+2	3E-7	1E-9	-	-
		St wall (2E+4)	-	-	-	-	3E-4	3E-3
		W, see ²⁰⁰ Bi	-	9E-2	4E-7	1E-9	-	-
84	Polonium-203 ²	D, all compounds except those given for W	3E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, oxides, hydroxides, and nitrates	-	9E+4	4E-5	1E-7	-	-
84	Polonium-205 ²	D, see ²⁰³ Po	2E+4	4E+4	2E-5	5E-8	3E-4	3E-3
		W, see ²⁰³ Po	-	7E+4	3E-5	1E-7	-	-
84	Polonium-207	D, see ²⁰³ Po	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ²⁰³ Po	-	3E+4	1E-5	4E-8	-	-
84	Polonium-210	D, see ²⁰³ Po	3E+0	6E-1	3E-10	9E-13	4E-8	4E-7
		W, see ²⁰³ Po	-	6E-1	3E-10	9E-13	-	-
85	Astatine-207 ²	D, halides	6E+3	3E+3	1E-6	4E-9	8E-5	8E-4
		W	-	2E+3	9E-7	3E-9	-	-
85	Astatine-211	D, halides	1E+2	8E+1	3E-8	1E-10	2E-6	2E-5
		W	-	5E+1	2E-8	8E-11	-	-
86	Radon-220	With daughters removed	-	2E+4	7E-6	2E-8	-	-
		With daughters present	-	2E+1	9E-9	3E-11	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)		
		ALI (µCi)	DAC (µCi/ml)					
			(or 12 working level months)		(or 1.0 working level)			
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2	3E-8	1E-10	-	-
				(or 4 working level months)		(or 0.33 working level)		
87	Francium-222 ²	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223 ²	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
88	Radium-223	W, all compounds	5E+0	7E-1	3E-10	9E-13	-	-
		Bone surf (9E+0)	-	-	-	-	1E-7	1E-6
88	Radium-224	W, all compounds	8E+0	2E+0	7E-10	2E-12	-	-
		Bone surf (2E+1)	-	-	-	-	2E-7	2E-6
88	Radium-225	W, all compounds	8E+0	7E-1	3E-10	9E-13	-	-
		Bone surf (2E+1)	-	-	-	-	2E-7	2E-6
88	Radium-226	W, all compounds	2E+0	6E-1	3E-10	9E-13	-	-
		Bone surf (5E+0)	-	-	-	-	6E-8	6E-7
88	Radium-227 ²	W, all compounds	2E+4	1E+4	6E-6	-	-	-
		Bone surf (2E+4)	-	Bone surf (2E+4)	-	3E-8	3E-4	3E-3
88	Radium-228	W, all compounds	2E+0	1E+0	5E-10	2E-12	-	-
		Bone surf (4E+0)	-	-	-	-	6E-8	6E-7
89	Actinium-224	D, all compounds except those given for W and Y	2E+3	3E+1	1E-8	-	-	-
		LLI wall (2E+3)	-	Bone surf (4E+1)	-	5E-11	3E-5	3E-4
		W, halides and nitrates	-	5E+1	2E-8	7E-11	-	-
		Y, oxides and hydroxides	-	5E+1	2E-8	6E-11	-	-
89	Actinium-225	D, see ²²⁴ Ac	5E+1	3E-1	1E-10	-	-	-
		LLI wall (5E+1)	-	Bone surf (5E-1)	-	7E-13	7E-7	7E-6
		W, see ²²⁴ Ac	-	6E-1	3E-10	9E-13	-	-
		Y, see ²²⁴ Ac	-	6E-1	3E-10	9E-13	-	-
89	Actinium-226	D, see ²²⁴ Ac	1E+2	3E+0	1E-9	-	-	-
