RULES
OF
TENNESSEE DEPARTMENT OF ENVIRONMENT AND HEALTH
RADIOLOGICAL DIVISION

CHAPTER 0400-20-05
STANDARDS FOR PROTECTION AGAINST RADIATION

TABLE OF CONTENTS

(Rule 0400-20-05-.32, continued)

0400-20-05-.01 THROUGH 0400-20-05-.29 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.30 PURPOSE.

(1) The regulations in Rules 0400-20-05-.30 through 0400-20-05-.165 establish standards for protection against ionizing radiation. These standards are issued under Tennessee Code Annotated (T.C.A.) 4-5-201 et seq. and 68-202-203 and 206, as amended. These standards are also issued to meet the Nuclear Regulatory Commission's requirements for compatibility as set out in 42 United States Code Annotated (USCA) Section 2021(d)(2) and 10 CFR 20. It is the intent of the Division of Radiological Health of the Tennessee Department of Environment and Conservation that these rules enable the State of Tennessee to maintain its compatibility as an Agreement State. This principle should be considered, when relevant, in any interpretation of these rules. To that end, judicial or administrative interpretation of corresponding rules in other jurisdictions should be given persuasive authority.

(2) The purpose of these standards is to control the receipt, possession, use, transfer and disposal of sources of radiation by any person. This is done so that the total dose to an individual from all sources of radiation other than background radiation does not exceed these standards. However, nothing in these standards shall be construed as limiting a licensee's or registrant's actions that may be necessary to protect health and safety during an emergency.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.31 SCOPE.

These standards apply to all persons who receive, possess, use, transfer, or dispose of sources of radiation within the jurisdiction of the State of Tennessee. The limits in these standards do not apply to doses due to background radiation or to exposure of patients to radiation for medical diagnosis or therapy.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.32 DEFINITIONS.

(1) "Absorbed dose" means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

(2) "Act" means the Tennessee Code Annotated, Title 68, Chapter 202, as amended.

(3) "Activity" is the rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq).

(4) "Adult" means an individual 18 or more years of age.

(Rule 0400-20-05-.32, continued)

(5) "Airborne radioactive material" means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors or gases.

(6) "Airborne radioactivity area" means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

(a) In excess of the derived air concentrations (DACs) specified in Schedule RHS 8-30; or

(b) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

(7) "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.

(8) "ALARA" (acronym for "as low as is reasonably achievable") means making every reasonable effort to maintain exposures to radiation as far below the dose limits in these standards as is practical consistent with the purpose for which the activity is undertaken and taking into account:

(a) The state of technology;

(b) The economics of improvements in relation to:

1. The state of technology;

2. Benefits to public health and safety, and other societal and socioeconomic considerations; and

3. Utilization of radiation and radioactive materials in the public interest.

(9) "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 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Schedule RHS 8-30.

(10) "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.

(11) "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.

(12) "Background radiation" means radiation from cosmic sources; naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material), and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "Background radiation" does not include radiation from sources of radiation subject to licensing or registering by the Division.

(Rule 0400-20-05-.32, continued)

(13) "Bioassay" ("radiobioassay") means the determination of kinds, quantities or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

(14) "Byproduct material" means:

(a) Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material;

(b) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition;

(c) 1. Any discrete source of radium-226 that is produced, extracted, or converted after extraction for use for a commercial, medical, or research activity; or

2. Any material that—

(i) Has been made radioactive by use of a particle accelerator; and

(ii) Is produced, extracted, or converted after extraction for use for a commercial, medical, or research activity; and

(d) Any discrete source of naturally occurring radioactive material, other than source material, that—

1. The Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security; and

2. Is extracted or converted after extraction for use in a commercial, medical, or research activity.

(15) "Class" (or "lung class" or "inhalation 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.

(16) "Collective dose" is the sum of the individual doses received in a given period of time by a specific population from exposure to a specific source of radiation.

(17) "Committed dose equivalent" (CDE) ($H_{T,50}$) is the dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50 year period following the intake.

(18) "Committed effective dose equivalent" (CEDE) ($H_{E,50}$) is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues ($H_{E,50}=(\Sigma WTH_{T,50})$.

(Rule 0400-20-05-.32, continued)

(19) "Constraint" (or "dose constraint") means a value above which specified licensee actions are required.

(20) "Declared pregnant woman" means a woman who has voluntarily informed her employer, 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.

(21) "Deep-dose equivalent" (DDE) (H_d), which applies to external whole-body exposure, is the dose equivalent at a tissue depth of 1 cm (1000 mg/cm^2).

(22) "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.

(23) "Department" refers to the Tennessee Department of Environment and Conservation.

(24) "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 (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in Schedule RHS 8-30.

(25) "Derived air concentration-hour" (DAC-hour) is 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 may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 Sv).

(26) "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).

(27) "Division" means the Division of Radiological Health of the Tennessee Department of Environment and Conservation.

(28) "Dose or radiation dose" is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined in other paragraphs of this rule.

(29) "Dose equivalent" (H_T) means the product of the absorbed dose in tissue, the quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

(30) "Dosimetry processor" means an individual or an organization that processes and evaluates individual monitoring equipment in order to determine the radiation dose delivered to the equipment ($\Sigma H_E,50=(W_T H_T,50)$.

(31) "Effective dose equivalent" (EDE) (H_E) is the sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated ($H_E=(\Sigma W_T H_T)$.

(32) "Embryo/fetus" means the developing human organism from conception until the time of birth.

(Rule 0400-20-05-.32, continued)

(33) "Entrance or access point" means any location through which an individual could gain access to radiation areas or to sources of radiation. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

(34) "Exposure" means being exposed to ionizing radiation or to radioactive material.

(35) "External dose" means that portion of the dose equivalent received from sources of radiation outside the body.

(36) "Extremity" means hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

(37) "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.

(38) "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.

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

(40) "Generally applicable environmental radiation standards" means standards issued by the Environmental Protection Agency (EPA) under the authority of the Atomic Energy Act of 1954, as amended, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outside the boundaries of locations under the control of persons possessing or using sources of radiation.

(41) "Government agency" means any executive department, commission, independent establishment, corporation wholly or partly owned by the United States of America, which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government.

(42) "Gray" (See subparagraph (1)(a) of Rule 0400-20-05-.33).

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

(44) "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 a dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

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

(46) "Individual" means any human being.

(47) "Individual monitoring" means:

(a) The assessment of dose equivalent by the use of devices designed to be worn by an individual;

(b) The assessment of committed effective dose equivalent by bioassay (see Bioassay) or by determination of the time–weighted air concentrations to which an individual has been exposed, i.e., DAC–hours; or

(Rule 0400-20-05-.32, continued)

(c) The assessment of dose equivalent by the use of survey data.

(48) "Individual monitoring devices" ("individual monitoring equipment") means devices designed to be worn by a single individual for the assessment of dose equivalent, such as film badges, thermoluminescence dosimeters (TLDs), pocket ionization chambers, and personal ("lapel") air sampling devices.

(49) "Internal dose" means that portion of the dose equivalent received from radioactive material taken into the body.

(50) "Lens dose equivalent" applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg/cm^2).

(51) "License" means a license issued under the regulations in Chapter 0400-20-10.

(52) "Licensed material" means radioactive material received, possessed, used, transferred or disposed of under a general or specific license issued by the Division.

(53) "Licensee" means the holder of a license.

(54) "Limits" ("dose limits") means the permissible upper bounds of radiation doses.

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

(56) "Lost" or "missing radioactive material" means radioactive material whose location is unknown. It includes material that has been shipped but has not reached its destination and whose location cannot be readily traced in the transportation system.

(57) "Member of the public" means any individual except when that individual is receiving an occupational dose.

(58) "Minor" means an individual less than 18 years of age.

(59) "Misadministration" means an event that meets the criteria in Rule 0400-20-05-.145.

(60) "Monitoring" ("radiation monitoring", "radiation protection monitoring") means the measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

(61) "Nationally tracked sources" means a sealed source containing a quantity equal to or greater than Category 1 or Category 2 levels of any radioactive material listed in Rule 0400-20-05-.164. In this context a sealed source is defined as radioactive material that is sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. It does not mean material encapsulated solely for disposal or nuclear material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet. Category 1 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 1 threshold. Category 2 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 2 threshold but less than the Category 1 threshold.

(62) "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.

(Rule 0400-20-05-.32, continued)

(63) "Nonstochastic effect" means health effects, 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 (also called a deterministic effect).

(64) "NRC" means the Nuclear Regulatory Commission or its duly authorized representatives.

(65) "Occupational dose" means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from registered, unregistered, licensed and unlicensed sources of radiation, whether in the possession of the licensee, registrant or other person. Occupational dose does not include dose received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with Rule 0400-20-07-.35, from voluntary participation in medical research programs, or as a member of the public.

(66) "Person" means an individual, trust, firm, joint stock company, corporation (including a government corporation), partnership, association, state, municipality, commission, political subdivision of a state, any interstate body, any governmental agency of this state and any department, agency or instrumentality of the federal government.

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

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

(69) "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.

(70) "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.

(71) "Public dose" means the dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under the control of a licensee or registrant. Public Dose does not include occupational dose or doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with Rule 0400-20-07-.35, or from voluntary participation in medical research programs.

(72) "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.

(73) "Quality factor" (Q) means the modifying factor (see Tables RHS 5-1 and RHS 5-2) that is used to derive dose equivalent from absorbed dose.

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

(75) "Quarter" means a period of time equal to one-fourth of the year observed by the licensee or registrant (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.

(Rule 0400-20-05-.32, continued)

(76) "Rad" (See Rule 0400-20-05-.33(1)(b)).

(77) "Radiation" includes all ionizing electromagnetic waves and corpuscular emissions such as, but not necessarily limited to, gamma rays and x-rays, alpha and beta particles, electrons, neutrons, and protons, and other nuclear particles, but not radio waves or visible, infrared, or ultraviolet light.

(78) "Radiation area" means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

(79) "Reference man" means a hypothetical aggregation of human physical and physiological characteristics arrived at by the Division after considering among others data and information published by the International Commission on Radiation Protection and the National Council on Radiation Protection and Measurements.

(80) "Rem" (See Rule 0400-20-05-.33(1)(c)).

(81) "Respiratory protective device" means an apparatus, such as a respirator, used to reduce the individual's intake of airborne radioactive materials.

(82) "Restricted area" means an area, access to which is limited by the licensee or registrant for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

(83) "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.

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

(85) "Shallow–dose equivalent (Hs)", which applies to the external exposure of the skin of the whole body or the skin of an extremity, is taken as the dose equivalent at a tissue depth of 0.007 centimeter (7 mg/cm^2).

(86) "Sievert" (See Rule 0400-20-05-.33(1)(d)).

(87) "Site boundary" means that line beyond which the land or property is not owned, leased or otherwise controlled by the licensee or registrant.

(88) "Source material" refers to:

(a) Uranium or thorium, or any combination thereof, in any physical or chemical form; or

(b) Ores which contain by weight, one-twentieth of one percent (0.05%) or more of: uranium, thorium or any combinations thereof. Source material does not include special nuclear material.

(89) "Stochastic effects" means health effects that occur 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.

(Rule 0400-20-05-.32, continued)

(90) "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.

(91) "Survey" means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the location of a source of radiation and measurements or calculations of levels of radiation or concentrations or quantities of radioactive material present.

(92) "Tight-fitting facepiece" means a respiratory inlet covering that forms a complete seal with the face.

(93) "Total effective dose equivalent" (TEDE) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

(94) "Unrestricted area" means an area, access to which is neither limited nor controlled by the licensee or registrant.

(95) "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.

(96) "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 1 meter from any surface that the radiation penetrates.

(Note: At very high doses received at high dose rates, units of absorbed dose (e.g., rads and grays) are appropriate, rather than units of dose equivalent (e.g., rems and sieverts)).

(97) "Week" means 7 consecutive days starting on Sunday.

(98) "Weighting factor (W_T), for an organ or tissue (T)" is the proportion of the risk of stochastic effects resulting from irradiation of the 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 WT are:

ORGAN DOSE WEIGHTING FACTORS

Organ or Tissue	W_T
Gonads	0.25
Breasts	0.15
Red Bone Marrow	0.12
Lung	0.12
Thyroid	0.03
Bone Surfaces	0.03
Remainder	[1]0.30
Whole Body	[2]1.00

[1] 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.

[2] 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

(Rule 0400-20-05-.32, continued)

specific guidance is issued.

(99) "Whole body" means, for purposes of external exposure, head, trunk (including male gonads), arms above the elbow, or legs above the knee.

(100) "Working level" (WL) is any combination of short-lived radon daughters (for radon-222: polonium-218, lead-214, bismuth-214, and polonium-214; and for radon-220: polonium-216, lead-212, bismuth-212, and polonium-212) in 1 liter of air that will result in the ultimate emission of 1.3 x 105 MeV of potential alpha particle energy.

(101) "Working level month" (WLM) means an exposure to 1 working level for 170 hours (2,000 working hours per year/12 months per year = approximately 170 hours per month).

(102) "Year" means the period of time beginning in January used to determine compliance with the provisions of these standards. The licensee or registrant may change the starting date of the year used to determine compliance by the licensee or registrant provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.33 UNITS OF RADIATION DOSE.

(1) Definitions. As used in these standards the units of radiation dose are:

(a) Gray (Gy) is the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule/kilogram (100 rads).

(b) Rad is the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 gray).

(c) Rem is the special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 sievert).

(d) Sievert is the SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 rems).

(2) As used in these standards the quality factors for converting absorbed dose to dose equivalent are shown in Table RHS 5-1.

TABLE RHS 5-1 QUALITY FACTORS AND ABSORBED DOSE EQUIVALENCIES

Type of Radiation	Quality Factor (Q)	Absorbed dose equal to a unit dose equivalent[1]
X-, gamma, or beta radiation	1	1
Alpha particles, multiple charged particles, fission fragments and heavy particles of unknown charge	20	0.05

(Rule 0400-20-05-.33, continued)

Neutrons of unknown energy	10	0.1
High-energy protons	10	0.1

[1] Absorbed dose in rad equal to 1 rem or the absorbed dose in gray equal to 1 sievert.

If measuring the neutron fluence rate is more convenient than determining the neutron dose equivalent rate as provided in this paragraph, 1 rem (0.01 Sv) of neutron radiation of unknown energies may be assumed to result from a total fluence of 25 million neutrons per square centimeter incident upon the body. If sufficient information exists to estimate the approximate energy distribution of the neutrons, the licensee or registrant may use the fluence rate per unit dose equivalent or the appropriate Q value from Table RHS 5-2 to convert a measured tissue dose in rads to dose equivalent in rems.

TABLE RHS 5-2 MEAN QUALITY FACTORS, Q, AND FLUENCE PER UNIT DOSE EQUIVALENT FOR MONOENERGETIC NEUTRONS

	Neutron Energy (MeV)	Quality Factor [a] (Q)	Fluence per unit dose equivalent [b] (neutrons cm^{-2} rem^{-1})
(Thermal).	2.5×10^{-8}	2	980×10^{6}
	1×10^{-7}	2	980×10^{6}
	1×10^{-6}	2	810×10^{6}
	1×10^{-5}	2	810×10^{6}
	1×10^{-4}	2	840×10^{6}
	1×10^{-3}	2	980×10^{6}
	1×10^{-2}	2.5	1010×10^{6}
	1×10^{-1}	7.5	170×10^{6}
	5×10^{-1}	11	39×10^{6}
	1	11	27×10^{6}
	2.5	9	29×10^{6}
	5	8	23×10^{6}
	7	7	24×10^{6}
	10	6.5	24×10^{6}
	14	7.5	17×10^{6}
	20	8	16×10^{6}
	40	7	14×10^{6}
	60	5.5	16×10^{6}
	1×10^{2}	4	20×10^{6}
	2×10^{2}	3.5	19×10^{6}
	3×10^{2}	3.5	16×10^{6}
	4×10^{2}	3.5	14×10^{6}

[a] Value of quality factor (Q) at the point where the dose equivalent is maximum in a 30-cm diameter cylinder tissue-equivalent phantom.
[b] Monoenergetic neutrons incident normally on a 30-cm diameter cylinder tissue-equivalent phantom.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.34 UNITS OF RADIOACTIVITY.

(1) For the purposes of these standards, activity is expressed in the special unit of curies (Ci) or in the SI unit of becquerels (Bq), or their multiples, or disintegrations (transformations) per unit of time.

(a) One becquerel = 1 disintegration per second (s^{-1}).

(Rule 0400-20-05-.34, continued)

(b) One curie = 3.7×10^{10} disintegrations per second = 3.7×10^{10} becquerels = 2.22×10^{12} disintegrations per minute.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.35 COMMUNICATIONS.

Unless otherwise specified, communications or reports concerning the regulations should be addressed to the Director, Division of Radiological Health, and mailed to the address given in Rule 0400-20-04-.07.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.36 THROUGH 0400-20-05-.39 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.40 RADIATION PROTECTION PROGRAMS.

(1) Each licensee and registrant shall develop, document and implement a radiation protection program for a licensee's or registrant's activities that ensures compliance with these standards. See Rule 0400-20-05-.131 for recordkeeping requirements relating to these programs.

(2) The licensee's or registrant's procedures and engineering controls shall be based on sound radiation protection principles and shall achieve occupational doses and doses to members of the public that are ALARA.

(3) The licensee or registrant shall periodically (at least annually) review radiation protection program content and implementation.

(4) To implement the ALARA requirements of paragraph (2) of this rule and notwithstanding the requirements in Rule 0400-20-05-.70, licensees shall establish a constraint on air emissions of radioactive material to the environment, excluding radon-222 and its daughters. The constraint shall ensure that the individual member of the public likely to receive the highest dose shall not be expected to receive a total effective dose equivalent in excess of 10 millirems (0.1 millisievert) per year from these emissions. If a licensee exceeds this dose constraint, the licensee shall report the occurrence as provided in Rule 0400-20-05-.143 and take prompt, appropriate corrective action to ensure against recurrence.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.41 THROUGH 0400-20-05-.49 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.50 OCCUPATIONAL DOSE LIMITS FOR ADULTS.

(1) Except for planned special exposures under Rule 0400-20-05-.54, the licensee or registrant shall limit the occupational dose to individual adults to the following annual dose limits:

(a) An annual limit that is the lesser of:

(Rule 0400-20-05-.50, continued)

1. A total effective dose equivalent of 5 rems (0.05 Sv) or

2. 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 equal to 50 rems (0.5 Sv).

(b) The annual limits to the lens of the eye, to the skin of the whole body and to the skin of the extremities:

1. A lens–dose equivalent to 15 rems (0.15 Sv), and

2. A shallow–dose equivalent of 50 rems (0.50 Sv) to the skin of the whole body or to the skin of any extremity.

(2) The amount by which occupational dose from all sources exceeds an individual's annual limits shall be subtracted from the individual's limits for planned special exposures for the current year and for lifetime exposure. See parts (1)(f)1 and 2 of Rule 0400-20-05-.54.

(3) When external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the Division or by the Nuclear Regulatory Commission. The assigned deep–dose equivalent shall be for the part of the body receiving the highest exposure. The assigned shallow–dose equivalent shall be the dose averaged over the contiguous 10 cm^2 of skin receiving the highest exposure. Deep–dose, lens–dose and shallow–dose equivalents may be assessed from surveys or other radiation measurements to demonstrate compliance with occupational dose limits. However, this may be done only if the individual monitoring device was not subject to the highest potential exposure, or the individual monitoring results are unavailable.

(4) Derived air concentration (DAC) and annual limit on intake (ALI) values are presented in Schedule RHS 8-30 and may be used to determine the individual's dose and demonstrate compliance with the occupational dose limits.

(5) In addition to 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 Schedule RHS 8-30).

(6) The licensee 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.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.51 COMPLIANCE WITH REQUIREMENTS FOR SUMMATION OF EXTERNAL AND INTERNAL DOSES.

(1) If the licensee is required to monitor under subparagraphs (1)(a) and (b) of Rule 0400-20-05-.71, 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 under subparagraph (1)(a) of Rule 0400-20-05-.71 or only under subparagraph (1)(b) of Rule 0400-20-05-.71 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 by meeting one of the conditions specified in paragraph (2) of this rule and the conditions in paragraphs (3) and (4) of this rule.

(Note: The dose equivalents for the lens of the eye, the skin, and the extremities are not

(Rule 0400-20-05-.51, continued)

included in the summation, but are subject to separate limits.)

(2) 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:

(a) The sum of the fractions of the inhalation ALI for each radionuclide; or

(b) The total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by 2,000; or

(c) The sum of the calculated committed effective dose equivalents to all significantly irradiated organs or tissues (T)[1] where the organ dose is expressed as a fraction of the annual limit. This sum shall be calculated from bioassay data using appropriate biological models.

(3) Intake by oral ingestion. The licensee shall account for oral ingestion of radionuclides and include it in demonstrating compliance with the limits when:

(a) The occupationally exposed individual intakes radionuclides by ingestion; and

(b) The oral ingestion exceeds 10 percent of the applicable oral ALI.

(4) Intake through wounds or absorption through skin. The licensee shall evaluate and, to the extent practical, account for intakes through wounds or skin absorption.

(Note: The intake through intact skin has been included in the calculation of DAC for hydrogen-3 and does not need to be further evaluated.)

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.52 DETERMINATION OF EXTERNAL DOSE FROM AIRBORNE RADIOACTIVE MATERIAL.

In determining the dose from airborne radioactive material, the licensee shall include the contribution to the deep-dose equivalent, lens-dose equivalent, and shallow-dose equivalent from external exposure to the radioactive cloud (see Schedule RHS 8-30 footnotes 1 and 2).

(Note: Airborne radioactivity measurements and DAC values should 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 should be based upon measurements using instruments or individual monitoring devices.)

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

[1] An organ or tissue is considered significantly irradiated if the product of the weighting factors, W_T, and the committed dose equivalent, H_{T50}, per unit intake for that organ or tissue is greater than 10 percent of the maximum weighted value of H_{T50} (i.e., $W_T H_{T50}$) per unit intake for any organ or tissue.

0400-20-05-.53 DETERMINATION OF INTERNAL EXPOSURE.

(1) To assess the dose used to determine compliance with occupational dose equivalent limits, and when required by Rule 0400-20-05-.71, the licensee shall take suitable and timely measurements of:

(a) Concentrations of radioactive materials in air in work areas; or

(b) Quantities of radionuclides in the body; or

(c) Quantities of radionuclides excreted from the body; or

(d) Combinations of these measurements.

(2) The licensee shall assume that the concentration of airborne radioactive material inhaled by an individual is equal to the concentration in the individual's ambient air unless:

(a) Respiratory protective equipment is used, as provided in Rule 0400-20-05-.92; or

(b) The assessment of intake is based on bioassays.

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

(a) 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

(b) Upon prior approval of the Division adjust the DAC or ALI values to reflect the actual physical and chemical characteristics of airborne radioactive material (e.g., aerosol size distribution or density); and

(c) Separately assess the contribution of fractional intakes of Class D, W or Y compounds of a given radionuclide (see Schedule RHS 8-30) to the committed effective dose equivalent.

(4) If the licensee uses the measurements in subparagraph (1)(b) or (c) of this rule to assess intakes of Class Y material, the licensee may delay recording and reporting the assessments for up to 7 months. This delay is allowed only if:

(a) It is necessary to make additional measurements basic to the assessments;

(b) Recording and reporting are not otherwise required by Rule 0400-20-05-.141 or 0400-20-05-.143.

(5) 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 must be either:

(a) The sum of the ratios of the concentration to the appropriate DAC value (e.g., D, W, Y) from Schedule RHS 8-30 for each radionuclide in the mixture; or

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

(Rule 0400-20-05-.53, continued)

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

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

(a) The licensee uses the total activity of the mixture in demonstrating compliance with the dose limits in Rule 0400-20-05-.50 and in complying with the monitoring requirements in subparagraph (1)(b) of Rule 0400-20-05-.71;

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

(c) The sum of the percentages for all disregarded radionuclides does not exceed 30 percent.

(8) 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 Sv). This assumption may only be made for radionuclides that have their ALIs or DACs based on the committed effective dose equivalent.

(9) When the ALI (and the associated DAC) is determined by the nonstochastic organ dose limit of 50 rems (0.5 Sv), the intake of radionuclides that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) (the stochastic ALI) is listed in parentheses in Table 1 of Schedule RHS 8-30. In this case, the licensee may, as a simplifying assumption, use the stochastic ALIs to determine committed effective dose equivalent. However, if the licensee uses the stochastic ALIs, the licensee must also demonstrate that the limit in subparagraph (1)(a) of Rule 0400-20-05-.50 is met.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.54 PLANNED SPECIAL EXPOSURES.