		LLI wall (1E+2)	-	Bone surf (4E+0)	-	5E-12	2E-6	2E-5
		W, see ²²⁴ Ac	-	5E+0	2E-9	7E-12	-	-
		Y, see ²²⁴ Ac	-	5E+0	2E-9	6E-12	-	-
89	Actinium-227	D, see ²²⁴ Ac	2E-1	4E-4	2E-13	-	-	-
		Bone surf (4E-1)	-	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
		W, see ²²⁴ Ac	-	2E-3	7E-13	-	-	-
		Y, see ²²⁴ Ac	-	Bone surf (3E-3)	-	4E-15	-	-
			-	4E-3	2E-12	6E-15	-	-
89	Actinium-228	D, see ²²⁴ Ac	2E+3	9E+0	4E-9	-	3E-5	3E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
	W, see ²²⁴ Ac	-	Bone surf (2E+1)	-	2E-11	-	-
		-	4E+1	2E-8	-	-	-
	Y, see ²²⁴ Ac	-	Bone surf (6E+1)	-	8E-11	-	-
		-	4E+1	2E-8	6E-11	-	-
90	Thorium-226 ²	W, all compounds except those given for Y	5E+3	2E+2	6E-8	2E-10	-
		St wall (5E+3)	-	-	-	7E-5	7E-4
	Y, oxides and hydroxides	-	1E+2	6E-8	2E-10	-	-
90	Thorium-227	W, see ²²⁶ Th	1E+2	3E-1	1E-10	5E-13	2E-6
	Y, see ²²⁶ Th	-	3E-1	1E-10	5E-13	-	2E-5
90	Thorium-228	W, see ²²⁶ Th	6E+0	1E-2	4E-12	-	-
		Bone surf (1E+1)	Bone surf (2E-2)	-	3E-14	2E-7	2E-6
	Y, see ²²⁶ Th	-	2E-2	7E-12	2E-14	-	-
90	Thorium-229	W, see ²²⁶ Th	6E-1	9E-4	4E-13	-	-
		Bone surf (1E+0)	Bone surf (2E-3)	-	3E-15	2E-8	2E-7
	Y, see ²²⁶ Th	-	2E-3	1E-12	-	-	-
		-	Bone surf (3E-3)	-	4E-15	-	-
90	Thorium-230	W, see ²²⁶ Th	4E+0	6E-3	3E-12	-	-
		Bone surf (9E+0)	Bone surf (2E-2)	-	2E-14	1E-7	1E-6
	Y, see ²²⁶ Th	-	2E-2	6E-12	-	-	-
		-	Bone surf (2E-2)	-	3E-14	-	-
90	Thorium-231	W, see ²²⁶ Th	4E+3	6E+3	3E-6	9E-9	5E-5
	Y, see ²²⁶ Th	-	6E+3	3E-6	9E-9	-	5E-4
90	Thorium-232	W, see ²²⁶ Th	7E-1	1E-3	5E-13	-	-
		Bone surf (2E+0)	Bone surf (3E-3)	-	4E-15	3E-8	3E-7
	Y, see ²²⁶ Th	-	3E-3	1E-12	-	-	-
		-	Bone surf (4E-3)	-	6E-15	-	-
90	Thorium-234	W, see ²²⁶ Th	3E+2	2E+2	8E-8	3E-10	-
		LLI wall (4E+2)	-	-	-	5E-6	5E-5
	Y, see ²²⁶ Th	-	2E+2	6E-8	2E-10	-	-
91	Protactinium-227 ²	W, all compounds except those given for Y	4E+3	1E+2	5E-8	2E-10	5E-5
	Y, oxides and hydroxides	-	1E+2	4E-8	1E-10	-	5E-4
91	Protactinium-228	W, see ²²⁷ Pa	1E+3	1E+1	5E-9	-	2E-5
		-	Bone surf (2E+1)	-	3E-11	-	2E-4
	Y, see ²²⁷ Pa	-	1E+1	5E-9	2E-11	-	-
91	Protactinium-230	W, see ²²⁷ Pa	6E+2	5E+0	2E-9	7E-12	-
		Bone surf (9E+2)	-	-	-	1E-5	1E-4
	Y, see ²²⁷ Pa	-	4E+0	1E-9	5E-12	-	-
91	Protactinium-231	W, see ²²⁷ Pa	2E-1	2E-3	6E-13	-	-
		Bone surf (5E-1)	Bone surf (4E-3)	-	6E-15	6E-9	6E-8
	Y, see ²²⁷ Pa	-	4E-3	2E-12	-	-	-
		-	Bone surf	-	-	-	-

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
91	Protactinium-232 W, see ²²⁷ Pa	-	(6E-3)	-	8E-15	-	-
		1E+3	2E+1	9E-9	-	2E-5	2E-4
		-	Bone surf (6E+1)	-	8E-11	-	-
	Y, see ²²⁷ Pa	-	6E+1	2E-8	-	-	-
		-	Bone surf (7E+1)	-	1E-10	-	-
91	Protactinium-233 W, see ²²⁷ Pa	1E+3	7E+2	3E-7	1E-9	-	-
		LLI wall (2E+3)	-	-	-	2E-5	2E-4
	Y, see ²²⁷ Pa	-	6E+2	2E-7	8E-10	-	-
91	Protactinium-234 W, see ²²⁷ Pa	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
	Y, see ²²⁷ Pa	-	7E+3	3E-6	9E-9	-	-
92	Uranium-230 D, UF, UOF, UO(NO)	4E+0	4E-1	2E-10	-	-	-
		Bone surf (6E+0)	Bone surf (6E-1)	-	8E-13	8E-8	8E-7
	W, UO, UF, UCl	-	4E-1	1E-10	5E-13	-	-
	Y, UO, UO	-	3E-1	1E-10	4E-13	-	-
92	Uranium-231 D, see ²³⁰ U	5E+3	8E+3	3E-6	1E-8	-	-
		LLI wall (4E+3)	-	-	-	6E-5	6E-4
	W, see ²³⁰ U	-	6E+3	2E-6	8E-9	-	-
	Y, see ²³⁰ U	-	5E+3	2E-6	6E-9	-	-
92	Uranium-232 D, see ²³⁰ U	2E+0	2E-1	9E-11	-	-	-
		Bone surf (4E+0)	Bone surf (4E-1)	-	6E-13	6E-8	6E-7
	W, see ²³⁰ U	-	4E-1	2E-10	5E-13	-	-
	Y, see ²³⁰ U	-	8E-3	3E-12	1E-14	-	-
92	Uranium-233 D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
	W, see ²³⁰ U	-	7E-1	3E-10	1E-12	-	-
	Y, see ²³⁰ U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-234 ³ D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
	W, see ²³⁰ U	-	7E-1	3E-10	1E-12	-	-
	Y, see ²³⁰ U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-235 ³ D, see ²³⁰ U	1E+1	1E+0	6E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
	W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
	Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-236 D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
	W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
	Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-237 D, see ²³⁰ U	2E+3	3E+3	1E-6	4E-9	-	-
		LLI wall (2E+3)	-	-	-	3E-5	3E-4
	W, see ²³⁰ U	-	2E+3	7E-7	2E-9	-	-
	Y, see ²³⁰ U	-	2E+3	6E-7	2E-9	-	-
92	Uranium-238 ³ D, see ²³⁰ U	1E+1	1E+0	6E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
	W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
	Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-239 ² D, see ²³⁰ U	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)	
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)		
		ALI (µCi)	DAC (µCi/ml)					
	W, see ²³⁰ U	-	2E+5	7E-5	2E-7	-	-	
	Y, see ²³⁰ U	-	2E+5	6E-5	2E-7	-	-	
92	Uranium-240	D, see ²³⁰ U	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		W, see ²³⁰ U	-	3E+3	1E-6	4E-9	-	-
		Y, see ²³⁰ U	-	2E+3	1E-6	3E-9	-	-
92	Uranium-natural ³	D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
		Bone surf (2E+1)		Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ²³⁰ U	-	8E-1	3E-10	9E-13	-	-
		Y, see ²³⁰ U	-	5E-2	2E-11	9E-14	-	-
93	Neptunium-232 ²	W, all compounds	1E+5	2E+3	7E-7	-	2E-3	2E-2
			-	Bone surf (5E+2)	-	6E-9	-	-
93	Neptunium-233 ²	W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93	Neptunium-234	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
93	Neptunium-235	W, all compounds	2E+4	8E+2	3E-7	-	-	-
		LLI wall (2E+4)		Bone surf (1E+3)	-	2E-9	3E-4	3E-3
93	Neptunium-236	W, all compounds (1.15E+5 y)	3E+0	2E-2	9E-12	-	-	-
		Bone surf (6E+0)		Bone surf (5E-2)	-	8E-14	9E-8	9E-7
93	Neptunium-236	W, all compounds (22.5 h)	3E+3	3E+1	1E-8	-	-	-
		Bone surf (4E+3)		Bone surf (7E+1)	-	1E-10	5E-5	5E-4
93	Neptunium-237	W, all compounds	5E-1	4E-3	2E-12	-	-	-
		Bone surf (1E+0)		Bone surf (1E-2)	-	1E-14	2E-8	2E-7
93	Neptunium-238	W, all compounds	1E+3	6E+1	3E-8	-	2E-5	2E-4
			-	Bone surf (2E+2)	-	2E-10	-	-
93	Neptunium-239	W, all compounds	2E+3	2E+3	9E-7	3E-9	-	-
		LLI wall (2E+3)		-	-	-	2E-5	2E-4
93	Neptunium-240 ²	W, all compounds	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
94	Plutonium-234	W, all compounds except PuO	8E+3	2E+2	9E-8	3E-10	1E-4	1E-3
		Y, PuO	-	2E+2	8E-8	3E-10	-	-
94	Plutonium-235 ²	W, see ²³⁴ Pu	9E+5	3E+6	1E-3	4E-6	1E-2	1E-1
		Y, see ²³⁴ Pu	-	3E+6	1E-3	3E-6	-	-
94	Plutonium-236	W, see ²³⁴ Pu	2E+0	2E-2	8E-12	-	-	-
		Bone surf (4E+0)		Bone surf (4E-2)	-	5E-14	6E-8	6E-7
		Y, see ²³⁴ Pu	-	4E-2	2E-11	6E-14	-	-
94	Plutonium-237	W, see ²³⁴ Pu	1E+4	3E+3	1E-6	5E-9	2E-4	2E-3
		Y, see ²³⁴ Pu	-	3E+3	1E-6	4E-9	-	-
94	Plutonium-238	W, see ²³⁴ Pu	9E-1	7E-3	3E-12	-	-	-
		Bone surf (2E+0)		Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ²³⁴ Pu	-	2E-2	8E-12	2E-14	-	-
94	Plutonium-239	W, see ²³⁴ Pu	8E-1	6E-3	3E-12	-	-	-
		Bone surf (1E+0)		Bone surf (1E-2)	-	2E-14	2E-8	2E-7