(1) A licensee or registrant may authorize an adult worker to receive doses in addition to the doses received under the limits specified in Rule 0400-20-05-.50. Additional doses are allowed only if the following conditions are satisfied:

(a) The additional doses are accounted for separately from the doses received under the limits in Rule 0400-20-05-.50.

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

(c) The licensee or registrant (and employer if different from the licensee or registrant) gives specific written authorization before the planned special exposure occurs.

(d) Before a planned special exposure, the licensee or registrant ensures that the individuals involved are:

1. Informed of the purpose of the planned operation;

(Rule 0400-20-05-.54, continued)

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.

(e) Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant ascertains prior doses during the lifetime of the individual for each individual involved, as required by paragraph (2) of Rule 0400-20-05-.133.

(f) Subject to paragraph (2) of Rule 0400-20-05-.50 the licensee or registrant does 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 paragraph (1) of Rule 0400-20-05-.50 in any year; and

2. Five times the annual dose limits in paragraph (1) of Rule 0400-20-05-.50 during the individual's lifetime.

(g) The licensee or registrant maintains records of the conduct of a planned special exposure in accordance with Rule 0400-20-05-.134 and submits a written report in accordance with Rule 0400-20-05-.144.

(h) The licensee or registrant records in the individual's record the best estimate of the dose resulting from the planned special exposure. The dose from planned special exposures is not to be considered in controlling future occupational dose of the individual under paragraph (1) of Rule 0400-20-05-.50 but is to be included in evaluations required by subparagraphs (1)(e) and (f) of this rule.

(i) The licensee or registrant gives the individual written notice of the estimated dose within 30 days after the date of the planned special exposure.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.55 OCCUPATIONAL DOSE LIMITS FOR MINORS.

The annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adult workers in Rule 0400-20-05-.50.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.56 DOSE TO AN EMBRYO/FETUS.

(1) 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 mSv). (For recordkeeping requirements see Rule 0400-20-05-.135).

(2) Using ALARA the licensee or registrant shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman.

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

(Rule 0400-20-05-.56, continued)

(a) The deep-dose equivalent to the declared pregnant woman; and

(b) The dose equivalent to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

(4) If when a woman declares her pregnancy to the licensee or registrant the dose equivalent to the embryo/fetus is found to be 0.45 rem (4.5 mSv) or greater, the embryo/fetus is permitted an additional dose equivalent not exceeding 0.05 rem (0.5 mSv) during the remainder of the pregnancy.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.57 THROUGH 0400-20-05-.58 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.59 ORDER REQUIRING FURNISHING OF BIOASSAY SERVICES.

Where necessary to ascertain the extent of an individual's exposure to concentrations of radioactive material, the Division may require a licensee to make available to the individual bioassay services and to furnish a copy of the reports of such services to the Division.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.60 DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC.

(1) Each licensee and registrant shall conduct operations so that:

(a) The total effective dose equivalent received by any individual member of the public from the licensed or registered operation does not exceed 0.1 rem (1 mSv) in a year. This limit is exclusive of the dose contribution from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with Rule 0400-20-07-.35, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with Rule 0400-20-05-.122; and

(b) The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with Rule 0400-20-07-.35, does not exceed 0.002 rem (0.02 mSv) in any one hour.

(2) If a licensee or registrant permits members of the public to have access to controlled areas, the limit for members of the public continues to apply to those individuals.

(3) Notwithstanding paragraph (1)(a) of this rule, a licensee or registrant may permit visitors to an individual who cannot be released, under Rule 0400-20-07-.35, to receive a radiation dose greater than 0.1 rem (1mSv) if:

(a) The radiation dose received does not exceed 0.5 rem (5 mSv); and

(b) The authorized user, as defined in Rule 0400-20-07-.05, has determined before the visit that it is appropriate.

(Rule 0400-20-05-.60, continued)

(4) A licensee, registrant or applicant may apply for prior authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 mSv). This application by the licensee, registrant or applicant shall include the following:

(a) Demonstration of the need for and the expected duration of operations in excess of the limit in paragraph (1) of this rule;

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

(c) The procedures to be followed to maintain the dose as low as is reasonably achievable (ALARA).

(5) In addition to the requirements of this chapter, a licensee or registrant subject to the provisions of EPA's generally applicable environmental radiation standards in 40 CFR Part 190 shall comply with those standards.

(6) The Division 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.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.61 COMPLIANCE WITH DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC.

(1) The licensee or registrant shall demonstrate compliance with the dose limits in Rule 0400-20-05-.60 by making or causing to be made surveys of:

(a) Radiation levels in unrestricted and restricted areas; and

(b) Radiation levels and radioactive materials in effluents released to unrestricted areas.

(2) A licensee or registrant shall show compliance with the annual dose limit in Rule 0400-20-05-.60 by:

(a) Demonstrating by measurement or calculation that the individual likely to receive the highest dose from the licensee's or registrant's operation does not receive a total effective dose equivalent exceeding the annual dose limit; or

(b) Demonstrating that:

1. 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 2 of Schedule RHS 8-30; and

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

(3) Upon approval from the Division, the licensee may adjust the effluent concentration values in Schedule RHS 8-30, Table 2, for members of the public, to take into account the actual physical and chemical characteristics of the effluents (e.g., aerosol size distribution, solubility, density, radioactive decay equilibrium, chemical form).

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq* ***Administrative History:*** *Original rule filed*

(Rule 0400-20-05-.61, continued)
February 22, 2012; effective May 22, 2012.

0400-20-05-.62 THROUGH 0400-20-05-.69 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.70 GENERAL SURVEY AND MONITORING REQUIREMENTS.

1) Each licensee and registrant shall make or cause to be made, surveys of areas, including the subsurface, that:

(a) May be necessary for the licensee or registrant to comply with the standards in this chapter; and

(b) Are reasonable under the circumstances to evaluate:

1. The magnitude and extent of radiation levels;

2. Concentrations or quantities of residual radioactive material; and

3. The potential radiological hazards of the radiation levels and residual radioactivity detected.

(2) Notwithstanding the requirements in .0400-20-05-.132, records from surveys describing the location and amount of subsurface residual radioactivity identified at the site must be kept with records important for decommissioning, and such records must be retained in accordance with 0400-20-10-.26 as applicable.

~~(2)~~(3) The licensee or registrant shall ensure that instruments and equipment used for quantitative radiation measurements (e.g., dose rate and effluent monitoring) are calibrated periodically for the radiation measured.

~~(3)~~(4) Except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to the extremities, all personnel dosimeters for determining the dose and used to comply with these standards or with conditions specified in a license or registration shall be processed and evaluated by a dosimetry processor:

(a) Holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology; and

(b) Approved for processing and evaluating dosimeters exposed to the type of radiation(s) included in the NVLAP program that most closely approximates the type of radiation(s) being monitored by the dosimeter.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.71 CONDITIONS REQUIRING INDIVIDUAL MONITORING OF EXTERNAL AND INTERNAL OCCUPATIONAL DOS

(1) Each licensee and registrant shall monitor exposures to radiation and radioactive material at levels sufficient to demonstrate compliance with the occupational dose limits of this chapter:

(Rule 0400-20-05-.71, continued)

(a) Each licensee and registrant shall monitor occupational exposure to radiation from licensed or unlicensed and registered or unregistered radiation sources under the control of the licensee and registrant 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 Rule 0400-20-05-.50;

2. Minors likely to receive, in 1 year from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv), 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);

3. Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv) [2]; and

4. Individuals entering a high or very high radiation area.

(2) Each licensee shall monitor (see Rule 0400-20-05-.53) the occupational intake of radioactive material by, and assess the committed effective dose equivalent to:

(a) Adults likely to receive, in 1 year, an intake in excess of ten percent of the applicable ALI(s) in Table 1, Columns 1 and 2, of Schedule RHS 8–30;

(b) Minors likely to receive, in 1 year, a committed effective dose equivalent in excess of 0.1 rem (1 mSv); and

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

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.72 THROUGH 0400-20-05-.79 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.80 CONTROL OF ACCESS TO HIGH RADIATION AREA REQUIREMENTS

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

(a) A device that, upon an attempt at entry and before any opening into the area occurs, reduces the level of radiation. Before an opening occurs the level of radiation shall be below that at which an individual could receive a deep-dose equivalent of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the source of radiation or any surface that the radiation penetrates;

(b) A device that emits a conspicuously visible or audible alarm so the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; or

[2] All of the occupational doses in Rule 0400-20-05-.50 continue to be applicable to the declared pregnant woman as long as the embryo/fetus dose equivalent limit is not exceeded.

(Rule 0400-20-05-.71, continued)

(c) Locked entryways, except when access to the area is required, with positive control over each individual entry.

(2) In the case of a high radiation area established for a period of 30 days or less, the licensee or registrant may substitute continuous direct or electronic surveillance to prevent unauthorized entry for the controls required in paragraph (1) of this rule.

(3) A licensee or registrant may apply to the Division for approval of alternative methods for controlling access to high radiation areas.

(4) No control required by paragraphs (1) through (3) of this rule shall prevent individuals from leaving a high radiation area.

(5) Control is not required for 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:

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

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

(6) Control of areas in hospitals is not required solely because of the presence of patients containing radioactive material, provided:

(a) There are personnel in attendance who will take necessary precautions to prevent exposure of individuals to radiation or radioactive material in excess of the limits in these standards; and

(b) The licensee operates within the ALARA provisions of its radiation protection program.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.81 CONTROL OF ACCESS TO VERY HIGH RADIATION AREAS.

In addition to the requirements in Rule 0400-20-05-.80, the licensee or registrant shall institute additional 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.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.82 CONTROL OF ACCESS TO VERY HIGH RADIATION AREAS - IRRADIATORS.

(1) Each area in which there may exist radiation levels in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radiation source[3] that is used to irradiate materials shall meet the following requirements:

[3] This rule applies to radiation from radiation sources that are used in non-self-shielded configuration. This rule does not apply to sources of radiation that are used in teletherapy, in radiography, or in completely self-shielded irradiators in which the source is both stored and operated within the same shielding radiation barrier and, in the designed configuration of the equipment, is always physically inaccessible to any individual and cannot create high levels of radiation in an area that is accessible to any individual.

(Rule 0400-20-05-.82, continued)

(a) At least one authorized person who is familiar with the activity of the facility and is prepared to render or summon assistance shall be physically present when radiation is produced.

(b) Each installation shall have primary barriers and/or secondary barriers sufficient to assure compliance with Rules 0400-20-05-.50, 0400-20-05-.55, 0400-20-05-.56 and 0400-20-05-.60 of these standards.

(c) Each irradiation area shall be constructed so that persons within the area shall at all times be able to leave. Access control devices required by parts (h)2 through 4 of this paragraph shall not prevent an individual from leaving the area.

(d) Devices and administrative procedures shall control each area to ensure that the area is clear of individuals prior to irradiation.

(e) After any use of the radiation source and prior to the first individual's entry into the area, the area shall be surveyed to ensure that the radiation level in the area from the radiation source is below that at which an individual could receive a deep-dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour.

(f) Control Panel:

1. Only the operator at the control panel shall be able to activate an irradiator to create a radiation field in any area.

2. The irradiator control panel shall be provided with a locking device to prevent unauthorized use. The locking device shall, when locked, make the irradiator incapable of creating a radiation field.

3. The control panel and each entrance to an irradiation area shall have a device that gives a continuous indication of the radiation levels present in the area(s).

4. All meters and controls on the irradiator control panel shall be identified and discernible.

5. The operator shall have at the control panel a copy of operating and emergency procedures specific for that facility.

(g) Warning Devices:

1. Each area shall have devices that automatically generate conspicuously visible and audible alarm signals for at least five (5) seconds before irradiation begins. Following activation of these warning devices, there shall be a delay of not less than thirty (30) seconds before the irradiation may begin. The alarm signals shall be discernible in all irradiation areas. The alarm signals shall be sufficient to alert personnel in the area and to allow any individual in the area to reach and to operate the clearly identified emergency shut-off switches required in part (h)1 of this paragraph.

2. Each area shall have visible flashing or rotating warning lights that operate when, and only when, radiation is being produced. Each entrance shall have a visible warning device that need not be flashing or rotating, but which operates when, and only when, radiation is being produced.

(h) Control Devices:

(Rule 0400-20-05-.82, continued)

1. Each area shall contain accessible emergency shut-off switches. Operation of an emergency shut-off switch shall prevent irradiation from occurring. These switches and their mode of operation shall be identified by a conspicuously posted sign adjacent to each switch. Shut-off switches shall include a manual reset at each switch that must be reset at the switch before the irradiator may be reactivated by the operator at the control panel.

2. Each entrance or access point shall be equipped with interlocks. When any interlock is interrupted, broken, or tripped and before any opening into the area occurs, either:

   (i) The irradiator shall shut off automatically; or

   (ii) The radiation level within the area from the radiation source shall be reduced below that at which an individual could receive a deep-dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour.

   After shut-off or reduction in output, restoring the irradiator to full operation shall be possible only from the control panel.

3. Additional control devices shall be provided so that, upon failure of the interlocks to function as required by part 2 of this subparagraph:

   (i) The radiation level within the area from the radiation source shall be reduced below that at which an individual could receive a deep-dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour; and

   (ii) Conspicuously visible and audible alarm signals shall be generated that make the following persons aware of the hazard and of the failure of the interlocks:

      (I) Any individual attempting to enter the area; and

      (II) The individual required to be present in subparagraph (a) of this paragraph.

4. Interlocks shall not be used to shut off the irradiator except in an emergency or during testing.

5. Interlocks shall be bypassed only to test, adjust, maintain, and/or rearrange equipment. A conspicuous indication of the bypassed condition shall be made at the control panel. This subparagraph does not authorize the operation of an irradiator with warning devices, interlocks, emergency shut-off switches or other control devices that are incapable of proper operation.

6. Activities in which interlocks are bypassed as permitted under part 5 of this subparagraph shall be:

   (i) Authorized only by the radiation safety officer;

   (ii) Performed only for a specified time;

   (iii) Recorded, showing:

      (I) Date,

(Rule 0400-20-05-.82, continued)

(II) Length of time bypassed,

(III) Reason for bypassing, and

(IV) Signature of the individual installing and removing the bypass.

These records shall be maintained for inspection by the Division; and

(iv) Performed at low power and current, if possible.

7. No individual shall be permitted to enter an area, the access of which is controlled by interlocks, while such interlocks are bypassed as permitted in part 5 of this subparagraph, unless such individual is utilizing personnel monitoring equipment that shall give an audible indication when a dose rate of 0.015 rem (0.15 mSv) per hour is exceeded. The personnel monitoring equipment referred to in this part is in addition to that required elsewhere in these standards. Calibration requirements in paragraph (2) of Rule 0400-20-05-.70 shall also apply to such personnel monitoring equipment.

8. The licensee or registrant shall provide control devices so that, upon failure or removal of physical radiation barriers other than a sealed source's shielded storage container:

(i) The radiation level within the area from the radiation source shall be reduced below that at which an individual could receive a deep-dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour; and

(ii) Conspicuously visible and audible alarm signals shall be generated that make the following persons aware of the hazard and of the failure or removal of the physical barrier:

(I) Any individual attempting to enter the area; and

(II) The individual required to be present in subparagraph (a) of this paragraph.

9. When the shield for the stored sealed source(s) is a liquid, the licensee shall provide means to monitor the integrity of the shield and to signal, automatically, loss of adequate shielding.

10. Physical radiation barriers that comprise permanent structural components, such as walls, which have no credible probability of failure or removal in ordinary circumstances need not meet the requirements of part 8 of this subparagraph.

(i) There shall be available at each facility portable radiation monitoring equipment that is operable and has been calibrated for the radiations being produced by the facility. Such equipment shall be tested for operation and calibrated at intervals not to exceed 3 months and after each instrument servicing or repair. A note shall be attached to each instrument showing the latest calibration date. Records of calibration shall be maintained for inspection by the Division.

(j) The interlock and emergency shut-off systems required in subparagraph (h) of this paragraph shall be separate electrical circuits and/or mechanical systems.

(Rule 0400-20-05-.82, continued)

(k) Electrical circuit diagrams of the irradiator and the associated interlock and emergency shut-off systems shall be kept current and on file at each irradiator facility.

(l) The access control and warning devices required in subparagraphs (g) and (h) of this paragraph shall have been tested for proper functioning (see Rule 0400-20-05-.138 for recordkeeping requirements).

1. Unless irradiation was continued uninterrupted from the previous day, testing shall be conducted prior to daily initiation of irradiation;

2. After any unintended interruption, testing shall be conducted prior to resumption of irradiation; and

3. The licensee or registrant shall submit and adhere to a schedule for periodic tests of the access control and warning systems.

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

(n) Portals used in transporting only materials to and from the irradiation area shall be controlled by devices and administrative procedures that warn and physically protect individuals from inadvertent entry. Exit portals shall be equipped to:

1. Detect and signal the presence of any loose radiation sources being carried toward such an exit; and

2. Automatically prevent loose radiation sources from being carried out of the area.

(o) Licensees, registrants or applicants may apply to the Division for approval of alternative safety measures for irradiators, provided:

1. The irradiator is within the purview of this rule;

2. The irradiator will be used in a variety of positions or locations (such as open fields or forests) that make it impractical to comply with certain requirements of subparagraph (h) of this paragraph (such as automatic control of radiation levels);

3. Any alternative safety measures shall provide a degree of personnel protection at least equivalent to those specified in this rule;

4. At least one of the alternative measures shall include an access-preventing interlock control based on a measurement of the radiation. This interlock control shall ensure that no individual can gain access to the area in which an individual could receive a deep-dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or any surface that the radiation penetrates.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.83 THROUGH 0400-20-05-.89 RESERVED.

Authority: *§§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.90 USE OF PROCESS OR OTHER ENGINEERING CONTROLS.

The licensee shall use, to the extent practicable, process or other engineering controls (e.g., containment, decontamination or ventilation) to control the concentrations of radioactive material in air.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.91 USE OF OTHER CONTROLS.

(1) The licensee shall maintain the total effective dose equivalent ALARA by limiting intakes and increased monitoring if process or other engineering controls are not practical to control airborne radioactive materials concentration below those contained in the definition of airborne radioactivity area in Rule 0400-20-05-.32. The limitation of intakes and increased monitoring shall be by one or more of the following means:

(a) Control of access;

(b) Limitation of exposure times;

(c) Use of respiratory protection equipment; or

(d) Other mechanisms specifically approved by the Division.

(2) If the licensee performs an ALARA analysis to determine whether 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.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.92 USE OF INDIVIDUAL RESPIRATORY PROTECTION EQUIPMENT

(1) If the licensee assigns or permits the use of respiratory protection equipment to limit intakes pursuant to Rule 0400-20-05-.91:

(a) 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/Mine Safety and Health Administration (NIOSH/MSHA), except as otherwise noted in this chapter.

(b) A licensee desiring to use equipment that has not been tested or certified by NIOSH, or for which there is no schedule for testing or certification, shall apply for authorization except as provided in this chapter. The application shall demonstrate by licensee testing or on the basis of reliable test information, that the equipment's material and performance characteristics provide protection equivalent to that of the equipment in subparagraph (a) of this paragraph under anticipated conditions of use.

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

1. Air sampling sufficient to identify the potential hazard, permit proper equipment selection and estimate doses;

2. Surveys and bioassays, as appropriate, to evaluate actual intakes;

(Rule 0400-20-05-.92, continued)

3. Testing of respirators for operability (user seal check for face sealing devices and functional check for other) immediately before each use;

4. Written procedures regarding:

(i) The routine, non–routine and emergency use of respirators,

(ii) Respirator selection,
(iii) Fit testing,

(iv) Limitations on periods of respirator use and relief from respirator use,

(v) Storage, issuance, maintenance, repair, testing and quality assurance of respiratory protection equipment, including testing for operability immediately before each use;

(vi) Supervision and training of respirator users;

(vii) Monitoring, including air sampling and bioassays;

(viii) Breathing air quality;

(ix) Inventory and control;

(x) Record keeping; and

(xi) The use of process or other engineering controls, instead of respirators;

5. Determination by a physician that the individual user is medically fit to use the respiratory protection equipment before:

(i) The initial fitting of a face-sealing respirator;

(ii) The first field use of non–face–sealing respirators; and

(iii) Either every 12 months thereafter or periodically at a frequency determined by a physician;

6. 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.

(d) 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.

(e) The licensee's use of the equipment shall not exceed the equipment's specifications. The licensee shall provide proper visual, communication and other special capabilities (such as adequate skin protection) when needed.

(f) 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,

(Rule 0400-20-05-.92, continued)

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.

(g) 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 shall 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 shall be immediately available to assist all users of this type of equipment and to provide effective emergency rescue if needed.

(h) Atmosphere-supplying respirators shall 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:

1. Oxygen content (v/v) of 19.5-23.5%;

2. Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

3. Carbon monoxide (CO) content of 10 ppm or less;

4. Carbon dioxide content of 1,000 ppm or less; and

5. Lack of noticeable odor.

(i) 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.

(j) 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 shall be used. If the dose is later found to be less than the estimated dose, the corrected value may be used.

(2) In estimating an individual’s exposure to airborne radioactive materials, the licensee may make allowance for respiratory protection equipment used to limit intakes pursuant to Rule 0400-20-05-.91. To make such an allowance the following conditions, in addition to those in paragraph (1) of this rule shall be satisfied:

(a) The licensee selects respiratory protection equipment that provides a protection factor (see Schedule RHS 8–32) greater than the multiple by which peak concentrations of airborne radioactive materials in the working area are expected to exceed the values specified in Schedule RHS 8–30, Table 1, Column 3. If the selection of a respiratory protection device with a protection factor greater than the peak concentrations is inconsistent with the goal specified in Rule 0400-20-05-.91 of keeping the total effective dose equivalent ALARA, the licensee may select respiratory protection equipment with

(Rule 0400-20-05-.92, continued)

a lower protection factor only if such a selection would result in keeping the total effective dose equivalent ALARA. The concentration of radioactive material inhaled when respirators are used may be initially estimated by dividing the average concentration in air, during each period of uninterrupted respirator use, by the protection factor. If the exposure is later found to exceed the estimate, the corrected value shall be used; if the exposure is later found to be less than the estimate, the corrected value may be used.

(b) The licensee shall obtain authorization from the Division before assigning respiratory protection factors in excess of those specified in Schedule RHS 8–32. The Division may authorize a licensee to use higher protection factors on receipt of an application that:

1. Describes the situation for which a need exists for higher protection factors; and

2. Demonstrates that the respiratory protection equipment provides these higher protection factors under the proposed conditions of use.

(c) The licensee shall use as emergency devices only respiratory protection equipment that has been specifically certified or had certification extended for emergency use by NIOSH/MSHA.

(d) The licensee shall notify, in writing, the Division at least 30 days before the date that respiratory protection equipment is first used under the provisions of either paragraph (1) or (2) of this rule.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.93 FURTHER RESTRICTIONS ON THE USE OF RESPIRATORY PROTECTION EQUIPMENT.

(1) The Division may impose restrictions in addition to those in Rules 0400-20-05-.91 and 0400-20-05-.92 and in Schedule RHS 8-32 to:

(a) Ensure that the respiratory protection program of the licensee is adequate to limit doses of 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.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.94 APPLICATION FOR USE OF HIGHER ASSIGNED PROTECTION FACTORS.

(1) The licensee shall obtain authorization from the Division before using assigned respiratory protection factors in excess of those specified in Schedule RHS 8–32. The Division may authorize a licensee to use higher 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.

(2) Reserved.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.95 THROUGH 0400-20-05-.99 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.100 SECURITY OF STORED MATERIAL.

The licensee or registrant shall secure stored radiation sources against unauthorized access or removal.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.101 CONTROL OF MATERIAL NOT IN STORAGE.

The licensee shall control and maintain constant surveillance of radioactive material that is not in storage.

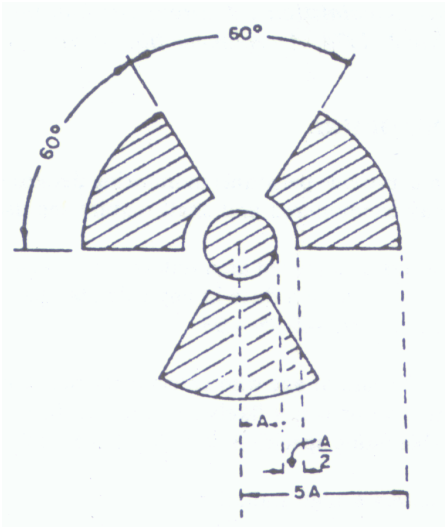
Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.102 THROUGH 0400-20-05-.109 RESERVED.

Authority: *§§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.110 CAUTION SIGNS.

(1) Unless otherwise authorized by the Division, the standard radiation symbol prescribed by this Chapter shall use the colors magenta, or purple, or black on yellow background. The symbol prescribed by this chapter is the three-bladed design:



RADIATION SYMBOL

(a) Cross-hatched area is to be magenta, or purple, or black; and

(Rule 0400-20-05-.110, continued)

(b) The background is to be yellow.

(2) The color requirements of paragraph (1) of this rule do not apply to licensees and registrants who use conspicuously etched or stamped radiation symbols to label sources, source holders or device components containing sources of radiation that are subjected to high temperatures.

(3) On or near the required signs and labels, the licensee or registrant may provide additional information to make individuals aware of potential radiation exposures and to minimize the exposures.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.111 POSTING REQUIREMENTS.

(1) 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.”

(2) 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.”

(3) 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.”

(4) 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.”

(5) Each area where radioactive material is used or stored in amounts exceeding 10 times that specified in Schedule RHS 8-31 shall be posted by the licensee with conspicuous sign(s) bearing the radiation symbol and the words “CAUTION, RADIOACTIVE MATERIAL(S)” or “DANGER, RADIOACTIVE MATERIAL(S).”

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

(a) The materials are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to radiation or radioactive materials in excess of the limits established in this chapter; and

(b) The area or room is subject to the licensee’s control.

(7) Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs pursuant to this rule provided that:

(a) The patient is being treated with sealed sources or has been treated with unsealed radioactive material in quantities less than 30 millicuries (110 MBq) or the measured dose rate at 1 meter from the patient is less than 0.005 rem (0.05 mSv) per hour; and

(b) There are personnel in attendance who will take the necessary precautions to:

1. Prevent the exposure of individuals to radiation and radioactive material in excess of these Basic Standards; and

(Rule 0400-20-05-.111, continued)

2. Operate within the ALARA provisions of the licensee's radiation protection program.

(8) 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 source container or housing does not exceed 0.005 rem (0.05 mSv) per hour.

(9) A room containing medical or dental diagnostic x-ray equipment, restricted to use within the room, need not be posted as noted in paragraphs (1) and (2) of this rule provided:

(a) The registrant exercises control to ensure the patient will be the only person exposed to radiation levels exceeding the limits in these standards; and

(b) Each room entrance is identified as an "X-ray Room".

(10) Provided a room or area is not otherwise required to be posted under paragraphs (1) or (2) of this rule, a room or area will not have to be so posted because mobile or portable medical or dental diagnostic x-ray equipment is intermittently used between rooms and/or areas.

(11) All radiation machines shall be clearly labeled at the control panel near the switch that energizes the apparatus, and at any remote switch that energize the apparatus, with the words "CAUTION - RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED" or "DANGER - RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED"

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.112 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.113 LABELING CONTAINERS.

(1) The licensee shall ensure that each container of radioactive 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 sufficient information to permit individuals handling, using or in the vicinity of the containers to take precautions to avoid or minimize exposures. Such information may need to include, without limitation, the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, the kinds of material and the mass enrichment.

(2) Prior to removal or disposal of empty uncontaminated containers to unrestricted areas, the licensee shall:

(a) Remove or deface the radioactive material label; or

(b) Otherwise clearly indicate that the container no longer contains radioactive materials.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.114 EXEMPTIONS TO LABELING REQUIREMENTS.

(1) A licensee is not required to label:

(a) Containers holding radioactive material in quantities less than the quantities listed in Schedule RHS 8-31;

(b) Containers holding radioactive material in concentrations less than those specified in Table 2 of Schedule RHS 8-30;

(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 chapter;

(d) Containers when they are in transport and packaged and labeled in accordance with the regulations of the U.S. Department of Transportation[4];

(e) Containers that are accessible only to individuals authorized to handle, use or be 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 reactor components, piping, and tanks.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.115 PROCEDURES FOR RECEIVING AND OPENING PACKAGES.

(1) Each licensee who expects to receive a package containing quantities of radioactive material in excess of a Type A quantity, as defined in Rule 0400-20-04-.04, shall arrange to receive:

(a) The package when the carrier offers it for delivery; or

(b) Notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.

(2) Each licensee shall:

(a) Monitor the external surfaces of a labeled[5] package for radioactive contamination unless the package contains only radioactive material in the form of a gas or in special form as defined in Rule 0400-20-04-.04;

(b) Monitor the external surfaces of a labeled 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 Rule 0400-20-04-.04 and Rule 0400-20-10-.37, Schedule RHS 10–6; and

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

[5] Labeled means labeled with a Radioactive White I, Yellow II or Yellow III label as specified in U.S. Department of Transportation (DOT) regulations in 49 CFR §§172.403 and 172.436–440, as published October 1, 1993.

(Rule 0400-20-05-.115, continued)

(c) 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.

(3) The licensee shall monitor as soon as practical after receipt of the package. A package received at the licensee's facility during the licensee's normal working hours or showing evidence of package degradation shall be monitored within 3 hours. A package not received during the licensee's normal working hours and not showing evidence of package degradation shall be monitored no later than 3 hours after the beginning of the next working day.

(4) The licensee shall immediately notify the final delivery carrier and the Division by telephone, telegram, mailgram or facsimile when either removable radioactive surface contamination or external radiation levels exceed the following:

(a) Removable radioactive surface contamination limits:

1. The level of removable (non–fixed) radioactive contamination on the external surfaces of each package offered for transport shall be kept ALARA. The level of removable radioactive contamination may be determined by wiping an area of 300 square centimeters of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient measurements shall be taken in the most appropriate locations to yield a representative assessment of the removable contamination levels. Except as provided in part 2 of this subparagraph, the amount of radioactivity measured on any single wiping material, when averaged over the surface wiped, shall not exceed the limits set forth in Table RHS 5–3 at any time during transport. Other methods of assessment of equal or greater efficiency may be used. When other methods are used, the detection efficiency of the method used shall be taken into account and in no case shall the removable contamination on the external surfaces of the package exceed 10 times the limits set forth in Table RHS 5–3.

Table RHS 5–3 REMOVABLE EXTERNAL RADIOACTIVE CONTAMINATION WIPE LIMITS

Contaminant	Maximum Permissible Limits		
	Bq/cm^2	$\mu Ci/cm^2$	dpm/cm^2
Beta and gamma emitters and low toxicity alpha emitters; all radionuclides with half–lives less than 10 days; natural uranium; natural thorium; uranium–235; uranium–238; thorium–232; thorium–228; and thorium–230 when contained in ores or physical concentrates	0.37	1 (E–5)	22
All other alpha emitting radionuclides	0.037	1 (E–6)	2.2

2. For packages transported as exclusive use shipments by rail or highway only, the removable contamination at any time during transport shall not exceed 10 times the levels prescribed in Table RHS 5–1. The levels at the beginning of transport shall not exceed the levels prescribed in Table RHS 5–1.

(b) External radiation limits:

(Rule 0400-20-05-.115, continued)

1. The external radiation levels around the package and around the vehicle, if applicable, shall not exceed 200 millirems (2 millisieverts) per hour at any point on the external surface of the package at any time during transportation. The transport index shall not exceed 10.

2. A package that exceeds the radiation level limits specified in part 1 of this subparagraph shall be transported as exclusive use by rail, highway, or water, and the radiation levels external to the package shall not exceed the following during transportation:

(i) 200 millirems (2 millisieverts) per hour on the accessible external surface of the package, unless the following conditions are met, in which case the limit is 1,000 millirems (10 millisieverts) per hour:

(I) The shipment is made in a closed transport vehicle;

(II) The package is secured within the vehicle so that its position remains fixed during transportation; and

(III) There are no loading or unloading operations between the beginning and end of the transportation;

(ii) 200 millirems (2 millisieverts) per hour at any point on the outer surface of the vehicle, including the top and underside of the vehicle, or in the case of a flat–bed style vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, or enclosure, if used, and on the lower external surface of the vehicle; and

(iii) 10 millirems (0.1 millisievert) per hour at any point 2 meters (6.6 feet) from the outer lateral surfaces of the vehicle (excluding the top and underside of the vehicle); or in the case of a flat–bed style vehicle, at any point 2 meters from the vertical planes projected from the outer edges of the vehicle (excluding the top and underside of the vehicle); and

(iv) 2 millirems (0.02 millisievert) per hour in any normally–occupied space of the vehicle, except that this provision does not apply to private motor carriers if persons occupying these spaces wear radiation monitoring devices in accordance with Rule 0400-20-05-.71.

(5) Each licensee shall:

(a) Establish, maintain and retain written procedures for safely opening packages in which radioactive material is received; and

(b) Ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.

(6) Licensees transferring special form sources to or from a work site in licensee owned or operated vehicles are exempt from the contamination monitoring requirements of paragraph (2) of this rule. Licensees are not exempt from the requirement in paragraph (2) of this rule for surveying radiation levels to ensure that the source is still properly secured in its shield.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.116 THROUGH 0400-20-05-.119 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.120 GENERAL DISPOSAL REQUIREMENTS.

(1) A licensee shall dispose of radioactive material only:

(a) By transfer to an authorized recipient as provided in other chapters of these regulations;

(b) By decay in storage;

(c) By release in effluents within the limits in Rule 0400-20-05-.60; or

(d) As authorized under Rule 0400-20-05-.121, 0400-20-05-.122, 0400-20-05-.123, 0400-20-05-.124 or 0400-20-05-.127.

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

(a) Treatment prior to disposal;

(b) Treatment or disposal by incineration;

(c) Decay in storage; or

(d) Disposal at a land disposal facility licensed under Chapter 0400-20-11.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.121 METHOD FOR GRANTING APPROVAL OF ALTERNATIVE DISPOSAL PROCEDURES.

(1) A licensee or applicant for a license may apply to the Division for approval of alternative procedures for disposal of radioactive material generated in the licensee's activities. Each application shall include:

(a) A description of the waste that contains the radioactive material to be disposed, including the physical and chemical properties important to risk evaluation;

(b) The proposed manner and conditions of waste disposal;

(c) An analysis and evaluation of pertinent information about the environment of the disposal site;

(d) The nature and location of other potentially affected licensed and unlicensed facilities; and

(e) Analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this chapter.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule*

(Rule 0400-20-05-.121, continued)
filed February 22, 2012; effective May 22, 2012.

0400-20-05-.122 DISPOSAL BY RELEASE INTO SANITARY SEWERAGE.

(1) A licensee may release radioactive material into sanitary sewerage if each of the following conditions is satisfied:

(a) The material is readily soluble in water or is a readily dispersible biological material; and

(b) The quantity of radioactive material the licensee releases into the sewer in any one 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 Schedule RHS 8-30; and

(c) If more than one radionuclide is released, the following conditions shall also be satisfied:

1. The license shall determine the fraction of the limit in Table III of Schedule RHS 8-30 represented by its releases into sanitary sewerage. This shall be done 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 Schedule RHS 8-30; and

2. The sum of the fractions for each radionuclide required by part 1 of this subparagraph does not exceed unity; and

(d) The total quantity of licensed and other radioactive material that the licensee releases into the sanitary sewerage system in a year does not exceed:

1. 5 curies (185 GBq) of hydrogen-3;

2. 1 curie (37 GBq) of carbon-14; and

3. 1 curie (37 GBq) of all other radioactive materials combined.

(2) Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in paragraph (1) of this rule.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.123 TREATMENT OR DISPOSAL BY INCINERATION.

A licensee may treat or dispose of radioactive material by incineration only in the amounts and forms specified in Rule 0400-20-05-.124 or as specifically approved by the Division pursuant to Rule 0400-20-05-.121.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.124 DISPOSAL OF SPECIFIC WASTES.

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

(Rule 0400-20-05-.124, continued)

(a) 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and

(b) 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.

(2) A licensee may not dispose of tissue under subparagraph (1)(b) of this rule in a manner that would permit its use either as food for humans or as animal feed.

(3) The licensee shall maintain records in accordance with Rule 0400-20-05-.137.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.125 TRANSFER FOR DISPOSAL AND MANIFESTS.

(1) This rule and Schedule RHS 8-33 concern low level radioactive waste and are to:

(a) Control transfers of low-level radioactive waste by any waste generator, waste collector or waste processor licensee, as defined in Schedule RHS 8-33 of Rule 0400-20-05-.161, 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 Chapter 0400-20-11.

(b) Establish a manifest tracking system; and

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

(2) Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility shall document the information required on U.S. NRC Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee as specified in Section I of Schedule RHS 8-33.

(3) Each shipment manifest shall include a certification by the waste generator as specified in Section II of Schedule RHS 8-33.

(4) The waste generator, collector, processor, disposal facility operator, and each person involved in the transfer and disposal shall comply with the requirements specified in Section III of Schedule RHS 8-33.

(5) Any licensee shipping byproduct material as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 0400-20-05-.32 intended for ultimate disposal at a land disposal facility licensed under Chapter 0400-20-11 shall document the information required on the NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee as specified in Schedule RHS 8-33.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.126 COMPLIANCE WITH ENVIRONMENTAL AND HEALTH PROTECTION REGULATIONS.

Nothing in these standards relieves the licensee from complying with other federal, state, and local regulations governing toxic or hazardous properties of waste materials.

(Rule 0400-02-05-.126, continued)

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.127 DISPOSAL OF CERTAIN BYPRODUCT MATERIAL

(1) Licensed material as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 0400-20-05-.32 may be disposed of in accordance with Chapter 0400-20-05, even though it is not defined as low-level radioactive waste. Therefore, any licensed byproduct material being disposed of at a facility, or transferred for ultimate disposal at a facility licensed under Chapter 0400-20-11, must meet the requirements of Rule 0400-20-05-.125.

(2) A licensee may dispose of byproduct material, as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 0400-20-05-.32, at a disposal facility authorized to dispose of such material in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act, as authorized under the Energy Policy Act of 2005.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.128 THROUGH 0400-20-05-.129 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.130 GENERAL RECORDS PROVISIONS.

(1) Each licensee and registrant shall use the units: curie, rad, rem, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by these standards.

(2) In the records required by this chapter, the licensee may record quantities in SI units in parentheses following each of the units specified in paragraph (1) of this rule. However, all quantities must be recorded as stated in paragraph (1) of this rule.

(3) Notwithstanding the requirements in paragraph (1) of this rule, when recording information on shipment manifests, as required in paragraph (2) of Rule 1200-02-05-.125, information shall be recorded in the International System of Units (SI) or in SI and units as specified in paragraph (1) of this rule.

(4) The licensee or registrant shall make a clear distinction among the quantities entered on the records required by this chapter (e.g., total effective dose equivalent, shallow-dose equivalent, lens dose equivalent, deep–dose equivalent, committed effective dose equivalent).

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.131 RECORDS OF RADIATION PROTECTION PROGRAMS.

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

(a) The provisions of the program; and

(Rule 0400-20-05-.131, continued)

(b) Audits and other reviews of program content and implementation.

(2) The licensee or registrant shall retain the records required by subparagraph (1)(a) of this rule until the Division terminates each pertinent license or registration requiring the record. The licensee or registrant shall retain the records required by subparagraph (1)(b) of this rule for 3 years after the record is made.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.132 RECORDS OF SURVEYS.

(1) Each licensee and registrant shall maintain records showing the results of surveys and calibrations required by Rule 0400-20-05-.70 and paragraph (2) of Rule 0400-20-05-.115. The licensee or registrant shall retain these records for 3 years after the record is made.

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

(a) Survey results used to determine the dose from external sources and to assess individual dose equivalents with or without individual monitoring data;

(b) Results of measurements and calculations used to:

1. Determine individual intakes of radioactive material;

2. Assess internal intakes of radioactive material; and

3. Assess internal dose;

(c) Results of air sampling, surveys and bioassays required pursuant to parts (1)(c)1 and 2 of Rule 0400-20-05-.92; and

(d) Results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.133 DETERMINATION OF PRIOR OCCUPATIONAL DOSE.

(1) For each individual who is likely to receive, in a year, an occupational dose requiring monitoring pursuant to Rule 0400-20-05-.71, the licensee or registrant shall:

(a) Determine the occupational radiation dose received during the current year; and

(b) Attempt to obtain the records of lifetime cumulative occupational radiation dose.

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

(a) The internal and external doses from all previous planned special exposures; and

(b) All doses in excess of the limits (including doses received during accidents and emergencies) received during the lifetime of the individual.

(Rule 0400-20-05-.133, continued)

(3) In complying with the requirements of paragraph (1) of this rule, a licensee or registrant may:

(a) Accept, as a record of the individual's occupational dose for the current year, a written statement disclosing the nature and the amount of any occupational dose the individual may have received during the current year. Such statement shall be signed by the individual or the individual's most recent employer for work involving radiation exposure.

(b) Accept, as the record of lifetime cumulative radiation dose, an up-to-date Form RHS 8-1H, or equivalent. Such form shall be signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure. If the individual is employed by a person other than the licensee or registrant, the countersignature shall be from the current employer.

(c) From the most recent employer obtain reports of the individual's dose equivalent(s) for work involving radiation exposure. If the individual is employed by a person other than the licensee or registrant the report shall be from the individual's current employer. Reports may be obtained by telephone, telegram, electronic media 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.

(4) The licensee or registrant shall record the exposure history together with all information required by paragraph (1) of this rule on Form RHS 8-1H[6], or other clear and legible record. The form or record shall show each period in which the individual received occupational exposure and be signed by the individual receiving 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 Form RHS 8-1H. For any period in which the licensee or registrant does not obtain a report, the licensee or registrant shall place a notation on Form RHS 8-1H indicating the periods of time for which data are not available.

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

(a) In establishing administrative controls under paragraph (6) of Rule 0400-20-05-.50 for the current year, reduce the individual's allowable dose limit by 1.25 rems (12.5 mSv) for each quarter for which records were unavailable and the individual could have received occupational exposure; and

(b) Not allow the individual to be available for planned special exposures.

(6) The licensee or registrant shall retain the records on Form RHS 8-1H or equivalent until the Division terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing Form RHS 8-1H for three (3) years after the record is made.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

[6] Licensees or registrants are not required to reevaluate the separate external dose equivalents and internal committed dose equivalents. Further, occupational exposure histories obtained and recorded on Form RHS 8-1 before January 1, 1994, 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.

0400-20-05-.134 RECORDS OF PLANNED SPECIAL EXPOSURES.

(1) For each use of the provisions of Rule 0400-20-05-.54 for planned special exposures, the licensee or registrant shall maintain records that describe:

(a) The exceptional circumstances requiring the use of a planned special exposure;

(b) The name of the management official who authorized the planned special exposure and a copy of the signed authorization;

(c) What actions were necessary;

(d) Why the actions were necessary;

(e) How doses were maintained ALARA; and

(f) What individual and collective doses were expected to result, and the doses actually received in the planned special exposure.

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

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.135 RECORDS OF INDIVIDUAL MONITORING RESULTS.

(1) Each licensee and registrant shall maintain records of doses received:

(a) By all individuals for whom monitoring was required pursuant to Rule 0400-20-05-.71 and

(b) During the planned special exposures, accidents and emergency conditions.

(2) These records shall include,[7] when applicable:

(a) The deep–dose equivalent to the whole body, lens–dose equivalent, shallow–dose equivalent to the skin and shallow–dose equivalent to the extremities;

(b) The estimated intake of radionuclides (see Rule 0400-20-05-.51);

(c) The committed effective dose equivalent assigned to the intake of radionuclides;

(d) The specific information used to assess the committed effective dose equivalent pursuant to paragraph (3) of Rule 0400-20-05-.53 and when required by Rule 0400-20-05-.71;

(e) The total effective dose equivalent when required by Rule 0400-20-05-.51; and

(f) The total of the deep–dose equivalent and the committed dose to the organ receiving the highest total dose.

[7] Assessments of dose equivalent and records made using units in effect before the licensee's or registrant's adoption of Rules 0400-20-05-.30 through 0400-20-05-.160 need not be changed.

(Rule 0400-20-05-.135, continued)

(3) The licensee or registrant shall make entries of the records specified in paragraph (1) of this rule at least annually.

(4) The licensee or registrant shall maintain the records:

(a) On Form RHS 8-2C and in accordance with its instructions, or

(b) In clear and legible form containing all information required by Form RHS 8-2C.

(5) The records required under this rule should be protected from public disclosure because of their personal privacy nature. These records are protected when transferred to the Division under the regulations in Rule 0400-20-04-.10.

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

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

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.136 RECORDS OF DOSE TO INDIVIDUAL MEMBERS OF THE PUBLIC.

(1) Each licensee and registrant shall maintain records sufficient to demonstrate compliance with the dose limit for individual members of the public (see Rule 0400-20-05-.60).

(2) The licensee or registrant shall retain the records required by paragraph (1) of this rule until the Division terminates each pertinent license or registration requiring the record.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.137 RECORDS OF WASTE DISPOSAL.

(1) Each licensee shall maintain records of the disposal of radioactive materials made under Rules 0400-20-05-.121, 0400-20-05-.122, 0400-20-05-.123, and 0400-20-05-.124, Chapter 0400-20-11 and disposal by burial in soil, including burials authorized before May 12, 1986[8].

(2) The licensee shall retain the records required by paragraph (1) of this rule until the Division terminates each pertinent license requiring the record. Requirements for disposition of these records, prior to license termination, are located in Rule 0400-20-10-.26 for activities licensed under these rules.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

[8] A previous Rule 0400-20-05-.19 permitted burial of small quantities of radioactive materials in soil before May 12, 1986 without specific Division Authorization.

0400-20-05-.138 RECORDS OF TESTING ENTRY CONTROL DEVICES FOR VERY HIGH RADIATION AREAS.

(1) Each licensee and registrant shall maintain records of tests made under parts (1)(l)1, 2, and 3 of Rule 0400-20-05-.82 on entry control devices for very high radiation areas. These records shall include the date, time, and results of each such test of function.

(2) The licensee or registrant shall retain the records required by paragraph (1) of this rule for 3 years after the record is made.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.139 FORM OF RECORDS.

Each record required by this chapter shall remain legible throughout the retention period. The record may be the original or a reproduced copy or a microform provided that the copy or microform is authenticated by authorized personnel. The microform shall be capable of producing a clear copy throughout the retention period. The record may also be stored in electronic media capable of producing legible, accurate, and complete records during the 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.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.140 REPORTS OF THEFT OR LOSS OF LICENSED MATERIAL.

(1) Telephone reports.

(a) Each licensee shall report:

1. Immediately after learning of any lost, stolen or missing radioactive material:

(i) In an aggregate quantity equal to or greater than 1,000 times the quantity specified in Schedule RHS 8-31; and

(ii) Under such circumstances that it appears to the licensee that an exposure could result to persons in unrestricted areas; or

2. Within 30 days after learning of any lost, stolen or missing radioactive material:

(i) In a quantity greater than 10 times the quantity specified in Schedule RHS 8-31; and

(ii) That is still missing at this time.

(b) Reports shall be made to the Division, telephone (615) 532-0364, during the hours of 7:00 a.m. Central Time to 4:30 p.m. Central Time except weekends and holidays. At all other times, reports can be made through the Tennessee Emergency Management Agency (615) 741-0001.

(2) Written reports

(Rule 0400-20-05-.140, continued)

(a) Each licensee required to make a report under paragraph (1) of this rule shall, within 30 days after making the telephone report, make a written report setting forth the following information:

1. A description of the radioactive material involved, including kind, quantity and chemical and physical form;

2. A description of the circumstances under which the loss, theft or misplacement occurred;

3. A statement of disposition, or probable disposition, of the radioactive material involved;

4. Exposures of individuals to radiation and the circumstances under which the exposures occurred;

5. The possible total effective dose equivalent to persons in unrestricted areas;

6. Actions that have been taken, or will be taken, to recover the material; and

7. Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss, theft or misplacement of radioactive material.

(b) Reports shall be made to the Division of Radiological Health at the address given in Rule 0400-20-04-.07.

(3) If after filing the written report, the licensee learns of additional substantive information the licensee shall report such additional information within 30 days.

(4) Each report filed with the Division shall list for each individual exposed: the name, Social Security account number, and date of birth. The report shall be prepared so that this information is stated in a separate and detachable part.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.141 NOTIFICATION OF INCIDENTS.