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1 Oral Ingestion ALI (μCi)	Col. 2 ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
	Y, see ^{234}Pu	-	2E-2 Bone surf (2E-2)	7E-12	-	-	-
94	Plutonium-240 W, see ^{234}Pu	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-
	Y, see ^{234}Pu	-	2E-2 Bone surf (2E-2)	7E-12	2E-14	2E-8	2E-7
94	Plutonium-241 W, see ^{234}Pu	4E+1 Bone surf (7E+1)	3E-1 Bone surf (6E-1)	1E-10	-	-	-
	Y, see ^{234}Pu	-	8E-1 Bone surf (1E+0)	3E-10	8E-13	1E-6	1E-5
94	Plutonium-242 W, see ^{234}Pu	8E-1 Bone surf (1E+0)	7E-3 Bone surf (1E-2)	3E-12	-	-	-
	Y, see ^{234}Pu	-	2E-2 Bone surf (2E-2)	7E-12	2E-14	2E-8	2E-7
94	Plutonium-243 W, see ^{234}Pu	2E+4	4E+4	2E-5	5E-8	2E-4	2E-3
	Y, see ^{234}Pu	-	4E+4	2E-5	5E-8	-	-
94	Plutonium-244 W, see ^{234}Pu	8E-1 Bone surf (2E+0)	7E-3 Bone surf (1E-2)	3E-12	-	-	-
	Y, see ^{234}Pu	-	2E-2 Bone surf (2E-2)	7E-12	2E-14	2E-8	2E-7
94	Plutonium-245 W, see ^{234}Pu	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
	Y, see ^{234}Pu	-	4E+3	2E-6	6E-9	-	-
94	Plutonium-246 W, see ^{234}Pu	4E+2 LLI wall (4E+2)	3E+2	1E-7	4E-10	-	-
	Y, see ^{234}Pu	-	3E+2	1E-7	4E-10	6E-6	6E-5
95	Americium-237 ² W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-238 ² W, all compounds	4E+4	3E+3 Bone surf (6E+3)	1E-6	-	5E-4	5E-3
		-	-	-	9E-9	-	-
95	Americium-239 W, all compounds	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
95	Americium-240 W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
95	Americium-241 W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-
		-	-	-	2E-14	2E-8	2E-7
95	Americium-242m W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-
		-	-	-	2E-14	2E-8	2E-7
95	Americium-242 W, all compounds	4E+3	8E+1 Bone surf	4E-8	-	5E-5	5E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
		-	(9E+1)	-	1E-10	-	-
95 Americium-243	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
95 Americium-244m ²	W, all compounds	6E+4 St wall (8E+4)	4E+3 Bone surf (7E+3)	2E-6 -	- 1E-8	- 1E-3	- 1E-2
95 Americium-244	W, all compounds	3E+3	2E+2 Bone surf (3E+2)	8E-8 -	- 4E-10	4E-5 -	4E-4 -
95 Americium-245	W, all compounds	3E+4	8E+4	3E-5	1E-7	4E-4	4E-3
95 Americium-246m ²	W, all compounds	5E+4 St wall (6E+4)	2E+5 -	8E-5 -	3E-7 -	- 8E-4	- 8E-3
95 Americium-246 ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
96 Curium-238	W, all compounds	2E+4	1E+3	5E-7	2E-9	2E-4	2E-3
96 Curium-240	W, all compounds	6E+1 Bone surf (8E+1)	6E-1 Bone surf (6E-1)	2E-10 -	- 9E-13	- 1E-6	- 1E-5
96 Curium-241	W, all compounds	1E+3	3E+1 Bone surf (4E+1)	1E-8 -	- 5E-11	2E-5 -	2E-4 -
96 Curium-242	W, all compounds	3E+1 Bone surf (5E+1)	3E-1 Bone surf (3E-1)	1E-10 -	- 4E-13	- 7E-7	- 7E-6
96 Curium-243	W, all compounds	1E+0 Bone surf (2E+0)	9E-3 Bone surf (2E-2)	4E-12 -	- 2E-14	- 3E-8	- 3E-7