(1) Immediate notification. Notwithstanding other requirements for notification the requirements of this rule are controlling. Licensees and registrants shall notify the Division as soon as possible but not later than 4 hours after discovery that a source of radiation possessed by the licensee or registrant has caused, may have caused or threatens to cause any of the following:

(a) An individual to receive:

1. A total effective dose equivalent of 25 rems (0.25 Sv) or more;

2. A lens-dose equivalent of 75 rems (0.75 Sv) or more; or

3. A shallow-dose equivalent to the skin or extremities of 250 rads (2.5 Gy) or more;

(b) The release of radioactive material that could cause an individual present for 24 hours to receive 5 times or more the annual occupational limit on intake. This does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or specific process enclosures; or

(Rule 0400-20-05-.141, continued)

(c) Prevention of immediate protective actions necessary to avoid exposure to radiation or releases that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).

(2) Twenty-four hour notification. Licensees and registrants shall notify the Division within 24 hours after discovery that a source of radiation possessed by the licensee or registrant may have caused or threatens to cause any of the following:

(a) An individual to receive, in a period of 24 hours:

1. A total effective dose equivalent exceeding 5 rems (0.05 Sv),

2. A lens-dose equivalent exceeding 15 rems (0.15 Sv), or

3. A shallow-dose equivalent to the skin or extremities exceeding 50 rems (0.5 Sv);

(b) The release of radioactive material that could cause an individual present for 24 hours to receive an intake exceeding one annual occupational limit on intake. This does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or specific process enclosures; or

(c) Any of the following events involving licensable material:

1. An unplanned contamination event that:

(i) Requires restricted access to the contaminated area for more than 24 hours. Restriction may be by imposing additional radiological controls or by prohibiting entry into the area;

(ii) Involves a quantity of material greater than five times the lowest annual limit on intake specified for the material in Schedule RHS 8-30 of Rule 0400-20-05-.161; and

(iii) Restricts access to the area for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination.

2. An event in which equipment is disabled or fails to function as designed when:

(i) The equipment is required by regulation or license condition to:

(I) Prevent releases exceeding regulatory limits,

(II) Prevent exposures to radiation exceeding regulatory limits, or

(III) Mitigate the consequences of an accident;

(ii) The equipment is required to be available and operable when it is disabled or fails to function; and

(iii) No equipment meeting the same performance standards is immediately available, operable and capable of performing the required safety function.

3. An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.

(Rule 0400-20-05-.141, continued)

4. An unplanned fire or explosion damaging any licensable material or any device, container or equipment containing licensable material when:

(i) The quantity of material involved exceeds five times the lowest annual limit on intake specified for the material in Schedule RHS 8-30 in Rule 0400-20-05-.161, and

(ii) The damage affects the integrity of the licensable material or any device, container or equipment containing licensable material.

(3) Preparation and submission of reports. Licensees and registrants shall make reports in response to the requirements of this rule as follows:

(a) Licensees and registrants shall make reports required by paragraphs (1) and (2) of this rule by telephone to the Division.

1. The telephone number for the Division is:

(615) 532-0364 7:00 a.m. Central Time to 4:30 p.m. Central Time except weekends and holidays

(615) 741-0001 Tennessee Emergency Management Agency at all other times.

2. To the extent that the information is available at the time of notification, the information provided in these reports shall include:

(i) The caller's name and call back telephone number;

(ii) A description of the event, including date and time;

(iii) The exact location of the event;

(iv) The isotopes, quantities, and chemical and physical form of the licensable material involved; and

(v) Any personnel radiation exposure data available.

(b) Written report. Licensees and registrants who make a report required by paragraph (1) or (2) of this rule shall submit a written follow-up report within 30 days of the initial report. This requirement may be satisfied by submitting written reports prepared under other regulations that contain all necessary information and are appropriately distributed. Licensees and registrants shall send these written reports to the Division at the address given in Rule 0400-20-04-.07. The reports shall include the following:

1. A description of the event, including the probable cause and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;

2. The exact location of the event;

3. The isotopes, quantities, and chemical and physical forms of the licensable material involved;

4. Date and time of the event;

(Rule 0400-20-05-.141, continued)

5. Corrective actions taken or planned and the results of any evaluations or assessments; and

6. For each individual exposed:

(i) The name, Social Security number and date of birth. The report shall be prepared so that this information is stated in a separate and detachable part, and

(ii) The extent of exposure of each individual without identification of individuals by name.

(4) This rule does not include doses that result from, and are within the limits for, planned special exposures reported under Rule 0400-20-05-.144.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.142 REPORTS TO INDIVIDUALS OF EXPOSURE TO RADIATION.

(1) Licensees and registrants shall report radiation exposure data for an individual, including the results of any measurements, analyses and calculations of radioactive material deposited or retained in the body of an individual, as specified in this rule.

(2) Each licensee or registrant shall make dose information available to workers as shown in records maintained by the licensee or registrant under the provisions of Rule 0400-20-05-.135. The licensee shall provide an annual report to each individual monitored under Rule 0400-20-05-.71 of the dose received in that monitoring year if:

(a) The individual's occupational dose exceeds 1 mSv (100 mrem) TEDE or 1 mSv (100 mrem) to any individual organ or tissue; or

(b) The individual requests his or her annual dose report.

(3) Each licensee or registrant, at the request of a worker formerly engaged in licensed or registered activities controlled by the licensee or registrant, shall furnish to the worker a report of the individual's exposure to sources of radiation:

(a) 1. As shown in records maintained by the licensee or registrant pursuant to Rule 0400-20-05-.135 for each year the worker was required to be monitored under the provisions of Rule 0400-20-05-.71; and

2. For each year the worker was required to be monitored under the requirements in effect before January 2, 1993.

(b) This report shall:

1. Be furnished within 30 days from the time the request is made or within 30 days after the exposure of the individual has been determined by the licensee, whichever is later;

2. Cover the period that the worker's activities involved exposure to sources of radiation licensed or registered by the Division; and

3. Include the dates and locations of licensed or registered activities in which the worker participated during this period.

(Rule 0400-20-05-.142, continued)

(c) The worker's request shall include social security number, dates and location of employment or association and other appropriate identifying data.

(4) When a licensee or registrant is required under Rule 0400-20-05-.141, 0400-20-05-.143 or 0400-20-05-.144 to report to the Division any exposure of an individual to radiation or radioactive material, the licensee or registrant shall also provide a copy of the report submitted to the Division to the individual. Such report shall be transmitted at a time not later than the transmittal to the Division.

(5) At the request of a worker who is terminating employment with the licensee or registrant that involved radiation dose, or of a worker who, while employed by another person, is terminating assignment to work involving radiation dose in the licensee's or registrant's facility during the current year, each licensee or registrant shall provide at termination to each worker, or to the worker's designee, a written report regarding the radiation dose received by that worker from operations of the licensee or registrant during the current year or fraction thereof. If the most recent monitoring results are not available at that time, the licensee or registrant shall provide a written estimate of the dose. Estimated doses shall be clearly indicated as such.

(6) Reports submitted under this rule shall:

(a) Be in writing;

(b) Include appropriate identifying data such as the name of the licensee or registrant, the name of the individual and the individual's social security number;

(c) Include the individual's radiation exposure information;

(d) Include data and results obtained under Division regulations, or conditions, as shown in records maintained by the licensee or registrant under Division regulations; and

(e) Contain the following statement:

This report is furnished to you under the provisions of the Division of Radiological Health of the Tennessee Department of Environment and Conservation regulations entitled "State Regulations for Protection Against Radiation." You should preserve this report for future reference.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.143 REPORTS OF EXPOSURES, RADIATION LEVELS, AND CONCENTRATIONS OF RADIOACTIVE MATERIAL EXCEEDING THE LIMITS.

(1) In addition to the notification required by Rule 0400-20-05-.141, each licensee and registrant shall submit a written report within 30 days after learning of any of the following occurrences:

(a) Any incident for which notification is required by Rule 0400-20-05-.141;

(b) Doses in excess of any of the following:

1. The occupational dose limits for adults in Rule 0400-20-05-.50;

2. The occupational dose limits for minors in Rule 0400-20-05-.55;

(Rule 0400-20-05-.143, continued)

3. The limits for an embryo/fetus of a declared pregnant woman in Rule 0400-20-05-.56;

4. The limits for an individual member of the public in Rule 0400-20-05-.60;

5. Any applicable limit in the license or registration; or

6. The ALARA constraints for air emissions established under paragraph (4) of Rule 0400-20-05-.40; or

(c) Levels of radiation or concentrations of radioactive material in:

1. A restricted area in excess of any applicable limit in the license or registration; or

2. An unrestricted area in excess of 10 times any limit set forth in these standards, the license or registration; whether or not there is exposure of any individual in excess of the limits in Rule 0400-20-05-.60).

(d) Levels of radiation or releases of radioactive material exceeding EPA's generally applicable environmental standards in 40 C.F.R. Part 190, or license or registration conditions. This applies only if the licensee or registrant is subject to the standards.

(2) Contents of reports.

(a) Each report required by paragraph (1) of this rule shall describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:

1. Estimates of each individual's dose;

2. The levels of radiation and concentrations of radioactive material involved;

3. The cause of the elevated exposures, dose rates or concentrations; and

4. 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 conditions.

(b) Each report filed under paragraph (1) of this rule shall include for each occupationally overexposed individual[9]: the name, Social Security account number and date of birth. The report shall be prepared so that this information is stated in a separate and detachable part.

(3) All licensees or registrants who make reports under paragraph (1) of this rule shall submit the report in writing to the Division of Radiological Health at the address given in Rule 0400-20-04-.07.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

[9] With respect to the limit for the embryo/fetus (Rule 0400-20-05-.56), the identifiers should be those of the declared pregnant woman.

0400-20-05-.144 REPORTS OF PLANNED SPECIAL EXPOSURES.

The licensee or registrant shall submit a written report to the Division of Radiological Health, L&C Annex, 3rd Floor, 401 Church Street, Nashville, TN 37243-1532 within 30 days following any planned special exposure. The report shall inform the Division that a planned special exposure occurred and provide the information required by Rule 0400-20-05-.134.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.145 NOTIFICATIONS, RECORDS AND REPORTS OF MISADMINISTRATION.

(1) Other than events that result from intervention by a patient or human research subject, a licensee or registrant shall report to the Division any event in which the administration of radioactive material, radiation from radioactive material, or radiation from a radiation producing machine results in:

(a) A dose that differs from the prescribed dose or dose that would have resulted from the prescribed dosage by more than 0.05 Sievert (5 rem) effective dose equivalent, 0.5 Sievert (50 rem) to an organ or tissue, or 0.5 Sievert (50 rem) shallow dose equivalent to the skin; and

1. The total dose delivered differs from the prescribed dose by 20 percent or more;

2. The total dosage delivered differs from the prescribed dosage by 20 percent or more or falls outside the prescribed dosage range; or

3. The fractionated dose delivered differs from the prescribed dose, for a single fraction, by 50 percent or more.

(b) A dose that exceeds 0.05 Sv (5 rem) effective dose equivalent, 0.5 Sv (50 rem) to an organ or tissue, or 0.5 Sv (50 rem) shallow dose equivalent to the skin from any of the following:

1. An administration of a wrong radioactive drug;

2. An administration of a radioactive drug containing radioactive material by the wrong route of administration;

3. An administration of a dose or dosage to the wrong individual or human research subject;

4. An administration of a dose or dosage delivered by the wrong mode of treatment; or

5. A leaking sealed source.

(c) A dose to the skin or an organ or tissue other than the treatment site that exceeds by 0.5 Sv (50 rem) to an organ or tissue and 50 percent or more of the dose expected from the administration defined in the written directive (excluding, for permanent implants, seeds that were implanted in the correct site but migrated outside the treatment site).

(d) A therapeutic radiation machine dose:

(Rule 0400-20-05-.145, continued)

1. Involving the wrong individual, wrong mode of treatment or wrong treatment site;

2. When the treatment consists of 3 or fewer fractions and the calculated total administered dose differs from the total prescribed dose by more than 10 percent of the total prescribed dose;

3. When the calculated weekly administered dose exceeds the weekly prescribed dose by 30 percent or more of the weekly prescribed dose; or

4. When the calculated total administered dose differs from the total prescribed dose by more than 20 percent of the total prescribed dose.

(2) A licensee or registrant shall report to the Division any event resulting from intervention of a patient or human research subject in which the administration of radioactive material or radiation from radioactive material results or will result in unintended permanent functional damage to an organ or a physiological system, as determined by a physician.

(3) A licensee or registrant shall notify the Division at the number given in Rule 0400-20-04-.07 no later than the next calendar day after discovery of the misadministration.

(4) A licensee or registrant shall submit a written report to the Division at the address listed in Rule 0400-20-04-.07 within 15 days after discovery of the misadministration.

(a) The written report must include:

1. The licensee or registrant's name;

2. The name of the prescribing physician;

3. A brief description of the event;

4. Why the event occurred;

5. The effect, if any, on the individual(s) who received the administration;

6. What actions, if any, have been taken or are planned to prevent recurrence; and

7. Certification that the licensee or registrant notified the individual (or the individual's responsible relative or guardian), and if not, why not.

(b) The report may not contain the individual's name or any other information that could lead to identification of the individual.

(5) A licensee or registrant shall provide notification of the misadministration to the referring physician and also notify the individual who is the subject of the misadministration no later than 24 hours after its discovery, unless the referring physician personally informs the licensee or registrant either that they will inform the individual or that, based on medical judgment, telling the individual would be harmful. The licensee or registrant is not required to notify the individual without first consulting the referring physician. If the referring physician or the affected individual cannot be reached within 24 hours, the licensee or registrant shall notify the individual as soon as possible thereafter. The licensee or registrant may not delay any appropriate medical care for the individual, including any necessary remedial care as a result of the misadministration, because of any delay in notification. To meet the requirements of this rule, the notification of the individual who is the subject of the misadministration may be made instead to that individual's responsible relative or guardian. If a verbal notification is made, the licensee or registrant shall inform the individual or

(Rule 0400-20-05-.145, continued)

appropriate responsible relative or guardian that a written description of the event can be obtained from the licensee upon request. The licensee or registrant shall provide a written description if requested.

(6) Aside from the notification requirement, nothing in this rule affects any rights or duties of licensees, registrants, and physicians in relation to each other, to individuals affected by the misadministration, or to that individual's responsible relatives or guardians.

(7) A licensee or registrant shall retain a record of a misadministration in accordance with this rule for 3 years. A copy of the record shall be provided to the referring physician if other than the licensee or registrant, within 15 days after discovery of the misadministration. The record must contain the licensee or registrant's name; names of the individuals involved; the social security number or other identification number if one has been assigned, of the individual who is the subject of the misadministration; a brief description of the event; why it occurred; the effect, if any, on the individual; the actions, if any, taken, or planned, to prevent recurrence; and, whether the licensee or registrant notified the individual (or the individual's responsible relative or guardian) and, if not, whether such failure to notify was based on guidance from the referring physician.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.146 REPORTS TO INDIVIDUALS OF EXCEEDING DOSE LIMITS.

When a licensee or registrant is required by Rule 0400-20-05-.143 or 0400-20-05-.144 to report to the Division any exposure of an identified occupationally exposed individual, or an identified member of the public, to radiation or radioactive material, the licensee or registrant shall also provide the individual a report on his or her exposure data included in the report to the Division. This report must be transmitted no later than the transmittal to the Division.

Authority: *T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.147 THROUGH 0400-20-05-.149 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.150 APPLICATIONS FOR EXEMPTIONS.

The Division may, upon application by a licensee or registrant or upon its own initiative, grant a specific written exemption from these standards if the Division determines the exemption is authorized by law and would not result in undue hazard to life or property.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.151 ADDITIONAL REQUIREMENTS.

The Division may, by rule, regulation, or order, impose requirements on a licensee or registrant, in addition to those established in these regulations, as it deems appropriate or necessary to protect health or to minimize danger to life or property.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.152 VACATING PREMISES.

Each specific licensee shall, no less than 30 days before vacating or relinquishing possession or control of premises, notify the Division in writing of intent to vacate. If the premises have been contaminated with radioactive material as a result of his activities, the Department may require that the licensee decontaminate or have decontaminated the location to a level for use as an unrestricted area, the details to be specified in each case by the Division.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.153 THROUGH 0400-20-05-.159 RESERVED.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.160 VIOLATIONS.

A violation of any of these standards subjects the violator to possible civil and criminal penalties.

Authority: *T.C.A. §§ 68-202-201 et seq., and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.161 SCHEDULES.

RHS 8-30
ANNUAL LIMITS ON INTAKE (ALI) AND DERIVED AIR CONCENTRATIONS (DAC) 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. The class (D, W, or Y) given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table I, columns 2 and 3. 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 systems.

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 schedule captioned, "Oral Ingestion ALI," "Inhalation," "ALI," and "DAC," are applicable to occupational exposure to radioactive material.

(Rule 0400-20-05-.161, continued)

The ALIs in this schedule are the annual intakes of a given radionuclide by the reference man, which would result in either a committed effective dose equivalent (CEDE) of 0.05 Sv (5 rem), stochastic ALI, or a committed dose equivalent of 0.5 Sv (50 rem) 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 0.05 Sv (5 rem). 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 Rule 0400-20-05-.32. 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 CEDE 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:

1. LLI wall = lower large intestine wall;
2. St wall = stomach wall;
3. Blad wall = bladder wall; and
4. 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, the use of that non-stochastic ALI is considered unduly conservative, the licensee or registrant may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee or registrant shall also ensure that the 0.5 Sv (50 rem) 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

(Rule 0400-20-05-.161, continued)

$$DAC = \frac{\text{ALI (in } \mu C_i)}{(2000\ hrs\ /\ working\ \ yr\ \text{X } 60 \text{ min/hr } \text{X } 2 \text{ x } 10^4\ ml\ /\ \text{min})}$$
$$= \frac{ALI}{2.4\ x\ 10^9}\ \mu\text{Ci/ml}$$

exposures. The relationship between the DAC and the ALI is given by:

where 2 x 10^4 ml is the volume of air breathed per minute at work by the 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 ingrowth 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 Rule 0400-20-05-.51. 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 radioisotopes. 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 schedule captioned "Air" and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of Rule 0400-20-05-.61. 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 0.5 mSv (0.05 rem).

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 Schedule RHS 8–1.

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 x 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 0.05 Sv (5 rem) annual occupational dose limit to the 1mSv (0.1 rem)

(Rule 0400-20-05-.161, continued)

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 the reference man.

Note 2 of this schedule 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 Rule 0400-20-05-.122. 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 a 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 5 mSv (0.5 rem).

LIST OF ELEMENTS

Name	Symbol	Atomic Number	Name	Symbol	Atomic Number
Actinium	Ac	89	Molybdenum	Mo	42
Aluminum	Al	13	Neodymium	Nd	60
Americium	Am	95	Neptunium	Np	93
Antimony	Sb	51	Nickel	Ni	28
Argon	Ar	18	Niobium	Nb	41
Arsenic	As	33	Nitrogen	N	7
Astatine	At	85	Osmium	Os	76
Barium	Ba	56	Oxygen	O	8
Berkelium	Bk	97	Palladium	Pd	46
Beryllium	Be	4	Phosphorus	P	15
Bismuth	Bi	83	Platinum	Pt	78
Bromine	Br	35	Plutonium	Pu	94
Cadmium	Cd	48	Polonium	Po	84
Calcium	Ca	20	Potassium	K	19
Californium	Cf	98	Praseodymium	Pr	59
Carbon	C	6	Promethium	Pm	61
Cerium	Ce	58	Protactinium	Pa	91
Cesium	Cs	55	Radium	Ra	88

(Rule 0400-20-05-.161, continued)

Chlorine	Cl	17	Radon	Rn	86
Chromium	Cr	24	Rhenium	Re	75
Cobalt	Co	27	Rhodium	Rh	45
Copper	Cu	29	Rubidium	Rb	37
Curium	Cm	96	Ruthenium	Ru	44
Dysprosium	Dy	66	Samarium	Sm	62
Einsteinium	Es	99	Scandium	Sc	21
Erbium	Er	68	Selenium	Se	34
Europium	Eu	63	Silicon	Si	14
Fermium	Fm	100	Silver	Ag	47
Fluorine	F	9	Sodium	Na	11
Francium	Fr	87	Strontium	Sr	38
Gadolinium	Gd	64	Sulfur	S	16
Gallium	Ga	31	Tantalum	Ta	73
Germanium	Ge	32	Technetium	Tc	43
Gold	Au	79	Tellurium	Te	52
Hafnium	Hf	72	Terbium	Tb	65
Holmium	Ho	67	Thallium	Tl	81
Hydrogen	H	1	Thorium	Th	90
Indium	In	49	Thulium	Tm	69
Iodine	I	53	Tin	Sn	50
Iridium	Ir	77	Titanium	Ti	22
Iron	Fe	26	Tungsten	W	74
Mercury	Hg	80	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 No.	Radionuclide	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 Concen-tration (µCi/ml)*
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (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 T2 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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
7	Nitrogen-13[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
8	Oxygen-15[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
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	-	-
15	Phosphorus-32	D, all compounds except phosphates given for W	6E+2	9E+2	4E-7	1E-9	9E-6	9E-5
		W, phosphates of Zn^{2+}, S^{3+}, Mg^{2+}, Fe^{3+}, Bi^{3+}, and lanthanides	-	4E+2	2E-7	5E-10	-	-
15	Phosphorus-33	D, see ^{32}P	6E+3	8E+3	4E-6	1E-8	8E-5	8E-4
		W, see ^{32}P	-	3E+3	1E-6	4E-9	-	-
16	Sulfur-35	Vapor	-	1E+4	6E-6	2E-8	-	-
		D, sulfides and sulfates except those given for W	1E+4	2E+4	7E-6	2E-8	-	-
			LLI wall (8E+3)	-	-	-	1E-4	1E-3

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
		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	6E+3	-	-	-	-	-
			-	2E+3	9E-7	3E-9	-	-
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and Fr	2E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		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+2	1E-7	3E-10	-	-
17	Chlorine-38[2]	D, see ^{36}Cl	2E+4	4E+4	2E-5	6E-8	-	-
			St wall (3E+4)	-	-	-	3E-4	3E-3
		W, see ^{36}Cl	-	5E+4	2E-5	6E-8	-	-
17	Chlorine-39[2]	D, see ^{36}Cl	2E+4	5E+4	2E-5	7E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{36}Cl	-	6E+4	2E-5	8E-8	-	-
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	7E+4	3E-5	9E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
19	Potassium-45[2]	D, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
20	Calcium-41	W, all compounds	3E+3	4E+3	2E-6	-	-	-
			Bone surf (4E+3)	Bone surf (4E+3)	-	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
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	3E+3	1E-6	4E-9	-	-
			LLI wall (3E+3)	-	-	-	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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
22	Titanium-44	D, all compounds except those given for W and Y	3E+2	1E+1	5E-9	2E-11	4E-6	4E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	3E+1	1E-8	4E-11	-	-
		Y, $SrTi0_3$	-	6E+0	2E-9	8E-12	-	-
22	Titanium-45	D, see ^{44}Ti	9E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{44}Ti	-	4E+4	1E-5	5E-8	-	-
		Y, see ^{44}Ti	-	3E+4	1E-5	4E-8	-	-
23	Vanadium-47[2]	D, all compounds except those given for W	3E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, oxides, hydroxides, carbides, and halides	-	1E+5	4E-5	1E-7	-	-
23	Vanadium-48	D, see ^{47}V	6E+2	1E+3	5E-7	2E-9	9E-6	9E-5
		W, see ^{47}V	-	6E+2	3E-7	9E-10	-	-
23	Vanadium-49	D, see ^{47}V	7E+4	3E+4	1E-5	-	-	-
			LLI wall (9E+4)	Bone surf (3E+4)	-	5E-8	1E-3	1E-2
		W, see ^{47}V	-	2E+4	8E-6	2E-8	-	-
24	Chromium-48	D, all compounds except those given for W and Y	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, halides and nitrates	-	7E+3	3E-6	1E-8	-	-
		Y, oxides and hydroxides	-	7E+3	3E-6	1E-8	-	-
24	Chromium-49[2]	D, see ^{48}Cr	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, see ^{48}Cr	-	1E+5	4E-5	1E-7	-	-
		Y, see ^{48}Cr	-	9E+4	4E-5	1E-7	-	-
24	Chromium-51	D, see ^{48}Cr	4E+4	5E+4	2E-5	6E-8	5E-4	5E-3
		W, see ^{48}Cr	-	2E+4	1E-5	3E-8	-	-
		Y, see ^{48}Cr	-	2E+4	8E-6	3E-8	-	-
25	Manganese-51[2]	D, all compounds except those given for W	2E+4	5E+4	2E-5	7E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	8E-8	-	-
25	Manganese-52m[2]	D, see ^{51}Mn	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{51}Mn	-	1E+5	4E-5	1E-7	-	-
25	Manganese-52	D, see ^{51}Mn	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
		W, see ^{51}Mn	-	9E+2	4E-7	1E-9	-	-
25	Manganese-53	D, see ^{51}Mn	5E+4	1E+4	5E-6	-	7E-4	7E-3
			-	Bone surf (2E+4)	-	3E-8	-	-
		W, see ^{51}Mn	-	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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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	-	-
28	Nickel-63	D, see ^{56}Ni	9E+3	2E+3	7E-7	2E-9	1E-4	1E-3