96 Curium-244	W, all compounds	1E+0 Bone surf (3E+0)	1E-2 Bone surf (2E-2)	5E-12 -	- 3E-14	- 3E-8	- 3E-7
96 Curium-245	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96 Curium-246	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96 Curium-247	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96 Curium-248	W, all compounds	2E-1 Bone surf (4E-1)	2E-3 Bone surf (3E-3)	7E-13 -	- 4E-15	- 5E-9	- 5E-8
96 Curium-249 ²	W, all compounds	5E+4	2E+4 Bone surf (3E+4)	7E-6 -	- 4E-8	7E-4 -	7E-3 -
96 Curium-250	W, all compounds	4E-2 Bone surf (6E-2)	3E-4 Bone surf (5E-4)	1E-13 -	- 8E-16	- 9E-10	- 9E-9
97 Berkelium-245	W, all compounds	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
97 Berkelium-246	W, all compounds	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)				
97	Berkelium-247 W, all compounds	5E-1 Bone surf (1E+0)	4E-3 Bone surf (9E-3)	2E-12 -	- 1E-14	- 2E-8	- 2E-7
97	Berkelium-249 W, all compounds	2E+2 Bone surf (5E+2)	2E+0 Bone surf (4E+0)	7E-10 -	- 5E-12	- 6E-6	- 6E-5
97	Berkelium-250 W, all compounds	9E+3 -	3E+2 Bone surf (7E+2)	1E-7 -	- 1E-9	1E-4 -	1E-3 -
98	Californium-244 ² those given for Y	W, all compounds except 3E+4 St wall (3E+4)	6E+2	2E-7	8E-10	-	-
	Y, oxides and hydroxides	-	6E+2	2E-7	8E-10	4E-4 -	4E-3 -
98	Californium-246 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	4E+2 -	9E+0 9E+0	4E-9 4E-9	1E-11 1E-11	5E-6 -	5E-5 -
98	Californium-248 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	8E+0 Bone surf (2E+1) -	6E-2 Bone surf (1E-1) 1E-1	3E-11 - 4E-11	- 2E-13 1E-13	- 2E-7 -	- 2E-6 -
98	Californium-249 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	5E-1 Bone surf (1E+0) - -	4E-3 Bone surf (9E-3) 1E-2 Bone surf (1E-2)	2E-12 - 4E-12 -	- 1E-14 - 2E-14	- 2E-8 -	- 2E-7 -
98	Californium-250 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	1E+0 Bone surf (2E+0) -	9E-3 Bone surf (2E-2) 3E-2	4E-12 - 1E-11	- 3E-14 4E-14	- 3E-8 -	- 3E-7 -
98	Californium-251 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	5E-1 Bone surf (1E+0) -	4E-3 Bone surf (9E-3) 1E-2 Bone surf (1E-2)	2E-12 - 4E-12 -	- 1E-14 - 2E-14	- 2E-8 -	- 2E-7 -
98	Californium-252 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	2E+0 Bone surf (5E+0) -	2E-2 Bone surf (4E-2) 3E-2	8E-12 - 1E-11	- 5E-14 5E-14	- 7E-8 -	- 7E-7 -
98	Californium-253 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	2E+2 Bone surf (4E+2) -	2E+0 - 2E+0	8E-10 - 7E-10	3E-12 - 2E-12	- 5E-6 -	- 5E-5 -
98	Californium-254 W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	2E+0 -	2E-2 2E-2	9E-12 7E-12	3E-14 2E-14	3E-8 -	3E-7 -
99	Einsteinium-250 W, all compounds	4E+4 -	5E+2 Bone surf (1E+3)	2E-7 -	- 2E-9	6E-4 -	6E-3 -
99	Einsteinium-251 W, all compounds	7E+3 -	9E+2 Bone surf (1E+3)	4E-7 -	- 2E-9	1E-4 -	1E-3 -
99	Einsteinium-253 W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6	2E-5

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
	ALI (µCi)	DAC (µCi/ml)					
99	Einsteinium-254m W, all compounds	3E+2 LLI wall (3E+2)	1E+1	4E-9	1E-11	-	-
99	Einsteinium-254W, all compounds	8E+0 Bone surf (2E+1)	7E-2 Bone surf (1E-1)	3E-11	-	-	-
100	Fermium-252 W, all compounds	5E+2	1E+1	5E-9	2E-11	6E-6	6E-5
100	Fermium-253 W, all compounds	1E+3	1E+1	4E-9	1E-11	1E-5	1E-4
100	Fermium-254 W, all compounds	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
100	Fermium-255 W, all compounds	5E+2	2E+1	9E-9	3E-11	7E-6	7E-5
100	Fermium-257 W, all compounds	2E+1 Bone surf (4E+1)	2E-1 Bone surf (2E-1)	7E-11	-	-	-
101	Mendelevium-257 W, all compounds	7E+3	8E+1 Bone surf (9E+1)	4E-8	-	1E-4	1E-3
101	Mendelevium-258 W, all compounds	3E+1 Bone surf (5E+1)	2E-1 Bone surf (3E-1)	1E-10	-	-	-
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours Submersion ¹	-	2E+2	1E-7	1E-9	-	-
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours	-	2E-1	1E-10	1E-12	1E-8	1E-7
-	Any single radionuclide not listed above that decays by alpha emission or spontaneous fission, or any mixture for which either the identity or the concentration of any radionuclide in the mixture is not known	-	4E-4	2E-13	1E-15	2E-9	2E-8