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	8E+2	3E-7	1E-9	-	-
28	Nickel-65	D, see ^{56}Ni	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{56}Ni	-	3E+4	1E-5	4E-8	-	-
		Vapor	-	2E+4	7E-6	2E-8	-	-
28	Nickel-66	D, see ^{56}Ni	4E+2	2E+3	7E-7	2E-9	-	-
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
		W, see ^{56}Ni	-	6E+2	3E-7	9E-10	-	-
		Vapor	-	3E+3	1E-6	4E-9	-	-
29	Copper-60[2]	D, all compounds except those given for W and Y	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	4E-5	1E-7	-	-
29	Copper-61	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{60}Cu	-	4E+4	2E-5	6E-8	-	-
		Y, see ^{60}Cu	-	4E+4	1E-5	5E-8	-	-
29	Copper-64	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{60}Cu	-	2E+4	1E-5	3E-8	-	-
		Y, see ^{60}Cu	-	2E+4	9E-6	3E-8	-	-
29	Copper-67	D, see ^{60}Cu	5E+3	8E+3	3E-6	1E-8	6E-5	6E-4
		W, see ^{60}Cu	-	5E+3	2E-6	7E-9	-	-
		Y, see ^{60}Cu	-	5E+3	2E-6	6E-9	-	-
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	7E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	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	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, oxides, hydroxides, carbides, halides, and nitrates	-	2E+5	8E-5	3E-7	-	-
31	Gallium-66	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	1E-5	1E-4
		W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-67	D, see ^{65}Ga	7E+3	1E+4	6E-6	2E-8	1E-4	1E-3
		W, see ^{65}Ga	-	1E+4	4E-6	1E-8	-	-
31	Gallium-68[2]	D, see ^{65}Ga	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{65}Ga	-	5E+4	2E-5	7E-8	-	-
31	Gallium-70[2]	D, see ^{65}Ga	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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
		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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
		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 (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-	-
36	Krypton-74[2]	Submersion[1]	-	-	3E-6	1E-8	-	-
36	Krypton-76	Submersion[1]	-	-	9E-6	4E-8	-	-
36	Krypton-77[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
36	Krypton-79	Submersion[1]	-	-	2E-5	7E-8	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
36	Krypton-81	Submersion[1]	-	-	7E-4	3E-6	-	-
36	Krypton-83m[2]	Submersion[1]	-	-	1E-2	5E-5	-	-
36	Krypton-85m	Submersion[1]	-	-	2E-5	1E-7	-	-
36	Krypton-85	Submersion[1]	-	-	1E-4	7E-7	-	-
36	Krypton-87[2]	Submersion[1]	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion[1]	-	-	2E-6	9E-9	-	-
37	Rubidium-79[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
37	Rubidium-81m[2]	D, all compounds	2E+5	3E+5	1E-4	5E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
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	6E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
37	Rubidium-89[2]	D, all compounds	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
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 $SrTi0_3$	-	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	4E+2	2E-7	6E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		Y, see ^{80}Sr	2E+2	9E+1	4E-8	1E-10	-	-
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	-	-
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	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ^{80}Sr	5E+2	1E+2	6E-8	2E-10	-	-
38	Strontium-90	D, see ^{80}Sr	3E+1	2E+1	8E-9	-	-	-
			Bone surf (4E+1)	Bone surf (2E+1)	-	3E-11	5E-7	5E-6
		Y, see ^{80}Sr	-	4E+0	2E-9	6E-12	-	-
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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		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	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
		Y, see ^{86m}Y	-	6E+2	3E-7	9E-10	-	-
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	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ^{86m}Y	-	1E+2	5E-8	2E-10	-	-
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	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		Y, see ^{86m}Y	-	8E+4	3E-5	1E-7	-	-
39	Yttrium-95[2]	W, see ^{86m}Y	4E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{86m}Y	-	1E+5	6E-5	2E-7	-	-
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
		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	-	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
			-	Bone surf (6E+1)	-	9E-11	-	-
		Y, see ^{86}Zr	-	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
			-	Bone surf (3E+2)	-	4E-10	-	-
		W, see ^{86}Zr	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{86}Zr	-	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
		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, hydroxide, and MoS_2	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-	D, see ^{90}Mo	2E+3	3E+3	1E-6	4E-9	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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		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
		W, see ^{93m}Tc	-	4E+5	2E-4	5E-7	-	-
43	Technetium-104[2]	D, see ^{93m}Tc	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{93m}Tc	-	9E+4	4E-5	1E-7	-	-
44	Ruthenium-94[2]	D, all compounds except those given for W and Y	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, halides	-	6E+4	3E-5	9E-8	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		Y, oxides and hydroxides	-	6E+4	2E-5	8E-8	-	-
44	Ruthenium-97	D, see ^{94}Ru	8E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-103	D, see ^{94}Ru	2E+3	2E+3	7E-7	2E-9	3E-5	3E-4
		W, see ^{94}Ru	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{94}Ru	-	6E+2	3E-7	9E-10	-	-
44	Ruthenium-105	D, see ^{94}Ru	5E+3	1E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{94}Ru	-	1E+4	6E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-106	D, see ^{94}Ru	2E+2	9E+1	4E-8	1E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		W, see ^{94}Ru	-	5E+1	2E-8	8E-11	-	-
		Y, see ^{94}Ru	-	1E+1	5E-9	2E-11	-	-
45	Rhodium-99m	D, all compounds except those given for W and Y	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		W, halides	-	8E+4	3E-5	1E-7	-	-
		Y, oxides and hydroxides	-	7E+4	3E-5	9E-8	-	-
45	Rhodium-99	D, see ^{99m}Rh	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{99m}Rh	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{99m}Rh	-	2E+3	8E-7	3E-9	-	-
45	Rhodium-100	D, see ^{99m}Rh	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{99m}Rh	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{99m}Rh	-	4E+3	2E-6	5E-9	-	-
45	Rhodium-101m	D, see ^{99m}Rh	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{99m}Rh	-	8E+3	4E-6	1E-8	-	-
		Y, see ^{99m}Rh	-	8E+3	3E-6	1E-8	-	-
45	Rhodium-101	D, see ^{99m}Rh	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{99m}Rh	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{99m}Rh	-	2E+2	6E-8	2E-10	-	-
45	Rhodium-102m	D, see ^{99m}Rh	1E+3	5E+2	2E-7	7E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		W, see ^{99m}Rh	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{99m}Rh	-	1E+2	5E-8	2E-10	-	-
45	Rhodium-102	D, see ^{99m}Rh	6E+2	9E+1	4E-8	1E-10	8E-6	8E-5
		W, see ^{99m}Rh	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{99m}Rh	-	6E+1	2E-8	8E-11	-	-
45	Rhodium-103m[2]	D, see ^{99m}Rh	4E+5	1E+6	5E-4	2E-6	6E-3	6E-2
		W, see ^{99m}Rh	-	1E+6	5E-4	2E-6	-	-
		Y, see ^{99m}Rh	-	1E+6	5E-4	2E-6	-	-
45	Rhodium-105	D, see ^{99m}Rh	4E+3	1E+4	5E-6	2E-8	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{99m}Rh	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{99m}Rh	-	6E+3	2E-6	8E-9	-	-
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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
45	Rhodium-107[2]	D, see ^{99m}Rh	7E+4	2E+5	1E-4	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{99m}Rh	-	3E+5	1E-4	4E-7	-	-
		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	6E+3	3E-6	9E-9	-	-
			LLI wall (7E+3)	-	-	-	1E-4	1E-3
		W, see ^{100}Pd	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{100}Pd	-	4E+3	1E-6	5E-9	-	-
46	Palladium-107	D, see ^{100}Pd	3E+4	2E+4	9E-6	-	-	-
			LLI wall (4E+4)	Kidneys (2E+4)	-	3E-8	5E-4	5E-3
		W, see ^{100}Pd	-	7E+3	3E-6	1E-8	-	-
		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	2E+5	8E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, nitrates and sulfides	-	2E+5	9E-5	3E-7	-	-
		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	2E+5	8E-5	3E-7	-	-
			St. wall (6E+4)	-	-	-	9E-4	9E-3
		W, see ^{102}Ag	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{102}Ag	-	2E+5	8E-5	3E-7	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
47	Silver-108m	D, see ^{102}Ag	6E+2	2E+2	8E-8	3E-10	9E-6	9E-5
		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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
		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
		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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		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	-	-
50	Tin-117m	D, see ^{110}Sn	2E+3	1E+3	5E-7	-	-	-
			LLI wall (2E+3)	Bone surf (2E+3)	-	3E-9	3E-5	3E-4
		W, see ^{110}Sn	-	1E+3	6E-7	2E-9	-	-
50	Tin-119m	D, see ^{110}Sn	3E+3	2E+3	1E-6	3E-9	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ^{110}Sn	-	1E+3	4E-7	1E-9	-	-
50	Tin-121m	D, see ^{110}Sn	3E+3	9E+2	4E-7	1E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-121	D, see ^{110}Sn	6E+3	2E+4	6E-6	2E-8	-	-
			LLI wall (6E+3)	-	-	-	8E-5	8E-4
		W, see ^{110}Sn	-	1E+4	5E-6	2E-8	-	-
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	6E+2	3E-7	9E-10	-	-
			LLI wall (6E+2)	-	-	-	9E-6	9E-5
		W, see ^{110}Sn	-	2E+2	7E-8	2E-10	-	-
50	Tin-125	D, see ^{110}Sn	4E+2	9E+2	4E-7	1E-9	-	-
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
		W, see ^{110}Sn	-	4E+2	1E-7	5E-10	-	-
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	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		W, see ^{115}Sb	-	3E+5	1E-4	5E-7	-	-
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	4E+5	2E-4	6E-7	-	-
			St wall (2E+5)	-	-	-	2E-3	2E-2
		W, see ^{115}Sb	-	5E+5	2E-4	7E-7	-	-
51	Antimony-120 (5.76 d)	D, see ^{115}Sb	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		W, see ^{115}Sb	9E+2	1E+3	5E-7	2E-9	-	-
51	Antimony-122	D, see ^{115}Sb	8E+2	2E+3	1E-6	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ^{115}Sb	7E+2	1E+3	4E-7	2E-9	-	-
51	Antimony-124m[2]	D, see ^{115}Sb	3E+5	8E+5	4E-4	1E-6	3E-3	3E-2
		W, see ^{115}Sb	2E+5	6E+5	2E-4	8E-7	-	-
51	Antimony-124	D, see ^{115}Sb	6E+2	9E+2	4E-7	1E-9	7E-6	7E-5
		W, see ^{115}Sb	5E+2	2E+2	1E-7	3E-10	-	-
51	Antimony-125	D, see ^{115}Sb	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
		W, see ^{115}Sb	-	5E+2	2E-7	7E-10	-	-
51	Antimony-126m[2]	D, see ^{115}Sb	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{115}Sb	-	2E+5	8E-5	3E-7	-	-
51	Antimony-126	D, see ^{115}Sb	6E+2	1E+3	5E-7	2E-9	7E-6	7E-5
		W, see ^{115}Sb	5E+2	5E+2	2E-7	7E-10	-	-
51	Antimony-127	D, see ^{115}Sb	8E+2	2E+3	9E-7	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ^{115}Sb	7E+2	9E+2	4E-7	1E-9	-	-
51	Antimony-128[2] (10.4 min)	D, see ^{115}Sb	8E+4	4E+5	2E-4	5E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		W, see ^{115}Sb	-	4E+5	2E-4	6E-7	-	-
51	Antimony-128 (9.01 h)	D, see ^{115}Sb	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, see ^{115}Sb	-	3E+3	1E-6	5E-9	-	-
51	Antimony-129	D, see ^{115}Sb	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, see ^{115}Sb	-	9E+3	4E-6	1E-8	-	-
51	Antimony-130[2]	D, see ^{115}Sb	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, see ^{115}Sb	-	8E+4	3E-5	1E-7	-	-
51	Antimony-131[2]	D, see ^{115}Sb	1E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (4E+4)	-	6E-8	2E-4	2E-3
		W, see ^{115}Sb	-	2E+4	1E-5		-	-
			-	Thyroid (4E+4)	-	6E-8	-	-
52	Tellurium-116	D, all compounds except those given for W	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
		W, oxides, hydroxides, and nitrates	-	3E+4	1E-5	4E-8	-	-
52	Tellurium-121m	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (7E+2)	Bone surf 4E+2)	-	5E-10	1E-5	1E-4
		W, see ^{116}Te	-	4E+2	2E-7	6E-10	-	-
52	Tellurium-121	D, see ^{116}Te	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ^{116}Te	-	3E+3	1E-6	4E-9	-	-
52	Tellurium-123m	D, see ^{116}Te	6E+2	2E+2	9E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	8E-10	1E-5	1E-4
		W, see ^{116}Te	-	5E+2	2E-7	8E-10	-	-
52	Tellurium-123	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	7E-10	2E-5	2E-4
		W, see ^{116}Te	-	4E+2	2E-7	-	-	-
			-	Bone surf (1E+3)	-	2E-9	-	-
52	Tellurium-125m	D, see ^{116}Te	1E+3	4E+2	2E-7	-	-	-
			Bone surf (1E+3)	Bone surf 1E+3)	-	1E-9	2E-5	2E-4
		W, see ^{116}Te	-	7E+2	3E-7	1E-9	-	-
52	Tellurium-127m	D, see ^{116}Te	6E+2	3E+2	1E-7	-	9E-6	9E-5
			-	Bone surf (4E+2)	-	6E-10	-	-
		W, see ^{116}Te	-	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	-	-	-
			Thyroid (6E+2)	Thyroid (1E+3)	-	2E-9	8E-6	8E-5
		W, see ^{116}Te	-	4E+2	2E-7	-	-	-
			-	Thyroid (9E+2)	-	1E-9	-	-
52	Tellurium-131[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	8E-5	8E-4
		W, see ^{116}Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-132	D, see ^{116}Te	2E+2	2E+2	9E-8	-	-	-
			Thyroid (7E+2)	Thyroid (8E+2)	-	1E-9	9E-6	9E-5
		W, see ^{116}Te	-	2E+2	9E-8	-	-	-
			-	Thyroid (6E+2)	-	9E-10	-	-
52	Tellurium-133m[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	9E-5	9E-4
		W, see ^{116}Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
52	Tellurium-133[2]	D, see ^{116}Te	1E+4	2E+4	9E-6	-	-	-
			Thyroid (3E+4)	Thyroid (6E+4)	-	8E-8	4E-4	4E-3
		W, see ^{116}Te	-	2E+4	9E-6	-	-	-
			-	Thyroid (6E+4)	-	8E-8	-	-
52	Tellurium-134[2]	D, see ^{116}Te	2E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (5E+4)	-	7E-8	3E-4	3E-3
		W, see ^{116}Te	-	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
53	Iodine-120[2]	D, all compounds	4E+3	9E+3	4E-6	-	-	-
			Thyroid (8E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-121	D, all compounds	1E+4	2E+4	8E-6	-	-	-
			Thyroid (3E+4)	Thyroid (5E+4)	-	7E-8	4E-4	4E-3
53	Iodine-123	D, all compounds	3E+3	6E+3	3E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
53	Iodine-124	D, all compounds	5E+1	8E+1	3E-8	-	-	-
			Thyroid (2E+2)	Thyroid (3E+2)	-	4E-10	2E-6	2E-5
53	Iodine-125	D, all compounds	4E+1	6E+1	3E-8	-	-	-
			Thyroid (1E+2)	Thyroid (2E+2)	-	3E-10	2E-6	2E-5
53	Iodine-126	D, all compounds	2E+1	4E+1	1E-8	-	-	-
			Thyroid (7E+1)	Thyroid (1E+2)	-	2E-10	1E-6	1E-5
53	Iodine-128[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
53	Iodine-129	D, all compounds	5E+0	9E+0	4E-9	-	-	-
			Thyroid (2E+1)	Thyroid (3E+1)	-	4E-11	2E-7	2E-6
53	Iodine-130	D, all compounds	4E+2	7E+2	3E-7	-	-	-
			Thyroid (1E+3)	Thyroid (2E+3)	-	3E-9	2E-5	2E-4
53	Iodine-131	D, all compounds	3E+1	5E+1	2E-8	-	-	-
			Thyroid (9E+1)	Thyroid (2E+2)	-	2E-10	1E-6	1E-5
53	Iodine-132m[2]	D, all compounds	4E+3	8E+3	4E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	3E-8	1E-4	1E-3
53	Iodine-132	D, all compounds	4E+3	8E+3	3E-6	-	-	-
			Thyroid (9E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-133	D, all compounds	1E+2	3E+2	1E-7	-	-	-
			Thyroid (5E+2)	Thyroid (9E+2)	-	1E-9	7E-6	7E-5
53	Iodine-134[2]	D, all compounds	2E+4	5E+4	2E-5	6E-8	-	-
			Thyroid (3E+4)	-	-	-	4E-4	4E-3
53	Iodine-135	D, all compounds	8E+2	2E+3	7E-7	-	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
			Thyroid (3E+3)	Thyroid (4E+3)	-	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	-	-
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	1E+5	6E-5	2E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
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	2E+5	8E-5	3E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
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	1E+5	6E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
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	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
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	1E+6	6E-4	2E-6	-	-
			St wall (5E+5)	-	-	-	7E-3	7E-2
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	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
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
56	Barium-140	D, all compounds	5E+2	1E+3	6E-7	2E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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	3E-8	-	2E-4	2E-3
			-	Liver (7E+1)	-	1E-10	-	-
		W, see ^{131}La	-	3E+2	1E-7	-	-	-
			-	Liver (3E+2)	-	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	1E+5	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{131}La	-	9E+4	4E-5	1E-7	-	-
58	Cerium-134	W, all compounds except those given for Y	5E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	-	-
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	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{134}Ce	-	4E+3	2E-6	5E-9	-	-
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	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{134}Ce	-	6E+2	2E-7	8E-10	-	-
58	Cerium-143	W, see ^{134}Ce	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{134}Ce	-	2E+3	7E-7	2E-9	-	-
58	Cerium-144	W, see ^{134}Ce	2E+2	3E+1	1E-8	4E-11	-	-
			LLI wall (3E+2)	-	-	-	3E-6	3E-5
		Y, see ^{134}Ce	-	1E+1	6E-9	2E-11	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
59	Praseodymium-136[2]	W, all compounds except those given for Y	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	9E-5	3E-7		-
59	Praseodymium-137[2]	W, see ^{136}Pr	4E+4	2E+5	6E-5	2E-7	5E-4	5E-3
		Y, see ^{136}Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-138m	W, see ^{136}Pr	1E+4	5E+4	2E-5	8E-8	1E-4	1E-3
		Y, see ^{136}Pr	-	4E+4	2E-5	6E-8	-	-
59	Praseodymium-139	W, see ^{136}Pr	4E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-142m[2]	W, see ^{136}Pr	8E+4	2E+5	7E-5	2E-7	1E-3	1E-2
		Y, see ^{136}Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-142	W, see ^{136}Pr	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		Y, see ^{136}Pr	-	2E+3	8E-7	3E-9	-	-
59	Praseodymium-143	W, see ^{136}Pr	9E+2	8E+2	3E-7	1E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{136}Pr	-	7E+2	3E-7	9E-10	-	-
59	Praseodymium-144[2]	W, see ^{136}Pr	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-145	W, see ^{136}Pr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{136}Pr	-	8E+3	3E-6	1E-8	-	-
59	Praseodymium-147[2]	W, see ^{136}Pr	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
		Y, see ^{136}Pr	-	2E+5	8E-5	3E-7	-	-
60	Neodymium-136[2]	W, all compounds except those given for Y	1E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	5E+4	2E-5	8E-8	-	-
60	Neodymium-138	W, see ^{136}Nd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		Y, see ^{136}Nd	-	5E+3	2E-6	7E-9	-	-
60	Neodymium-139m	W, see ^{136}Nd	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		Y, see ^{136}Nd	-	1E+4	6E-6	2E-8	-	-
60	Neodymium-139[2]	W, see ^{136}Nd	9E+4	3E+5	1E-4	5E-7	1E-3	1E-2
		Y, see ^{136}Nd	-	3E+5	1E-4	4E-7	-	-
60	Neodymium-141	W, see ^{136}Nd	2E+5	7E+5	3E-4	1E-6	2E-3	2E-2
		Y, see ^{136}Nd	-	6E+5	3E-4	9E-7	-	-
60	Neodymium-147	W, see ^{136}Nd	1E+3	9E+2	4E-7	1E-9	-	-
			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-4	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-4	9E-3
		Y, see ^{136}Nd	-	2E+5	8E-5	3E-7	-	-

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Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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-5	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-5	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-4	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-5	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-5	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-5	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-6	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	2E-4
		Y, see ^{141}Pm	-	2E+3	8E-7	2E-9	-	-
61	Promethium-150	W, see ^{141}Pm	5E+3	2E+4	8E-6	3E-8	7E-5	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-5	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-4	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-4	1E-3
62	Samarium-145	W, all compounds	6E+3	5E+2	2E-7	7E-10	8E-5	8E-4
62	Samarium-146	W, all compounds	1E+1	4E+2	1E-11	-	-	-
			Bone surf (3E+1)	Bone surf (6E-2)	-	9E-14	3E-7	3E-6
62	Samarium-147	W, all compounds	2E+1	4E-2	2E-11	-	-	-
			Bone surf (3E+1)	Bone surf (7E-2)	-	1E-13	4E-7	4E-6
62	Samarium-151	W, all compounds	1E+4	1E+2	4E-8	-	-	-
			LLI wall (1E+4)	Bone surf (2E+2)	-	2E-10	2E-4	2E-3
62	Samarium-153	W, all compounds	2E+3	3E+3	1E-6	4E-9	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
62	Samarium-155[2]	W, all compounds	6E+4	2E+5	9E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	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	4E-8	-	5E-5	5E-4
			-	Bone surf (1E+2)	-	2E-10	-	-
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	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	6E-4	6E-3
		W, oxides, hydroxides, and fluorides	-	2E+5	7E-5	2E-7	-	-
64	Gadolinium-146	D, see ^{145}Gd	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		W, see ^{145}Gd	-	3E+2	1E-7	4E-10	-	-
64	Gadolinium-147	D, see ^{145}Gd	2E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		W, see ^{145}Gd	-	4E+3	1E-6	5E-9	-	-
64	Gadolinium-148	D, see ^{145}Gd	1E+1	8E-3	3E-12	-	-	-
			Bone surf (2E+1)	Bone surf (2E+2)	-	2E-14	3E-7	3E-6
		W, see ^{145}Gd	-	3E-2	1E-11	-	-	-
			-	Bone surf (6E-2)	-	8E-14	-	-
64	Gadolinium-149	D, see ^{145}Gd	3E+3	2E+3	9E-7	3E-9	4E-5	4E-4
		W, see ^{145}Gd	-	2E+3	1E-6	3E-9	-	-
64	Gadolinium-151	D, see ^{145}Gd	6E+3	4E+2	2E-7	-	9E-5	9E-4
			-	Bone surf (6E+2)	-	9E-10	-	-
		W, see ^{145}Gd	-	1E+3	5E-7	2E-9	-	-
64	Gadolinium-152	D, see ^{145}Gd	2E+1	1E-2	4E-12	-	-	-
			Bone surf (3E+1)	Bone surf (2E-2)	-	3E-14	4E-7	4E-6
		W, see ^{145}Gd	-	4E-2	2E-11	-	-	-
			-	Bone surf (8E-2)	-	1E-13	-	-
64	Gadolinium-153	D, see ^{145}Gd	5E+3	1E+2	6E-8	-	6E-5	6E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		W, see ^{145}Gd	-	6E+2	2E-7	8E-10	-	-
64	Gadolinium-159	D, see ^{145}Gd	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ^{145}Gd	-	6E+3	2E-6	8E-9	-	-
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	3E+2	1E-7	-	-	-
			LLI wall (5E+4)	Bone surf (6E+2)	-	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	2E+3	7E-7	2E-9	-	-
			LLI wall (2E+3)	-	-	-	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	7E+2	3E-7	1E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
67	Holmium-155[2]	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
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	2E+6	1E-3	3E-6	-	-
			St wall (8E+5)	-	-	-	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	6E+5	3E-4	9E-7	-	-
			St wall (2E+5)	-	-	-	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	2E+3	7E-7	2E-9	-	-
			LLI wall (9E+2)	-	-	-	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	3E+3	1E-6	4E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
68	Erbium-172	W, all compounds	1E+3	1E+3	6E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
69	Thulium-162[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (7E+4)	-	-	-	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	2E+3	8E-7	3E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
69	Thulium-170	W, all compounds	8E+2	2E+2	9E-8	3E-10	-	-
			LLI wall (1E+3)	-	-	-	1E-5	1E-4
69	Thulium-171	W, all compounds	1E+4	3E+2	1E-7	-	-	-
			LLI wall (1E+4)	Bone surf (6E+2)	-	8E-10	2E-4	2E-3
69	Thulium-172	W, all compounds	7E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (8E+2)	-	-	-	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	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	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
		Y, oxides, hydroxides, and fluorides	-	3E+5	1E-4	4E-7	-	-
70	Ytterbium-166	W, see ^{162}Yb	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		Y, see ^{162}Yb	-	2E+3	8E-7	3E-9	-	-
70	Ytterbium-167[2]	W, see ^{162}Yb	3E+5	8E+5	3E-4	1E-6	4E-3	4E-2
		Y, see ^{162}Yb	-	7E+5	3E-4	1E-6	-	-
70	Ytterbium-169	W, see ^{162}Yb	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
		Y, see ^{162Yb}	-	7E+2	3E-7	1E-9	-	-
70	Ytterbium-175	W, see ^{162}Yb	3E+3	4E+3	1E-6	5E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		Y, see ^{162}Yb	-	3E+3	1E-6	5E-9	-	-
70	Ytterbium-177[2]	W, see ^{162}Yb	2E+4	5E+4	2E-5	7E-8	2E-4	2E-3
		Y, see ^{162}Yb	-	5E+4	2E-5	6E-8	-	-
70	Ytterbium-178[2]	W, see ^{162}Yb	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		Y, see ^{162}Yb	-	4E+4	2E-5	5E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y	3E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		Y, oxides, hydroxides, and fluorides	-	4E+3	2E-6	6E-9	-	-
71	Lutetium-170	W, see ^{169}Lu	1E+3	2E+3	9E-7	3E-9	2E-5	2E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-171	W, see ^{169}Lu	2E+3	2E+3	8E-7	3E-9	3E-5	3E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-172	W, see ^{169}Lu	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
		Y, see ^{169}Lu	-	1E+3	5E-7	2E-9	-	-
71	Lutetium-173	W, see ^{169}Lu	5E+3	3E+2	1E-7	-	7E-5	7E-4