FOOTNOTES:

¹"Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material.

²These radionuclides have radiological half-lives of less than 2 hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The DAC values for all radionuclides, other than those designated Class "Submersion," are based upon the committed effective dose equivalent due to the intake of the radionuclide into the body and do NOT include potentially significant contributions to dose equivalent from external exposures. The licensee may substitute 1E-7 µCi/ml for the listed DAC to account for the submersion dose prospectively, but should use individual monitoring devices or other radiation measuring instruments that measure external exposure to demonstrate compliance with the limits. (See 801.D.203.)

³For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see 801.D.201(e)). If the percent by weight (enrichment) of U-235 is not greater than 5, the concentration value for a 40-hour workweek is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8E-3 (SA) µCi-hr/ml, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μ Ci/ml)
		Oral Ingestion ALI (μ Ci)	Inhalation ALI (μ Ci)		Air (μ Ci/ml)	Water (μ Ci/ml)	

SA = 3.6E-7 curies/gram U U-depleted

SA = [0.4 + 0.38 (enrichment) + 0.0034 (enrichment)²] E-6 , enrichment \geq 0.72

where enrichment is the percentage by weight of U-235, expressed as percent.

NOTE:

1. If the identity of each radionuclide in a mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture shall be the most restrictive DAC of any radionuclide in the mixture.
2. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this appendix are not present in the mixture, the inhalation ALI, DAC, and effluent and sewage concentrations for the mixture are the lowest values specified in this appendix for any radionuclide that is not known to be absent from the mixture; or

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
		ALI (µCi)	DAC (µCi/ml)				
	If it is known that Ac-227-D and Cm-250-W are not present	-	7E-4	3E-13	-	-	-
	If, in addition, it is known that Ac-227-W,Y, Th-229-W,Y, Th-230-W, Th-232-W,Y, Pa-231-W,Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present	-	7E-3	3E-12	-	-	-
	If, in addition, it is known that Sm-146-W, Sm-147-W, Gd-148-D,W, Gd-152-D,W, Th-228-W,Y, Th-230-Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, Np-236-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-Y, Pu-240-Y, Pu-242-Y, Pu-244-W,Y, Cm-243-W, Cm-244-W, Cf-248-W, Cf-249-Y, Cf-250-W,Y, Cf-251-Y, Cf-252-W,Y, and Cf-254-W,Y are not present	-	7E-2	3E-11	-	-	-
	If, in addition, it is known that Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-Y, Es-254-W, Fm-257-W, and Md-258-W are not present	-	7E-1	3E-10	-	-	-
	If, in addition, it is known that Si-32-Y, Ti-44-Y, Fe-60-D, Sr-90-Y, Zr-93-D, Cd-113m-D, Cd-113-D, In-115-D,W, La-138-D, Lu-176-W, Hf-178m-D,W, Hf-182-D,W, Bi-210m-D, Ra-224-W, Ra-228-W, Ac-226-D,W,Y, Pa-230-W,Y, U-233-D,W, U-234-D,W, U-235-D,W, U-236-D,W, U-238-D,W, Pu-241-Y, Bk-249-W, Cf-253-W,Y, and Es-253-W are not present	-	7E+0	3E-9	-	-	-
	If it is known that Ac-227-D,W,Y, Th-229-W,Y, Th-232-W,Y, Pa-231-W,Y, Cm-248-W, and Cm-250-W are not present	-	-	-	1E-14	-	-
	If, in addition, it is known that Sm-146-W, Gd-148-D,W, Gd-152-D, Th-228-W,Y, Th-230-W,Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, U-Nat-Y, Np-236-W, Np-237-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-W,Y, Pu-240-W,Y, Pu-242-W,Y, Pu-244-W,Y, Am-241-W, Am-242m-W, Am-243-W, Cm-243-W, Cm-244-W, Cm-245-W, Cm-246-W, Cm-247-W, Bk-247-W, Cf-249-W,Y, Cf-250-W,Y, Cf-251-W,Y, Cf-252-W,Y, and Cf-254-W,Y are not present	-	-	-	1E-13	-	-
	If, in addition, it is known that Sm-147-W, Gd-152-W, Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, U-Nat-W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-W,Y, Es-254-W, Fm-257-W, and Md-258-W are not present	-	-	-	-	1E-12	-
	If, in addition it is known that Fe-60, Sr-90, Cd-113m, Cd-113, In-115, I-129, Cs-134, Sm-145, Sm-147, Gd-148, Gd-152, Hg-194 (organic), Bi-210m, Ra-223, Ra-224, Ra-225, Ac-225, Th-228, Th-230, U-233, U-234,						

Atomic Radionuclide No.	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
		Oral Ingestion ALI (µCi)	ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	

U-235, U-236, U-238, U-Nat, Cm-242, Cf-248, Es-254, Fm-257, and Md-258 are not present - - - - 1E-6 1E-5

- If a mixture of radionuclides consists of uranium and its daughters in ore dust (10 µm AMAD particle distribution assumed) prior to chemical separation of the uranium from the ore, the following values may be used for the DAC of the mixture: 6E-11 µCi of gross alpha activity from uranium-238, uranium-234, thorium-230, and radium-226 per milliliter of air; 3E-11 µCi of natural uranium per milliliter of air; or 45 micrograms of natural uranium per cubic meter of air.
- If the identity and concentration of each radionuclide in a mixture are known, the limiting values should be derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in Appendix B for the specific radionuclide when not in a mixture. The sum of such ratios for all of the radionuclides in the mixture may not exceed "1" (i.e., "unity").

Example: If radionuclides "A," "B," and "C" are present in concentrations CA, CB, and CC, and if the applicable DACs are DAC_A, DAC_B, and DAC_C, respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{DAC_A} + \frac{C_B}{DAC_B} + \frac{C_C}{DAC_C} \leq 1$$

* To convert from curies (Ci) to kilobecquerel (kBq), multiply the Ci value by 37.

1001 10100 1,000,000 10 1 1.01010100000000 100 1,000,000 11,000,000,000 100,000,000,000 1,000,000,000,000 Quantity

Net (m-223R)

D-115

0.00100 100,000 100100000 0.00001 0.001000 0.01 1000000 1 100000 00000100 1 0.001 0.010,000 0010.10.1

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Environmental Impact Statement for the Proposed Construction and Operation of the [REDACTED] Project, Final EIS, Volume 1, Part 1, Appendix D, Section 1

This appendix contains information regarding the [REDACTED] project, including [REDACTED] information, and is intended for disposal at [REDACTED] requirements for [REDACTED]

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MANIFESTS APPENDIX D
SECTION D
PART 801

required for the design of the system. The design of the system is based on the requirements of the system. The design of the system is based on the requirements of the system.

any high integrity manifest regarding the use, packing, and disposal containers of waste in the ship for an initial 30-day period, as set forth in the information to be provided by the shipper.

3. 2. 1. The shipper shall provide the following information to the carrier:

The volume of waste to be disposed of, the type of waste, the quantity of waste, the date of disposal, the location of disposal, and the name of the person responsible for disposal.

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material, and the total

Environmental Health and Safety Department, University of California, Berkeley, CA 94720-5080, USA

2. 1.

This section is for the use of the author only.

(e) (d) (c) (b) (a)

For heterogeneous systems, the results are shown in Figure 1. The results for homogeneous systems are shown in Figure 2.

Radionuclide concentrations in the soil are shown in Figure 3. The results for the homogeneous systems are shown in Figure 4.

III. of the tracking system
Control and Tracking An authorized representative

A.

(5)

(4)

(3)

(2)

(1)

A. (4) the system shall be designed to ensure that the system is capable of receiving and processing data from the tracking system in accordance with the requirements of the contract.

to the system in accordance with the requirements of the contract. The system shall be designed to ensure that the system is capable of receiving and processing data from the tracking system in accordance with the requirements of the contract.

B.

- (3) (2) (1) Any waste collector licensee who handles on-prepackaged waste shall:

disposal facility operator at the time of disposal, know, or have knowledge, of the identity of the waste, and the name and address of the waste generator.

D.

- (1) The land disposal facility operator shall: (9) (8) (7) (6) (5)

~~The revised copy of the final site investigation report shall be submitted to the appropriate regulatory agency for review and approval. The revised copy shall be submitted to the appropriate regulatory agency for review and approval. The revised copy shall be submitted to the appropriate regulatory agency for review and approval.~~

E.

(2) (1) receive with the (2) (1) of this section for

complex of the (2) (1) of this section for

E.

(1) following classification which is listed in Table II, and is for the purpose of this section (5) (4) (3) (2)

Cs-137, Ni-63, Co-60, and other isotopes of the same element

radium, thorium, uranium, and other naturally occurring radioactive materials, and the Section of Atomic Energy, U.S. Department of Energy

these isotopes are listed in Table II, and are for the purpose of this section

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TABLE II

1 0.05 3.70700 Column 1 Concentration Column 3

44 160 70* * curie/cubic meter*

4607000 700 *

II.

Radioactive Waste Characteristics

G. F.

A. as required (1) ~~to be stored in a container that is capable of withstanding a pressure of 15 psig for a minimum of 30 days without failure~~

- (4)
- (3)
- (2)
- (1) personnel handling and provide protection of hands and feet of fire no the Class II or III

exceed 1% of the initial activity of the

III.

Labeling

B.

- (3) (2) (1) none
- be red

* To convert Ci to kilobecquerel (kBq), multiply the Ci value by 37.

QUANTITIES FOR USE WITH

APPENDIX E
SECTION D
PART 801

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1001010 10 1,00010 10 10 10 1 1,0001 100100 10 10 100 100 110 10 100010 10100 10 10100 0.01

* To convert curies (Ci) to kilobecquerel (kBq), multiply the Ci value by 37.

D-137

10100 1001010100010000 1001010101101011010100010000 100 1000 101 1000100

* To convert from curie (Ci) to kilobecquerel (kBq), multiply the Ci value by 37.

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10010 1 10 1000 10 100 100100.01 10 10 1001001000 1000 1010000000 10010 10 10010100 100100

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