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
			-	Bone surf (5E+2)	-	6E-10	-	-
		Y, see ^{169}Lu	-	3E+2	1E-7	4E-10	-	-
71	Lutetium-174m	W, see ^{169}Lu	2E+3	2E+2	1E-7	-	-	-
			LLI wall (3E+3)	Bone surf (3E+2)	-	5E-10	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ^{169}Lu	-	2E+2	6E-8	2E-10	-	-
71	Lutetium-176m	W, see ^{169}Lu	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		Y, see ^{169}Lu	-	2E+4	9E-6	3E-8	-	-
71	Lutetium-176	W, see ^{169}Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
			-	Bone surf (1E+1)	-	2E-11	-	-
		Y, see ^{169}Lu	-	8E+0	3E-9	1E-11	-	-
71	Lutetium-177m	W, see ^{169}Lu	7E+2	1E+2	5E-8	-	1E-5	1E-4
			-	Bone surf (1E+2)	-	2E-10	-	-
		Y, see ^{169}Lu	-	8E+1	3E-8	1E-10	-	-
71	Lutetium-177	W, see ^{169}Lu	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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	-	-
72	Hafnium-183[2]	D, see ^{170}Hf	2E+4	5E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{170}Hf	-	6E+4	2E-5	8E-8	-	-
72	Hafnium-184	D, see ^{170}Hf	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{170}Hf	-	6E+3	3E-6	9E-9	-	-
73	Tantalum-172[2]	W, all compounds except those given for Y	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
		Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	-	1E+5	4E-5	1E-7	-	-
73	Tantalum-173	W, see ^{172}Ta	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-174[2]	W, see ^{172}Ta	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	9E+4	4E-5	1E-7	-	-
73	Tantalum-175	W, see ^{172}Ta	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
		Y, see ^{172}Ta	-	1E+4	6E-6	2E-8	-	-
73	Tantalum-176	W, see ^{172}Ta	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		Y, see ^{172}Ta	-	1E+4	5E-6	2E-8	-	-
73	Tantalum-177	W, see ^{172}Ta	1E+4	2E+4	8E-6	3E-8	2E-4	2E-3
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-178	W, see ^{172}Ta	2E+4	9E+4	4E-5	1E-7	2E-4	2E-3
		Y, see ^{172}Ta	-	7E+4	3E-5	1E-7	-	-
73	Tantalum-179	W, see ^{172}Ta	2E+4	5E+3	2E-6	8E-9	3E-4	3E-3
		Y, see ^{172}Ta	-	9E+2	4E-7	1E-9	-	-
73	Tantalum-180m	W, see ^{172}Ta	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{172}Ta	-	6E+4	2E-5	8E-8	-	-
73	Tantalum-180	W, see ^{172}Ta	1E+3	4E+2	2E-7	6E-10	2E-5	2E-4
		Y, see ^{172}Ta	-	2E+1	1E-8	3E-11	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
73	Tantalum-182m[2]	W, see ^{172}Ta	2E+5	5E+5	2E-4	8E-7	-	-
			St wall (2E+5)	-	-	-	3E-3	3E-2
		Y, see ^{172}Ta	-	4E+5	2E-4	6E-7	-	-
73	Tantalum-182	W, see ^{172}Ta	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		Y, see ^{172}Ta	-	1E+2	6E-8	2E-10	-	-
73	Tantalum-183	W, see ^{172}Ta	9E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{172}Ta	-	1E+3	4E-7	1E-9	-	-
73	Tantalum-184	W, see ^{172}Ta	2E+3	5E+3	2E-6	8E-9	3E-5	3E-4
		Y, see ^{172}Ta	-	5E+3	2E-6	7E-9	-	-
73	Tantalum-185[2]	W, see ^{172}Ta	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	6E+4	3E-5	9E-8	-	-
73	Tantalum-186[2]	W, see ^{172}Ta	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	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
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	7E+3	3E-6	9E-9	-	-
			LLI wall (3E+3)	-	-	-	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	1E+3	5E-7	2E-9	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
75	Rhenium-177[2]	D, all compounds except those given for W	9E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	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	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	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	2E+3	7E-7	-	-	-
			St wall (2E+3)	St wall (2E+3)	-	3E-9	2E-5	2E-4
		W, see ^{177}Re	-	2E+2	6E-8	2E-10	-	-
75	Rhenium-186	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		W, see ^{177}Re	-	2E+3	7E-7	2E-9	-	-
75	Rhenium-187	D, see ^{177}Re	6E+5	8E+5	4E-4	-	8E-3	8E-2
			-	St wall (9E+5)	-	1E-6	-	-
		W, see ^{177}Re	-	1E+5	4E-5	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	-	-
		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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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, 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	-	-
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	6E+3	3E-6	8E-9	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 (3E+4)	-	-	-	4E-5	4E-4
78	Platinum-193	D, all compounds	4E+4	2E+4	1E-5	3E-8	-	-
			LLI wall (5E+4)	-	-	-	6E-4	6E-3
78	Platinum-195m	D, all compounds	2E+3	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	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	-	-
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	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		W, see ^{193}Au	-	4E+3	2E-6	6E-9	-	-
		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	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{193}Au	-	2E+5	1E-4	3E-7	-	-
		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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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	5E-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	-	-
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

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Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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	6E-1	2E-1	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	-	-
			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

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		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 (or 12 working level months)	9E-9 (or 1.0 working level)	3E-11	-	-
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-
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	-	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
			Bone surf (4E-1)	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
		W, see ^{224}Ac	-	2E-3	7E-13	-	-	-
			-	Bone surf (3E-3)	-	4E-15	-	-
		Y, see ^{224}Ac	-	4E-3	2E-12	6E-15	-	-
89	Actinium-228	D, see ^{224}Ac	2E+3	9E+0	4E-9	-	3E-5	3E-4
			-	Bone surf (2E+1)	-	2E-11	-	-
		W, see ^{224}Ac	-	4E+1	2E-8	-	-	-
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{224}Ac	-	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	2E-5
		Y, see ^{226}Th	-	3E-1	1E-10	5E-13	-	-
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	5E-4
		Y, see ^{226}Th	-	6E+3	3E-6	9E-9	-	-
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	5E-4
		Y, oxides and hydroxides	-	1E+2	4E-8	1E-10	-	-
91	Protactinium-228	W, see ^{227}Pa	1E+3	1E+1	5E-9	-	2E-5	2E-4
			-	Bone surf (2E+1)	-	3E-11	-	-
		Y, see ^{227}Pa	-	1E+1	5E-9	2E-11	-	-

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Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
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 (6E-3)	-	8E-15	-	-
91	Protactinium-232	W, see ^{227}Pa	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_6, UO_2F_2, $UO_2(NO_3)_2$	4E+0	4E-1	2E-10	-	-	-
			Bone surf (6E+0)	Bone surf (6E-1)	-	8E-13	8E-8	8E-7
		W, UO_3, UF_4, UCl_4	-	4E-1	1E-10	5E-13	-	-
		Y, UO_2, U_3O_8	-	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	-	-

(Rule 0400-20-05-.161, continued)

Atomic No.	Radionuclide	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 ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
		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
		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 (1.15E+5 y)	W, all compounds	3E+0	2E-2	9E-12	-	-	-
			Bone surf (6E+0)	Bone surf (5E-2)	-	8E-14	9E-8	9E-7
93	Neptunium-236m (22.5 h)	W, all compounds	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_2	8E+3	2E+2	9E-8	3E-10	1E-4	1E-3
		Y, PuO_2	-	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

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Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
		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
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-240	W, see ^{234}Pu	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-241	W, see ^{234}Pu	4E+1	3E-1	1E-10	-	-	-
			Bone surf (7E+1)	Bone surf (6E-1)	-	8E-13	1E-6	1E-5
		Y, see ^{234}Pu	-	8E-1	3E-10	-	-	-
			-	Bone surf (1E+0)	-	1E-12	-	-
94	Plutonium-242	W, see ^{234}Pu	8E-1	7E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
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	7E-3	3E-12	-	-	-
			Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
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	3E+2	1E-7	4E-10	-	-
			LLI wall (4E+2)	-	-	-	6E-6	6E-5
		Y, see ^{234}Pu	-	3E+2	1E-7	4E-10	-	-
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	1E-6	-	5E-4	5E-3
			-	Bone surf (6E+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	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-	W, all compounds	8E-1	6E-3	3E-12	-	-	-

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Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
	242m		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242	W, all compounds	4E+3	8E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (9E+1)	-	1E-10	-	-
95	Americium-243	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-244m[2]	W, all compounds	6E+4	4E+3	2E-6	-	-	-
			St wall (8E+4)	Bone surf (7E+3)	-	1E-8	1E-3	1E-2
95	Americium-244	W, all compounds	3E+3	2E+2	8E-8	-	4E-5	4E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
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	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	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	6E-1	2E-10	-	-	-
			Bone surf (8E+1)	Bone surf (6E-1)	-	9E-13	1E-6	1E-5
96	Curium-241	W, all compounds	1E+3	3E+1	1E-8	-	2E-5	2E-4
			-	Bone surf (4E+1)	-	5E-11	-	-
96	Curium-242	W, all compounds	3E+1	3E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	4E-13	7E-7	7E-6
96	Curium-243	W, all compounds	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	2E-14	3E-8	3E-7
96	Curium-244	W, all compounds	1E+0	1E-2	5E-12	-	-	-
			Bone surf (3E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
96	Curium-245	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-246	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-247	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	2E-1	2E-3	7E-13	-	-	-
			Bone surf (4E-1)	Bone surf (3E-3)	-	4E-15	5E-9	5E-8
96	Curium-249[2]	W, all compounds	5E+4	2E+4	7E-6	-	7E-4	7E-3
			-	Bone surf (3E+4)	-	4E-8	-	-
96	Curium-250	W, all compounds	4E-2	3E-4	1E-13	-	-	-
			Bone surf (6E-2)	Bone surf (5E-4)	-	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
97	Berkelium-247	W, all compounds	5E-1	4E-3	2E-12	-	-	-

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Atomic No.	Radionuclide	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 ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
97	Berkelium-249	W, all compounds	2E+2	2E+0	7E-10	-	-	-
			Bone surf (5E+2)	Bone surf (4E+0)	-	5E-12	6E-6	6E-5
97	Berkelium-250	W, all compounds	9E+3	3E+2	1E-7	-	1E-4	1E-3
			-	Bone surf (7E+2)	-	1E-9	-	-
98	Californium-244[2]	W, all compounds except those given for Y	3E+4	6E+2	2E-7	8E-10	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		Y, oxides and hydroxides	-	6E+2	2E-7	8E-10	-	-
98	Californium-246	W, see ^{244}Cf	4E+2	9E+0	4E-9	1E-11	5E-6	5E-5
		Y, see ^{244}Cf	-	9E+0	4E-9	1E-11	-	-
98	Californium-248	W, see ^{244}Cf	8E+0	6E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
		Y, see ^{244}Cf	-	1E-1	4E-11	1E-13	-	-
98	Californium-249	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-	-
				Bone surf				
			-	(1E-2)	-	2E-14	-	-
98	Californium-250	W, see ^{244}Cf	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
		Y, see ^{244}Cf	-	3E-2	1E-11	4E-14	-	-
98	Californium-251	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-	-
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-252	W, see ^{244}Cf	2E+0	2E-2	8E-12	-	-	-
			Bone surf (5E+0)	Bone surf (4E-2)	-	5E-14	7E-8	7E-7
		Y, see ^{244}Cf	-	3E-2	1E-11	5E-14	-	-
98	Californium-253	W, see ^{244}Cf	2E+2	2E+0	8E-10	3E-12	-	-
			Bone surf (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{244}Cf	-	2E+0	7E-10	2E-12	-	-
98	Californium-254	W, see ^{244}Cf	2E+0	2E-2	9E-12	3E-14	3E-8	3E-7
		Y, see ^{244}Cf	-	2E-2	7E-12	2E-14	-	-
99	Einsteinium-250	W, all compounds	4E+4	5E+2	2E-7	-	6E-4	6E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-251	W, all compounds	7E+3	9E+2	4E-7	-	1E-4	1E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-253	W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6	2E-5
99	Einsteinium-254m	W, all compounds	3E+2	1E+1	4E-9	1E-11	-	-
			LLI wall (3E+2)	-	-	-	4E-6	4E-5
99	Einsteinium-	W, all compounds	8E+0	7E-2	3E-11	-	-	-

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Atomic No.	Radionuclide	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 Concen-tration (µCi/ml)*
			Oral Ingestion ALI (µCi)	Inhalation		Air (µCi/ml)	Water (µCi/ml)	
				ALI (µCi)	DAC (µCi/ml)			
	254		Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
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	2E-1	7E-11	-	-	-
			Bone surf (4E+1)	Bone surf (2E-1)	-	3E-13	5E-7	5E-6
101	Mendelevium-257	W, all compounds	7E+3	8E+1	4E-8	-	1E-4	1E-3
			-	Bone surf (9E+1)	-	1E-10	-	-
101	Mendelevium-258	W, all compounds	3E+1	2E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	5E-13	6E-7	6E-6
-	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

ENDNOTES:

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

[2] These 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

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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 Rule 0400-20-05-.52.)

[3] For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see paragraph (5) of Rule 0400-20-05-.50). 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:

$$SA = 3.6E\text{-}7 \text{ curies/gram U} \quad \text{U-depleted}$$

$$SA = [0.4 + 0.38 (\text{enrichment}) + 0.0034 (\text{enrichment})^2] E\text{-}6, \quad \text{enrichment} \geq 0.72$$

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 schedule 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 schedule for any radionuclide that is not known to be absent from the mixture; or

Atomic No.	Radionuclide	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)*
			Inhalation			Air (µCi/ml)	Water (µCi/ml)	
			Oral Ingestion ALI (µCi)	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	-	-	-

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Atomic No.	Radionuclide	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)*
			Inhalation			Air (µCi/ml)	Water (µCi/ml)	
			Oral Ingestion ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
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, 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

3. 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.

4. 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 Schedule RHS 8–30 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 C_A, C_B, and C_C, 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:

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

(Rule 0400-20-05-.161, continued)

SCHEDULE RHS 8–31
QUANTITIES [a] OF LICENSED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (µCi) *a
Hydrogen–3	1,000
Beryllium–7	1,000
Beryllium–10	1
Carbon–11	1,000
Carbon–14	1,000
Fluorine–18	1,000
Sodium–22	10
Sodium–24	100
Magnesium–28	100
Aluminum–26	10
Silicon–31	1,000
Silicon–32	1
Phosphorus–32	10
Phosphorus–33	100
Sulfur–35	100
Chlorine–36	10
Chlorine–38	1,000
Chlorine–39	1,000
Argon–39	1,000
Argon–41	1,000
Potassium–40	100
Potassium–42	1,000
Potassium–43	1,000
Potassium–44	1,000
Potassium–45	1,000
Calcium–41	100
Calcium–45	100
Calcium–47	100
Scandium–43	1,000
Scandium–44m	100
Scandium–44	100
Scandium–46	10
Scandium–47	100
Scandium–48	100
Scandium–49	1,000
Titanium–44	1
Titanium–45	1,000
Vanadium–47	1,000
Vanadium–48	100
Vanadium–49	1,000
Chromium–48	1,000
Chromium–49	1,000
Chromium–51	1,000
Manganese–51	1,000
Manganese–52m	1,000
Manganese–52	100
Manganese–53	1,000
Manganese–54	100
Manganese–56	1,000
Iron–52	100
Iron–55	100
Iron–59	10
Iron–60	1
Cobalt–55	100
Cobalt–56	10
Cobalt–57	100
Cobalt–58m	1,000
Cobalt–58	100
Cobalt–60m	1,000
Cobalt–60	1
Cobalt–61	1,000
Cobalt–62m	100
Nickel–56	100
Nickel–57	100
Nickel–59	100
Nickel–63	100
Nickel–65	1,000
Nickel–66	10
Copper–60	1,000
Copper–61	1,000
Copper–64	1,000
Copper–67	1,000
Zinc–62	100
Zinc–63	1,000
Zinc–65	10
Zinc–69m	100
Zinc–69	1,000
Zinc–71m	1,000
Zinc–72	100
Gallium–65	1,000
Gallium–66	100
Gallium–67	1,000
Gallium–68	1,000
Gallium–70	1,000
Gallium–72	100
Gallium–73	1,000
Germanium–66	1,000
Germanium–67	1,000
Germanium–68	10
Germanium–69	1,000
Germanium–71	1,000
Germanium–75	1,000
Germanium–77	1,000
Germanium–78	1,000
Arsenic–69	1,000
Arsenic–70	1,000
Arsenic–71	100
Arsenic–72	100
Arsenic–73	100
Arsenic–74	100

*a To Convert µCi to KBq, multiply the µCi value by 37.

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (μCi) [a]
Arsenic–76	100
Arsenic–77	100
Arsenic–78	1,000
Selenium–70	1,000
Selenium–73m	1,000
Selenium–73	100
Selenium–75	100
Selenium–79	100
Selenium–81m	1,000
Selenium–81	1,000
Selenium–83	1,000
Bromine–74m	1,000
Bromine–74	1,000
Bromine–75	1,000
Bromine–76	100
Bromine–77	1,000
Bromine–80m	1,000
Bromine–80	1,000
Bromine–82	100
Bromine–83	1,000
Bromine–84	1,000
Krypton–74	1,000
Krypton–76	1,000
Krypton–77	1,000
Krypton–79	1,000
Krypton–81	1,000
Krypton–83m	1,000
Krypton–85m	1,000
Krypton–85	1,000
Krypton–87	1,000
Krypton–88	1,000
Rubidium–79	1,000
Rubidium–81m	1,000
Rubidium–81	1,000
Rubidium–82m	1,000
Rubidium–83	100
Rubidium–84	100
Rubidium–86	100
Rubidium–87	100
Rubidium–88	1,000
Rubidium–89	1,000
Strontium–80	100
Strontium–81	1,000
Strontium–83	100
Strontium–85m	1,000
Strontium–85	100
Strontium–87m	1,000
Strontium–89	10
Strontium–90	0.1
Strontium–91	100
Strontium–92	100
Yttrium–86m	1,000
Yttrium–86	100
Yttrium–87	100
Yttrium–88	10
Yttrium–90m	1,000
Yttrium–90	10
Yttrium–91m	1,000
Yttrium–91	10
Yttrium–92	100
Yttrium–93	100
Yttrium–94	1,000
Yttrium–95	1,000
Zirconium–86	100
Zirconium–88	10
Zirconium–89	100
Zirconium–93	1
Zirconium–95	10
Zirconium–97	100
Niobium–88	1,000
Niobium–89m (66 min)	1,000
Niobium–89 (122 min)	1,000
Niobium–90	100
Niobium–93m	10
Niobium–94	1
Niobium–95m	100
Niobium–95	100
Niobium–96	100
Niobium–97	1,000
Niobium–98	1,000
Molybdenum–90	100
Molybdenum –93m	100
Molybdenum–93	10
Molybdenum–99	100
Molybdenum–101	1,000
Technetium–93m	1,000
Technetium–93	1,000
Technetium–94m	1,000
Technetium–94	1,000
Technetium–96m	1,000
Technetium–96	100
Technetium–97m	100
Technetium–97	1,000
Technetium–98	10
Technetium–99m	1,000
Technetium–99	100
Technetium–101	1,000
Technetium–104	1,000
Ruthenium–94	1,000
Ruthenium–97	1,000
Ruthenium–103	100
Ruthenium–105	1,000
Ruthenium–106	1
Rhodium–99m	1,000
Rhodium–99	100
Rhodium–100	100
Rhodium–101m	1,000
Rhodium –101	10
Rhodium–102m	10
Rhodium–102	10

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (μCi) [a]
Rhodium–103m	1,000
Rhodium–105	100
Rhodium–106m	1,000
Rhodium–107	1,000
Palladium–100	100
Palladium–101	1,000
Palladium–103	100
Palladium–107	10
Palladium–109	100
Silver–102	1,000
Silver–103	1,000
Silver–104m	1,000
Silver–104	1,000
Silver–105	100
Silver–106m	100
Silver–106	1,000
Silver–108m	1
Silver–110m	10
Silver–111	100
Silver–112	100
Silver–115	1,000
Cadmium–104	1,000
Cadmium–107	1,000
Cadmium–109	1
Cadmium–113m	0.1
Cadmium–113	100
Cadmium–115m	10
Cadmium–115	100
Cadmium–117m	1,000
Cadmium–117	1,000
Indium–109	1,000
Indium–110m (69.1m)	1,000
Indium–110 (4.9h)	1,000
Indium–111	100
Indium–112	1,000
Indium–113m	1,000
Indium–114m	10
Indium–115m	1,000
Indium–115	100
Indium–116m	1,000
Indium–117m	1,000
Indium–117	1,000
Indium–119m	1,000
Tin–110	100
Tin–111	1,000
Tin–113	100
Tin–117m	100
Tin–119m	100
Tin–121m	100
Tin–121	1,000
Tin–123m	1,000
Tin–123	10
Tin–125	10
Tin–126	10
Tin–127	1,000
Tin–128	1,000
Antimony–115	1,000
Antimony–116m	1,000
Antimony–116	1,000
Antimony–117	1,000
Antimony–118m	1,000
Antimony–119	1,000
Antimony–120 (16m)	1,000
Antimony–120 (5.76d)	100
Antimony–122	100
Antimony–124m	1,000
Antimony–124	10
Antimony–125	100
Antimony–126m	1,000
Antimony–130	1,000
Antimony–131	1,000
Tellurium–116	1,000
Tellurium–121m	10
Tellurium–121	100
Tellurium–123m	10
Tellurium–123	100
Tellurium–125m	10
Antimony–126	100
Antimony–127	100
Tellurium–127m	10
Tellurium–127	1,000
Antimony–128 (10.4 m)	1,000
Antimony–128 (9.01 h)	100
Antimony–129	100
Tellurium–129m	10
Tellurium–129	1,000
Tellurium–131m	10
Tellurium–131	100
Tellurium–132	10
Tellurium–133m	100
Tellurium–133	1,000
Tellurium–134	1,000
Iodine–120m	1,000
Iodine–120	100
Iodine–121	1,000
Iodine–123	100
Iodine–124	10
Iodine–125	1
Iodine–126	1
Iodine–128	1,000
Iodine–129	1
Iodine–130	10
Iodine–131	1
Iodine–132m	100
Iodine–132	100
Iodine–133	10
Iodine–134	1,000
Iodine–135	100

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (μCi) [a]
Xenon–120	1,000
Xenon–121	1,000
Xenon–122	1,000
Xenon–123	1,000
Xenon–125	1,000
Xenon–127	1,000
Xenon–129m	1,000
Xenon–131m	1,000
Xenon–133m	1,000
Xenon–133	1,000
Xenon–135m	1,000
Xenon–135	1,000
Xenon–138	1,000
Cesium–125	1,000
Cesium–127	1,000
Cesium–129	1,000
Cesium–130	1,000
Cesium–131	1,000
Cesium–132	100
Cesium–134m	1,000
Cesium–134	10
Cesium–135m	1,000
Cesium–135	100
Cesium–136	10
Cesium–137	10
Cesium–138	1,000
Barium–126	1,000
Barium–128	100
Barium–131m	1,000
Barium–131	100
Barium–133m	100
Barium–133	100
Barium–135m	100
Barium–139	1,000
Barium–140	100
Barium–141	1,000
Barium–142	1,000
Lanthanum–131	1,000
Lanthanum–132	100
Lanthanum–135	1,000
Lanthanum–137	10
Lanthanum–138	100
Lanthanum–140	100
Lanthanum–141	100
Lanthanum–142	1,000
Lanthanum–143	1,000
Cerium–134	100
Cerium–135	100
Cerium–137m	100
Cerium–137	1,000
Cerium–139	100
Cerium–141	100
Cerium–143	100
Cerium–144	1
Praseodymium–136	1,000
Praseodymium–137	1,000
Praseodymium–138m	1,000
Praseodymium–139	1,000
Praseodymium–142m	1,000
Praseodymium–142	100
Praseodymium–143	100
Praseodymium–144	1,000
Praseodymium–145	100
Praseodymium–147	1,000
Neodymium–136	1,000
Neodymium–138	100
Neodymium–139m	1,000
Neodymium–139	1,000
Neodymium–141	1,000
Neodymium–147	100
Neodymium–149	1,000
Neodymium–151	1,000
Promethium–141	1,000
Promethium–143	100
Promethium–144	10
Promethium–145	10
Promethium–146	1
Promethium–147	10
Promethium–148m	10
Promethium–148	10
Promethium–149	100
Promethium–150	1,000
Promethium–151	100
Samarium–141m	1,000
Samarium–141	1,000
Samarium–142	1,000
Samarium–145	100
Samarium–146	1
Samarium–147	100
Samarium–151	10
Samarium–153	100
Samarium–155	1,000
Samarium–156	1,000
Europium–145	100
Europium–146	100
Europium–147	100
Europium–148	10
Europium–149	100
Europium–150 (12.62h)	100
Europium–150 (34.2y)	1
Europium–152m	100
Europium–152	1
Europium–154	1
Europium–155	10
Europium–156	100
Europium– 157	100
Europium–158	1,000
Gadolinium–145	1,000
Gadolinium–146	10
Gadolinium–147	100
Gadolinium–148	0.001
Gadolinium–149	100

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (µCi) [a]
Gadolinium–151	10
Gadolinium–152	100
Gadolinium–153	10
Gadolinium–159	100
Terbium–147	1,000
Terbium–149	100
Terbium– 150	1,000
Terbium–151	100
Terbium–153	1,000
Terbium–154	100
Terbium–155	1,000
Terbium–156m (5.0 h)	1,000
Terbium–156m (24.4h)	1,000
Terbium–156	100
Terbium–157	10
Terbium–158	1
Terbium–160	10
Terbium–161	100
Dysprosium–155	1,000
Dysprosium–157	1,000
Dysprosium–159	100
Dysprosium–165	1,000
Dysprosium–166	100
Holmium–155	1,000
Holmium–157	1,000
Holmium–159	1,000
Holmium–161	1,000
Holmium–162m	1,000
Holmium–162	1,000
Holmium–164m	1,000
Holmium–164	1,000
Holmium–166m	1
Holmium–166	100
Holmium–167	1,000
Erbium–161	1,000
Erbium–165	1,000
Erbium–169	100
Erbium–171	100
Erbium–172	100
Thulium–162	1,000
Thulium–166	100
Thulium–167	100
Thulium–170	10
Thulium–171	10
Thulium–172	100
Thulium–173	100
Thulium–175	1,000
Ytterbium–162	1,000
Ytterbium–166	100
Ytterbium–167	1,000
Ytterbium–169	100
Ytterbium–175	100
Ytterbium–177	1,000
Ytterbium–178	1,000
Lutetium–169	100
Lutetium–170	100

Radionuclide	Quantity (µCi) [a]
Lutetium–171	100
Lutetium–172	100
Lutetium–173	10
Lutetium–174m	10
Lutetium–174	10
Lutetium–176m	1,000
Lutetium–176	100
Lutetium–177m	10
Lutetium–177	100
Lutetium–178m	1,000
Lutetium–178	1,000
Lutetium–179	1,000
Hafnium–170	100
Hafnium–172	1
Hafnium–173	1,000
Hafnium–175	100
Hafnium–177m	1,000
Hafnium–178m	0.1
Hafnium–179m	10
Hafnium–180m	1,000
Hafnium–181	10
Hafnium–182m	1,000
Hafnium–182	0.1
Hafnium–183	1,000
Hafnium–184	100
Tantalum–172	1,000
Tantalum–173	1,000
Tantalum–174	1,000
Tantalum–175	1,000
Tantalum–176	100
Tantalum–177	1,000
Tantalum–178	1,000
Tantalum–179	100
Tantalum–180m	1,000
Tantalum–180	100
Tantalum–182m	1,000
Tantalum–182	10
Tantalum–183	100
Tantalum–184	100
Tantalum–185	1,000
Tantalum–186	1,000
Tungsten–176	1,000
Tungsten–177	1,000
Tungsten–178	1,000
Tungsten–179	1,000
Tungsten–181	1,000
Tungsten–185	100
Tungsten–187	100
Tungsten–188	10
Rhenium–177	1,000
Rhenium–178	1,000
Rhenium–181	1,000
Rhenium–182 (12.7h)	1,000
Rhenium–182 (64.0 h)	100
Rhenium–184m	10
Rhenium–184	100

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (μCi) [a]
Rhenium–186m	10
Rhenium–186	100
Rhenium–187	1,000
Rhenium–188m	1,000
Rhenium–188	100
Rhenium–189	100
Osmium–180	1,000
Osmium–181	1,000
Osmium–182	100
Osmium–185	100
Osmium–189m	1,000
Osmium–191m	1,000
Osmium–191	100
Osmium–193	100
Osmium–194	1
Iridium–182	1,000
Iridium–184	1,000
Iridium–185	1,000
Iridium–186	100
Iridium–187	1,000
Iridium–188	100
Iridium–189	100
Iridium–190m	1,000
Iridium–190	100
Iridium–192m (1.4m)	10
Iridium–192 (73.8d)	1
Iridium–194m	10
Iridium–194	100
Iridium–195m	1,000
Iridium–195	1,000
Platinum–186	1,000
Platinum–188	100
Platinum –189	1,000
Platinum–191	100
Platinum–193m	100
Platinum–193	1,000
Platinum–195m	100
Platinum–197m	1,000
Platinum–197	100
Platinum–199	1,000
Platinum–200	100
Gold–193	1,000
Gold–194	100
Gold–195	10
Gold–198m	100
Gold–198	100
Gold–199	100
Gold–200m	100
Gold–200	1,000
Gold–201	1,000
Mercury–193m	100
Mercury–193	1,000
Mercury–194	1
Mercury–195m	100
Mercury–195	1,000
Mercury–197m	100
Mercury–197	1,000
Mercury–199m	1,000
Mercury–203	100
Thallium–194m	1,000
Thallium–194	1,000
Thallium–195	1,000
Thallium–197	1,000
Thallium–198m	1,000
Thallium–198	1,000
Thallium–199	1,000
Thallium–200	1,000
Thallium–201	1,000
Thallium–202	100
Thallium–204	100
Lead–195m	1,000
Lead–198	1,000
Lead–199	1,000
Lead–200	100
Lead–201	1,000
Lead–202m	1,000
Lead–202	10
Lead–203	1,000
Lead–205	100
Lead–209	1,000
Lead–210	0.01
Lead–211	100
Lead–212	1
Lead–214	100
Bismuth–200	1,000
Bismuth–201	1,000
Bismuth–202	1,000
Bismuth–203	100
Bismuth–205	100
Bismuth–206	100
Bismuth–207	10
Bismuth–210m	0.1
Bismuth–210	1
Bismuth–212	10
Bismuth–213	10
Bismuth–214	100
Polonium–203	1,000
Polonium–205	1,000
Polonium–207	1,000
Polonium–210	0.1
Astatine–207	100
Astatine–211	10
Radon–220	1
Radon–222	1
Francium–222	100
Francium–223	100
Radium–223	0.1
Radium–224	0.1
Radium–225	0.1
Radium–226	0.1
Radium–227	1,000
Radium–228	0.1

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (μCi) [a]
Actinium–224	1
Actinium–225	0.01
Actinium–226	0.1
Actinium–227	0.001
Actinium–228	1
Thorium–226	10
Thorium–227	0.01
Thorium–228	0.001
Thorium–229	0.001
Thorium–230	0.001
Thorium–231	100
Thorium–232	100
Thorium–234	10
Thorium–natural	100
Protactinium–227	10
Protactinium–228	1
Protactinium–230	0.1
Protactinium–231	0.001
Protactinium–232	1
Protactinium–233	100
Protactinium–234	100
Uranium–230	0.01
Uranium–231	100
Uranium–232	0.001
Uranium–233	0.001
Uranium–234	0.001
Uranium–235	0.001
Uranium–236	0.001
Uranium–237	100
Uranium–238	100
Uranium–239	1,000
Uranium–240	100
Uranium–natural	100
Neptunium–232	100
Neptunium–233	1,000
Neptunium–234	100
Neptunium–235	100
Neptunium–236 (1.15E+5)	0.001
Neptunium–236 (22.5h)	1
Neptunium–237	0.001
Neptunium–238	10
Neptunium–239	100
Neptunium–240	1,000
Plutonium–234	10
Plutonium–235	1,000
Plutonium–236	0.001
Plutonium–237	100
Plutonium–238	0.001
Plutonium–239	0.001
Plutonium–240	0.001
Plutonium–241	0.01
Plutonium–242	0.001
Plutonium–243	1,000
Plutonium–244	0.001
Plutonium–245	100
Americium–237	1,000
Americium–238	100
Americium–239	1,000
Americium–240	100
Americium–241	0.001
Americium–242m	0.001
Americium–242	10
Americium–243	0.001
Americium–244m	100
Americium–244	10
Americium–245	1,000
Americium–246m	1,000
Americium–246	1,000
Curium–238	100
Curium–240	0.1
Curium–241	1
Curium–242	0.01
Curium–243	0.001
Curium–244	0.001
Curium–245	0.001
Curium–246	0.001
Curium–247	0.001
Curium–248	0.001
Curium–249	1,000
Berkelium–245	100
Berkelium–246	100
Berkelium–247	0.001
Berkelium–249	0.1
Berkelium–250	10
Californium–244	100
Californium–246	1
Californium–248	0.01
Californium–249	0.001
Californium–250	0.001
Californium–251	0.001
Californium–252	0.001
Californium–253	0.1
Californium–254	0.001
Einsteinium–250	100
Einsteinium–250	100
Einsteinium–251	100
Einsteinium–253	0.1
Einsteinium–254m	1
Einsteinium–254	0.01
Fermium–252	1
Fermium–253	1
Fermium–254	10
Fermium–255	1
Fermium–257	0.01
Mendelevium–257	10
Mendelevium–258	0.01

(Rule 0400-20-05-.161, continued)

Radionuclide	Quantity (µCi) [*a]
Any alpha–emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition	0.001
Any radionuclide other than alpha emitting radionuclides not listed above, or mixtures of beta emitters of unknown composition	0.01

[a] The quantities listed above were derived by taking 1/10 of the most restrictive ALI listed in Table 1 Columns 1 and 2 of Schedule RHS 8–30 of this chapter, rounding to the nearest factor of 10, and arbitrarily constraining the values listed between 0.001 and 1,000 µCi (37 Bq and 37 MBq). Values of 100 µCi (3.7 MBq) have been assigned for radionuclides having a radioactive half–life in excess of 109 years, except rhenium, 1,000 µCi (37 MBq), to take into account their low specific activity.

NOTE: For purposes of Rules 0400-20-02-.111, 0400-20-05-.114, and 0400-20-05-.140, where there is involved a combination of radionuclides in known amounts, the limit for the combination shall be derived as follows: determine, for each radionuclide in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific radionuclide when not in combination. The sum of such ratios for all radionuclides in the combination may not exceed "1" — that is, unity.

[*a] *To Convert µCi to KBq, multiply the µCi value by 37.*

(Rule 0400-20-05-.161, continued)

SCHEDULE RHS 8–32
ASSIGNED PROTECTION FACTORS FOR RESPIRATORS [a]

	Operating Mode [c]	Assigned Protection Factors
I. Air–Purifying Respirators [Particulate [b] only] [c]:		
Filtering facepiece disposable [d]	Negative Pressure	([d])
Facepiece, half [e]	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, gases and vapors [f]]:		
1. Air–line respirator:		
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	([g])
2. Self–contained breathing apparatus (SCBA):		
Facepiece, full	Demand	[h] 100
Facepiece, full	Pressure Demand	[i] 10,000
Facepiece, full	Demand, Recirculating	[h] 100
Facepiece, full	Positive Pressure Recirculating	[i] 10,000
Any combination of air–purifying and atmosphere–supplying respirators	Assigned protection factor for type and mode of operation as listed above	

a These assigned protection factors apply only in a respiratory protection program that meets the requirements of this chapter. 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 U. S. Department of Labor regulations. Radioactive contaminants for which the concentration values in Table 1, Column 3 of schedule RHS 8–32 in this rule 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.

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

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

d Licensees may permit individuals to use this type of respirator who have not been medically

(Rule 0400-20-05-.161, continued)

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 Rule 0400-20-05-.92 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.

e Under-chin type only. No distinction is made in this Schedule 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 chapter are met.

f 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.

g 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 (i.e., Rule 0400-20-05-.92).

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

i 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.

(Rule 0400-20-05-.161, continued)

SCHEDULE RHS 8-33
REQUIREMENTS FOR TRANSFER OF LOW-LEVEL RADIOACTIVE WASTE FOR DISPOSAL AT LAND DISPOSAL FACILITIES AND MANIFESTS

I. Manifest.

A waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility shall prepare a manifest. The manifest shall contain the information requested on applicable NRC Forms 540 (Uniform Low-Level Radioactive Waste Manifest (Shipping Paper)) and 541 (Uniform Low-Level Radioactive Waste Manifest (Container and Waste Description)) and, if necessary, on an applicable NRC Form 542 (Uniform Low-Level Radioactive Waste Manifest (Manifest Index and Regional Compact Tabulation)). NRC Forms 540 and 540A shall be completed and shall physically accompany the pertinent low-level waste shipment. Upon agreement between shipper and consignee, NRC Forms 541 and 541A and 542 and 542A may be completed, transmitted and stored in electronic media with the capability for producing legible, accurate and complete records of the respective forms. Licensees are not required to comply with the manifesting requirements of this rule when they ship:

1. LLW for processing and expect its return (i.e., for storage under their license) prior to disposal at a licensed land disposal facility;

2. LLW that is being returned to the licensee who is the “waste generator” or “generator,” as defined in this rule; or

3. Radioactively contaminated material to a “‘waste processor” that becomes the processor’s “residual waste.”

For guidance in completing these forms, refer to the instructions that accompany the forms. Copies of manifests required by this appendix may be legible carbon copies, photocopies or computer printouts that reproduce the data in the format of the uniform manifest.

NRC Forms 540, 540A, 541, 541A, 542 and 542A and the accompanying instructions, in hard copy, may be obtained from the Information and Records Management Branch, Office of Information Resources Management, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (301) 415-7232.

This appendix includes information requirements of the Department of Transportation, as codified in 49 CFR part 172. Information on hazardous, medical, or other waste, required to meet Environmental Protection Agency regulations, as codified in 40 CFR parts 259, 261 or elsewhere, is not addressed in this rule and must be provided on the required EPA forms. However, the required EPA forms shall accompany the Uniform Low-Level Radioactive Waste Manifest required by this chapter.

As used in this appendix, the following definitions apply:

1. “Chelating agent” has the same meaning as that given in Rule 0400-20-11-.03.

2. “Chemical description” means a description of the principal chemical characteristics of a low-level radioactive waste.

3. “Computer-readable medium” means that the regulatory agency’s computer can transfer the information from the medium into its memory.

4. “Consignee” means the designated receiver of the shipment of low-level radioactive waste.

5. “Decontamination facility” means a facility operating under a license issued by the Division, the U.S. Nuclear Regulatory Commission, or another Agreement State, whose principal purpose is decontamination of equipment or materials to accomplish recycle, reuse or other waste

(Rule 0400-20-05-.161, continued)

management objectives and, for purposes of this rule, is not considered to be a consignee for LLW shipments.

6. "Disposal container" means a container principally used to confine low-level radioactive waste during disposal operations at a land disposal facility (also see "high integrity container"). Note that for some shipments, the disposal container may be the transport package.

7. "EPA identification number" means the number received by a transporter following application to the Administrator of EPA as required by 40 CFR 263.

8. "Generator" means a licensee operating under a license issued by the Division, the U.S. Nuclear Regulatory Commission, or another Agreement State who:

   a. Is a waste generator as defined in this rule, or

   b. Is the licensee to whom waste can be attributed within the context of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (e.g., waste generated as a result of decontamination or recycle activities).

9. "High integrity container" (HIC) means a container commonly designed to meet the structural stability requirements of paragraph (7) of Rule 0400-20-11-.17 and to meet Department of Transportation requirements for a Type A package.

10. "Land disposal facility" has the same meaning as that given in Rule 0400-20-11-.03.

11. "NRC Forms 540, 540A, 541, 541A, 542 and 542A" means official NRC Forms referenced in this appendix. Licensees need not use originals of these NRC Forms as long as any substitute forms are equivalent to the original documentation in respect to content, clarity, size and location of information. Upon agreement between the shipper and consignee, NRC Forms 541 (and 541A) and NRC Forms 542 (and 542A) may be completed, transmitted and stored in electronic media. The electronic media shall have the capability for producing legible, accurate and complete records in the format of the uniform manifest.

12. "Package" means the assembly of components necessary to ensure compliance with the packaging requirements of U.S. DOT regulations, together with its radioactive contents, as presented for transport.

13. "Physical description" means the items called for on NRC Form 541 to describe a low-level radioactive waste.

14. "Residual waste" means low-level radioactive waste resulting from processing or decontamination activities that cannot be easily separated into distinct batches attributable to specific waste generators. This waste is attributable to the processor or decontamination facility, as applicable.

15. "Shipper" means the licensed entity (i.e., the waste generator, waste collector, or waste processor) who offers low-level radioactive waste for transportation, typically consigning this type of waste to a licensed waste collector, waste processor, or land disposal facility operator.

16. "Shipping paper" means NRC Form 540 and, if required, NRC Form 540A which includes the information required by U.S. DOT in 49 CFR 172.

17. "Source material" has the same meaning as that given in Rule 0400-20-05-.32.

18. "Special nuclear material" has the same meaning as that given in T.C.A. §68-202-202(1).

19. "Uniform Low-Level Radioactive Waste Manifest" (or "uniform manifest") means the combination

(Rule 0400-20-05-.161, continued)

of NRC Forms 540, 541 and, if necessary, 542 and their respective continuation sheets as needed, or equivalent.

20. "Waste collector" means an entity, operating under a license issued by the Division, the U.S. NRC or another Agreement State, whose principal purpose is to collect and consolidate waste generated by others and to transfer this waste, without processing or repackaging the collected waste, to another licensed waste collector, licensed waste processor or licensed land disposal facility.

21. "Waste description" means the physical, chemical and radiological description of a low-level radioactive waste as called for on NRC Form 541.

22. "Waste generator" means an entity, operating under a license issued by the Division, the U.S. NRC or another Agreement State, who:

    a. Possesses any material or component that contains radioactivity or is radioactively contaminated for which the licensee foresees no further use, and:

    b. Transfers this material or component to a licensed land disposal facility or to a licensed waste collector or processor for handling or treatment before disposal. A licensee performing processing or decontamination services may be a "waste generator" if the transfer of low-level radioactive waste from its facility is defined as "residual waste."

23. "Waste processor" means an entity, operating under a license issued by the Division, the U.S. NRC or another Agreement State, whose principal purpose is to process, repackage or otherwise treat low-level radioactive material or waste generated by others before eventual transfer of waste to a licensed low-level radioactive waste land disposal facility.

24. "Waste type" means a waste within a disposal container having a unique physical description (i.e., a specific waste descriptor code or description; or a waste sorbed on or solidified in a specifically defined media).

Information Requirements

A. General Information

The shipper of the radioactive waste shall provide the following information on the uniform manifest:

1. The name, facility address and telephone number of the licensee shipping the waste.

2. An explicit declaration indicating whether the shipper is acting as a waste generator, collector, processor, or a combination of these identifiers for the purposes of the manifested shipment; and

3. The name, address and telephone number, or the name and U.S. EPA hazardous waste identification number for the carrier transporting the waste to the land disposal facility.

B. Shipment Information

The shipper of the radioactive waste shall provide the following information regarding the waste shipment on the uniform manifest:

1. The date of the waste shipment;

2. The total number of packages/disposal containers;

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3. The total disposal volume and disposal weight in the shipments;

4. The total radionuclide activity in the shipment;

5. The activity of each of the radionuclides H-3, C-14, Tc-99, and I-129 contained in the shipment; and

6. The total masses of U-233, U-235, and plutonium in special nuclear material, and the total mass of uranium and thorium in source material.

C. Disposal Container and Waste Information.

The shipper of the radioactive waste shall provide the following information on the uniform manifest regarding the waste and each disposal container of waste in the shipment:

1. An alphabetic or numeric identification that uniquely identifies each disposal container in the shipment;

2. A physical description of the disposal container, including the manufacturer and model of any high integrity container;

3. The volume displaced by the disposal container;

4. The gross weight of the disposal container, including the waste;

5. For waste consigned to a disposal facility, the maximum radiation level at the surface of each disposal container;

6. A physical and chemical description of the waste;

7. The total weight percentage of chelating agent for any waste containing more than 0.1 percent chelating agent by weight, plus the identity of the principal chelating agent;

8. The approximate volume of waste within a container;

9. The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name;

10. The identities and activities of individual radionuclides contained in each container, the masses of U-233, U-235 and plutonium in special nuclear material, and the masses of uranium and thorium in source material. For discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed source/devices and wastes in solidification/stabilization media), the identities and activities of individual radionuclides associated with or contained on these waste types within a disposal container shall be reported;

11. The total radioactivity within each container; and

12. For wastes consigned to a disposal facility, the classification of the waste under paragraph (6) of Rule 0400-20-11-.17. Waste not meeting the structural stability requirements of subparagraph (7)(b) of Rule 0400-20-11-.17 shall be identified.

D. Uncontainerized Waste Information.

The shipper of the radioactive waste shall provide the following information on the uniform manifest regarding a waste shipment delivered without a disposal container:

(Rule 0400-20-05-.161, continued)

1. The approximate volume and weight of the waste;

2. A physical and chemical description of the waste;

3. The total weight percentage of chelating agent if the chelating agent exceeds 0.1% by weight, plus the identity of the principal chelating agent;

4. For waste consigned to a disposal facility, the classification of the waste under paragraph (6) of Rule 0400-20-11-.17. Waste not meeting the structural stability requirements of subparagraph (7)(b) of Rule 0400-20-11-.17 shall be identified;

5. The identities and activities of individual radionuclides contained in the waste, the masses of U-233, U-235 and plutonium in special nuclear material, and the masses of uranium and thorium in source material; and

6. For wastes consigned to a disposal facility, the maximum radiation levels at the surface of the waste.

E. Multi-Generator Disposal Container Information.

This section applies to disposal containers enclosing mixtures of waste originating from different generators. (Note: The origin of the LLW resulting from a processor's activities may be attributable to one or more "generators" (including "waste generators") as defined in this rule). It also applies to mixtures of wastes shipped in an uncontainerized form, for which portions of the mixture within the shipment originate from different generators.

1. For homogeneous mixtures of waste, such as incinerator ash, provide the waste description applicable to the mixture and the volume of the waste attributed to each generator.

2. For heterogeneous mixtures of waste, such as the combined products from a large compactor, identify each generator contributing waste to the disposal container and, for discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed source/devices and wastes in solidification/stabilization media), the identities and activities of individual radionuclides contained on these waste types within the disposal container. For each generator, provide the following:

   a. The volume of waste within the disposal container;

   b. A physical and chemical description of the waste, including the solidification agent, if any;

   c. The total weight percentage of chelating agents for any disposal container containing more than 0.1 percent chelating agent by weight, plus the identity of the principal chelating agent;

   d. The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name if the media is claimed to meet stability requirements in subparagraph (7)(b) of Rule 0400-20-11-.17; and

   e. Radionuclide identities and activities contained in the waste, the masses of U-233, U-235 and plutonium in special nuclear material, and the masses of uranium and thorium in source material if contained in the waste.

II. Certification.

An authorized representative of the waste generator, processor, or collector shall certify by signing and

(Rule 0400-20-05-.161, continued)
dating the shipment manifest that the transported materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the U.S. Department of Transportation, the U.S. Nuclear Regulatory Commission and the Division of Radiological Health. A collector, in signing the certification, is certifying that nothing has been done to the collected waste that would invalidate the waste generator's certification.

III. Control and Tracking.

A. Any licensee who transfers radioactive waste to a land disposal facility or a licensed waste collector shall comply with the requirements in paragraphs A.1 through 9 of this section. Any licensee who transfers waste to a licensed waste processor for waste treatment or repackaging shall comply with the requirements of paragraphs A.4 through 9 of this section. A licensee shall:

1. Prepare all waste so that the waste is classified according to paragraph (6) of Rule 0400-20-11-.17 and meets the waste characteristics requirements in paragraph (7) of Rule 0400-20-11-.17;

2. Label each disposal container (or transport package if potential radiation hazards preclude labeling of the individual disposal container) of waste to identify whether it is Class A waste, Class B waste, Class C waste or greater than Class C waste, in accordance with paragraph (6) of Rule 0400-20-11-.17;

3. Conduct a quality assurance program to assure compliance with paragraphs (6) and (7) of Rule 0400-20-11-.17 (the program shall include management evaluation of audits);

4. Prepare the NRC Uniform Low-Level Radioactive Waste Manifest as required by this appendix;

5. Forward a copy or electronically transfer the Uniform Low-Level Radioactive Waste Manifest to the intended consignee so that either:

   a. Receipt of the manifest precedes the LLW shipment, or

   b. The manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee.

   c. Using both a. and b. is also acceptable;

6. Include NRC Form 540 (and NRC Form 540A, if required) with the shipment regardless of the option chosen in part 5 of this subparagraph;

7. Receive acknowledgement of the receipt of the shipment in the form of a signed copy of NRC Form 540;

8. Retain a copy of or electronically store the Uniform Low-Level Radioactive Waste Manifest and documentation of acknowledgement of receipt as the record of transfer of licensed material as required by Chapter 0400-20-10; and

9. For any shipments or any part of a shipment for which acknowledgement of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with Section III.E. of this Schedule.

B. Any waste collector licensee who handles only prepackaged waste shall:

1. Acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of NRC Form 540;

(Rule 0400-20-05-.161, continued)

2. Prepare a new manifest to reflect consolidated shipments that meet the requirements of this appendix. The waste collector shall ensure that, for each container of waste in the shipment, the manifest identifies the generator of that container of waste;

3. Forward a copy or electronically transfer the Uniform Low-Level Radioactive Waste Manifest to the intended consignee so that either:

   a. Receipt of the manifest precedes the LLW shipment, or

   b. The manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee.

   c. Using both a. and b. is also acceptable;

4. Include NRC Form 540 (and NRC Form 540A, if required) with the shipment regardless of the option chosen in part 3 of this subparagraph;

5. Receive acknowledgement of the receipt of the shipment in the form of a signed copy of NRC Form 540;

6. Retain a copy of or electronically store the Uniform Low-Level Radioactive Waste Manifest and documentation of acknowledgement of receipt as the record of transfer of licensed material as required by Chapter 0400-20-10;

7. For any shipments or any part of a shipment for which acknowledgement of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with Section III.E. of this Schedule; and

8. Notify the shipper and the Director, Division of Radiological Health, when any shipment, or part of a shipment, has not arrived within 60 days after receipt of an advance manifest, unless notified by the shipper that the shipment has been cancelled.

C. Any licensed waste processor who treats or repackages waste shall:

1. Acknowledge receipt of the waste from the shipper within 1 week of receipt by returning a signed copy of NRC Form 540;

2. Prepare a new manifest that meets the requirements of this appendix. Preparation of the new manifest reflects that the processor is responsible for meeting these requirements. For each container of waste in the shipment, the manifest shall identify the waste generators, the preprocessed waste volume and the other information required in Section I.E. of this Schedule;

3. Prepare all waste so that the waste is classified according to paragraph (6) of Rule 0400-20-11-.17 and meets the waste characteristics requirements in paragraph (7) of Rule 0400-20-11-.17;

4. Label each package of waste to identify whether it is Class A waste, Class B waste, or Class C waste, in accordance with paragraphs (6) and (8) of Rule 0400-20-11-.17;

5. Conduct a quality assurance program to assure compliance with paragraphs (6) and (7) of Rule 0400-20-11-.17 (the program shall include management evaluation of audits);

6. Forward a copy or electronically transfer the Uniform Low-Level Radioactive Waste Manifest to the intended consignee so that either:

(Rule 0400-20-05-.161, continued)

a. Receipt of the manifest precedes the LLW shipment, or

b. The manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee.

c. Using both a. and b. is also acceptable;

7. Include NRC Form 540 (and NRC Form 540A, if required) with the shipment regardless of the option chosen in Subsection III.C.6 of this Schedule;

8. Receive acknowledgement of the receipt of the shipment in the form of a signed copy of NRC Form 540;

9. Retain a copy of or electronically store the Uniform Low-Level Radioactive Waste Manifest and documentation of acknowledgement of receipt as the record of transfer of licensed material as required by Chapter 0400-20-10;

10. For any shipment or any part of a shipment for which acknowledgement of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with Section III.E. of this Schedule; and

11. Notify the shipper and the Director, Division of Radiological Health, when any shipment, or part of a shipment, has not arrived within 60 days after receipt of an advance manifest, unless notified by the shipper that the shipment has been cancelled.

D. The land disposal facility operator shall:

1. Acknowledge receipt of the waste within 1 week of receipt by returning, as a minimum, a signed copy of NRC Form 540 to the shipper. The shipper to be notified is the licensee who last possessed the waste and transferred the waste to the operator. If any discrepancy exists between materials listed on the Uniform Low-Level Radioactive Waste Manifest and materials received, copies or electronic transfer of the affected forms must be returned indicating the discrepancy;

2. Maintain copies of all completed manifests and electronically store the information required by paragraph (1) of Rule 0400-20-11-.19 until the Division terminates the license; and

3. Notify the shipper and the Director, Division of Radiological Health, when any shipment, or part of a shipment, has not arrived within 60 days after receipt of an advance manifest, unless notified by the shipper that the shipment has been cancelled.

E. Any shipment or part of a shipment for which acknowledgement is not received within the times set forth in this section shall:

1. Be investigated by the shipper if the shipper has not received notification or receipt within 20 days after transfer; and

2. Be traced and reported. The investigation shall include tracing the shipment and filing a report with the Director, Division of Radiological Health, at the address given in Rule 0400-20-04-.07. Each licensee who conducts a trace investigation shall file a written report with the Division within 2 weeks of completion of the investigation.

Authority: *T.C.A. §§ 68-202-101 et seq., 68-202-201 et seq. and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.162 TYPE X QUANTITIES AND TRANSPORT GROUPS.

(1) Transport group as used in this rule means any one of seven groups into which radionuclides in normal form are classified, according to their toxicity and their relative potential hazard in transport, in Table RHS 2–3.

(a) Any radionuclide, not specifically listed in one of the groups in Table RHS 2–3 shall be assigned to one of the groups in accordance with Table RHS 2–2.

(b) For mixtures of radionuclides the following shall apply:

1. If the identity and respective activity of each radionuclide are known, the permissible activity of each radionuclide shall be such that the sum, for all groups present, of the ratio between the total activity for each group to the permissible activity for each group will not be greater than unity.

2. If the groups of the radionuclides are known, but the activity in each group cannot be reasonably determined, the mixture shall be assigned to the most restrictive group present.

3. If the identity of all or some of the radionuclides cannot be reasonably determined, each of the unidentified radionuclides shall be considered as belonging to the most restrictive group that cannot be positively excluded.

4. Mixtures consisting of a single radioactive decay chain where the radionuclides are in the naturally occurring proportions shall be considered as consisting of a single radionuclide. The group and activity shall be that of the first member present in the chain, except that if a radionuclide “x” has a half–life longer than that of the first member and an activity greater than that of any other member, including the first, at any time during transportation, the group of the nuclide “x” and the activity of the mixture shall be the maximum activity of that nuclide “x” during transportation.

TABLE RHS 2–1
TYPE X QUANTITIES

Transport Group	Type X Quantity Limit (in curies)
I	0.001
II	0.050
III	3
IV	20
V	20
VI	1,000
VII	1,000
Special Form	20

(Rule 0400-20-05-.162, continued)

TABLE RHS 2–2

Radionuclide	Radioactive half–life 0 to 1,000 days	1,000 days to one million years	over one million years
Atomic Number 1–81	Group III	Group II	Group III
Atomic Number 82 and Over	Group I	Group I	Group III

TABLE RHS 2–3 TRANSPORT GROUPING OF RADIONUCLIDES

Element *	Radionuclide ***	Group
Actinium (89)	Ac–227	I
	Ac–228	I
Americium (95)	Am–241	I
	Am–243	I
Antimony (51)	Sb–122	IV
	Sb–124	III
	Sb–125	III
Argon (18)	Ar–37	VI
	Ar–41	II
	Ar–41 (uncompressed) **	V
Arsenic (33)	As–73	IV
	As–74	IV
	As–76	IV
	As–77	IV
Astatine (85)	At–211	III
Barium (56)	Ba–131	IV
	Ba–133	II
	Ba–140	III
Berkelium (97)	Bk–249	I
Beryllium (4)	Be–7	IV
Bismuth (83)	Bi–206	IV
	Bi–207	III
	Bi–210	II
	Bi–212	III
Bromine (35)	Br –82	IV
Cadmium (48)	Cd–109	IV
	Cd–115 m	III
	Cd–115	IV
Calcium (20)	Ca–45	IV
	Ca–47	IV
Californium (98)	Cf–249	I
	Cf–250	I
	Cf–252	I
Carbon (6)	C–14	IV
Cerium (58)	Ce–141	IV
	Ce–143	IV
	Ce–144	III

* Atomic number shown in parentheses.

*** Atomic weight shown after the radionuclide symbol.

** Uncompressed means at a pressure not exceeding one atmosphere.

m Metastable State.

(Rule 0400-20-05-.162, continued)

Element *	Radionuclide ***	Group
Cesium (55)	Cs–131	IV
	Cs–134 m	III
	Cs–134	III
	Cs–135	IV
	Cs–136	IV
	Cs–137	III
Chlorine (17)	Cl–36	III
	Cl–38	IV
Chromium (24)	Cr–51	IV
Cobalt (27)	Co–56	III
	Co–57	IV
	Co–58 m	IV
	Co–58	IV
	Co–60	III
Copper (29)	Cu–64	IV
Curium (96)	Cm–242	I
	Cm–243	I
	Cm–244	I
	Cm–245	I
	Cm–246	I
Dysprosium (66)	Dy–154	III
	Dy–165	IV
	Dy–166	IV
Erbium (68)	Er–169	IV
	Er–171	IV
Europium (63)	Eu–130	III
	Eu–152m	IV
	Eu–152	III
	Eu–154	II
	Eu–155	IV
Fluorine (9)	F–18	IV
Gadolinium (64)	Gd–153	IV
	Gd–159	IV
Gallium (31)	Ga–67	III
	Ga–72	IV
Germanium (32)	Ge–71	IV
Gold (79)	Au–193	III
	Au–194	III
	Au–195	III
	Au–196	IV
	Au–198	IV
	Au–199	IV
Hafnium (72)	Hf–181	IV
Holmium (67)	Ho–166	IV
Hydrogen (1)	H–3 (see tritium)	
Indium (49)	In–113 m	IV
	In–114 m	III
	In–115 m	IV
	In–115	IV
Iodine (53)	I–124	IV
	I–125	III

m Metastable State.

(Rule 0400-20-05-.162, continued)

Element [*]	Radionuclide [***]	Group
	I–126	III
	I–129	III
	I–131	III
	I–132	IV
	I–133	III
	I–134	IV
	I–135	IV
Iridium (77)	Ir–190	IV
	Ir–192	III
	Ir–194	IV
Iron (26)	Fe–55	IV
	Fe–59	IV
Krypton (36)	Kr–85 [m]	III
	Kr–85 [m] (uncompressed) [**]	V
	Kr–85	III
	Kr–85 (uncompressed) [**]	II
	Kr–87 (uncompressed) [**]	V
Lanthanum (57)	La–140	IV
Lead (82)	Pb–203	IV
	Pb–210	II
	Pb–212	II
Lutetium (71)	Lu–172	IV
	Lu–177	IV
Magnesium (12)	Mg–28	IV
Manganese (25)	Mn–52	IV
	Mn–54	IV
	Mn–56	IV
Mercury (80)	Hg–197 [m]	IV
	Hg–197	IV
	Hg–203	IV
Mixed fission products (MFP)		II
Molybdenum (42)	Mo–99	IV
Neodymium (60)	Nd–147	IV
	Nd–149	IV
Neptunium (93)	Np–237	I
	Np–239	I
Nickel (28)	Ni–56	III
	Ni–59	IV
	Ni–63	IV
	Ni–65	IV
Niobium (41)	Nb–93 [m]	IV
	Nb–95	IV
	Nb–97	IV
Osmium (76)	Os–185	IV
	Os–191 [m]	IV
	Os–191	IV
	Os–193	IV
Palladium (46)	Pd–103	IV
	Pd–109	IV
Phosphorus (15)	P–32	IV
Platinum (78)	Pt–191	IV
	Pt–193	IV

[**] Uncompressed means at a pressure not exceeding one atmosphere.
[m] Metastable State.

(Rule 0400-20-05-.162, continued)

Element *	Radionuclide ***	Group
	Pt–193 m	I
	Pt–197 m	IV
	Pt–197	IV
Plutonium (94)	Pu–238 (F)	I
	Pu–239 (F)	I
	Pu–240	I
	Pu–241 (F)	I
	Pu–242	I
Polonium (84)	Po–210	I
Potassium (19)	K–42	IV
	K–43	III
Praseodymium (59)	Pr–142	IV
	Pr–143	IV
Promethium (61)	Pm–147	IV
	Pm–149	IV
Protactinium (91)	Pa–230	I
	Pa–231	I
	Pa–233	II
Radium (88)	Ra–223	II
	Ra–224	II
	Ra–226	I
	Ra–228	I
Radon (86)	Rn–220	IV
	Rn–222	II
Rhenium (75)	Re–183	IV
	Re–186	IV
	Re–187	IV
	Re–188	IV
	Re Natural	IV
Rhodium (45)	Rh–103 m	IV
	Rh–105	IV
Rubidium (37)	Rb–86	IV
	Rb–87	IV
	Rb Natural	IV
Ruthenium (44)	Ru–97	IV
	Ru–103	IV
	Ru–105	IV
	Ru–106	III
Samarium (62)	Sm–145	III
	Sm–147	III
	Sm–151	IV
	Sm–153	IV
Scandium (21)	Sc–46	III
	Sc–47	IV
	Sc–48	IV
Selenium (34)	Se–75	IV
Silicon (14)	Si–31	IV
Silver (47)	Ag–105	IV
	Ag–110 m	III
	Ag–111	IV
Sodium (11)	Na–22	III

(F) Fissile material.
(F) Fissile material.
m Metastable State.

(Rule 0400-20-05-.162, continued)

Element *	Radionuclide ***	Group
	Na–24	IV
Strontium (38)	Sr–85 m	IV
	Sr–85	IV
	Sr–89	III
	Sr–90	II
	Sr–91	III
	Sr–92	IV
Sulfur (16)	S–35	IV
Tantalum (73)	Ta–182	III
Technetium (43)	Tc–96[10]	IV
	Tc–96	IV
	Tc–97 m	IV
	Tc–97	IV
	Tc–99 m	IV
	Tc–99	IV
Tellurium (52)	Te–125 m	IV
	Te–127 m	IV
	Te–127	IV
	Te–129 m	III
	Te–129	IV
	Te–131 m	III
	Te–132	IV
Terbium (65)	Tb–160	III
Thallium (81)	Tl–200	IV
	Tl–201	IV
	Tl–202	IV
	Tl–204	III
Thorium (90)	Th–227	II
	Th–228	I
	Th–230	I
	Th–231	I
	Th–232	III
	Th–234	II
	Th Natural	III
Thulium (69)	Tm–168	III
	Tm–170	III
	Tm–171	IV
Tin (50)	Sn–113	IV
	Sn–117 m	III
	Sn–121	III
	Sn–125	IV
Tritium (1)	H–3	IV
	H–3 (as a gas, as luminous paint, or absorbed on solid material)	VII
Tungsten (74)	W–181	IV
	W–185	IV
	W–187	IV
Uranium (92)	U–230	II
	U–232	I
	U–233 (F)	II
	U–234	II
	U–235 (F)	III

[10] Metasable State
(F) Fissile material.

(Rule 0400-20-05-.162, continued)

Element [*]	Radionuclide [***]	Group
	U–236	II
	U–238	III
	U Natural	III
	U Enriched [(F)]	III
	U Depleted	III
Vanadium (23)	V–48	IV
	V–49	III
Xenon (54)	Xe–125	III
	Xe–131 [m]	III
	Xe–131 [m] (uncompressed) [**]	V
	Xe–133	III
	Xe–133 (uncompressed) [**]	VI
	Xe–135	II
	Xe–135 (uncompressed) [**]	V
Ytterbium (70)	Yb–175	IV
Yttrium (39)	Y–88	III
	Y–90	IV
	Y–91 [m]	III
	Y–91	III
	Y–92	IV
	Y–93	IV
Zinc (30)	Zn–65	IV
	Zn–69 [m]	IV
	Zn–68	IV
	Zn–69	IV
Zirconium (40)	Zr–93	IV
	Zr–95	III
	Zr–97	IV

Authority: *T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.163 REPORTS OF TRANSACTIONS INVOLVING NATIONALLY TRACKED SOURCES.

Each licensee who manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit to the NRC a National Source Tracking Transaction Report as specified in paragraphs (1) through (5) of this rule for each type of transaction.

(1) Each licensee who manufactures a nationally tracked source shall complete and submit a National Source Tracking Transaction Report. The report must include the following information:

(a) The name, address, and license number of the reporting licensee;

(b) The name of the individual preparing the report;

(c) The manufacturer, model, and serial number of the source;

(d) The radioactive material in the source;

[**] Uncompressed means at a pressure not exceeding one atmosphere.
[m] Metastable State.

(Rule 0400-20-05-.163, continued)

(e) The initial source strength in becquerels (curies) at the time of manufacture; and

(f) The manufacture date of the source.

(2) Each licensee that transfers a nationally tracked source to another person shall complete and submit a National Source Tracking Transaction Report. The report must include the following information:

(a) The name, address, and license number of the reporting licensee;

(b) The name of the individual preparing the report;

(c) The name and license number of the recipient facility and the shipping address;

(d) The manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(e) The radioactive material in the source;

(f) The initial or current source strength in becquerels (curies);

(g) The date for which the source strength is reported;

(h) The shipping date;

(i) The estimated arrival date; and

(j) For nationally tracked sources transferred as waste under a Uniform Low-Level Radioactive Waste Manifest, the waste manifest number and the container identification of the container with the nationally tracked source.

(3) Each licensee that receives a nationally tracked source shall complete and submit a National Source Tracking Transaction Report. The report must include the following information:

(a) The name, address, and license number of the reporting licensee;

(b) The name of the individual preparing the report;

(c) The name, address, and license number of the person that provided the source;

(d) The manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(e) The radioactive material in the source;

(f) The initial or current source strength in becquerels (curies);

(g) The date for which the source strength is reported;

(h) The date of receipt; and

(i) For material received under a Uniform Low-Level Radioactive Waste Manifest, the waste manifest number and the container identification with the nationally tracked source.

(Rule 0400-20-05-.163, continued)

(4) Each licensee that disassembles a nationally tracked source shall complete and submit a National Source Tracking Transaction Report. The report must include the following information:

(a) The name, address, and license number of the reporting licensee;

(b) The name of the individual preparing the report;

(c) The manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(d) The radioactive material in the source;

(e) The initial or current source strength in becquerels (curies);

(f) The date for which the source strength is reported;

(g) The disassemble date of the source.

(5) Each licensee who disposes of a nationally tracked source shall complete and submit a National Source Tracking Transaction Report. The report must include the following information:

(a) The name, address, and license number of the reporting licensee;

(b) The name of the individual preparing the report;

(c) The waste manifest number;

(d) The container identification with the nationally tracked source;

(e) The date of disposal; and

(f) The method of disposal.

(6) The National Source Tracking Transaction Report discussed in paragraphs (1) through (5) of this rule must be submitted to the U.S. NRC by the close of the next business day after the transaction. A single report may be submitted for multiple sources and transactions. The reports must be submitted to the National Source Tracking System by using:

(a) The on-line National Source Tracking System;

(b) Electronically using a computer-readable format;

(c) By facsimile;

(d) By mail to the address on the NRC Form 748 National Source Tracking Transaction Report Form; or

(e) By telephone with follow up by facsimile or mail.

(7) Each licensee shall correct any error in previously filed reports or file a new report for any missed transaction within 5 business days of the discovery of the error or missed transaction. Such errors may be detected by a variety of methods such as administrative reviews or by physical inventories required by regulation. In addition, each licensee shall reconcile the inventory of nationally tracked sources possessed by the licensee against that licensee's

(Rule 0400-20-05-.163, continued)

data in the National Source Tracking System. The reconciliation must be conducted during the month of January in each year. The reconciliation process must include resolving any discrepancies between the National Source Tracking System and the actual inventory by filing the reports identified by paragraphs (1) through (5) of this rule. By January 31 of each year, each licensee must submit to the National Source Tracking System confirmation that the data in the National Source Tracking System is correct.

Authority: *T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.164 NATIONALLY TRACKED SOURCE THRESHOLDS.

The Terabecquerel (TBq) values are the regulatory standard. The curie (Ci) values specified are obtained by converting from the TBq value. The curie values are provided for practical usefulness only and are rounded after conversion.

Radioactive material	Category 1 (TBq)	Category 1 (Ci)	Category 2 (TBq)	Category 2 (Ci)
Actinium-227	20	540	0.2	5.4
Americium-241	60	1,600	0.6	16
Americium-241/Be	60	1,600	0.6	16
Californium-252	20	540	0.2	5.4
Cobalt-60	30	810	0.3	8.1
Curium-244	50	1,400	0.5	14
Cesium-137	100	2,700	1	27
Gadolinium-153	1,000	27,000	10	270
Iridium-192	80	2,200	0.8	22
Plutonium-238	60	1,600	0.6	16
Plutonium-239/Be	60	1,600	0.6	16
Polonium-210	60	1,600	0.6	16
Promethium-147	40,000	1,100,000	400	11,000
Radium-226	40	1,100	0.4	11
Selenium-75	200	5,400	2	54
Strontium-90	1,000	27,000	10	270
Thorium-228	20	540	0.2	5.4
Thorium-229	20	540	0.2	5.4
Thulium-170	20,000	540,000	200	5,400
Ytterbium-169	300	8,100	3	81

Authority: *T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*

0400-20-05-.165 REPORT, NOTIFICATION, AND RECORDS OF A DOSE TO AN EMBRYO/FETUS OR A NURSING CHILD.

(1) A licensee or registrant shall report to the Division at the address listed in Rule 0400-20-04-.07, any dose to an embryo/fetus that is greater than 50 mSv (5 rem) dose equivalent that is a result of an administration of radioactive material or radiation from radioactive material to a pregnant individual unless the dose to the embryo/fetus was specifically approved, in advance, by the authorized user.

(2) A licensee or registrant shall report any dose to a nursing child, that was not specifically approved, in advance, by the authorized user, that is a result of an administration of radioactive material to a breast-feeding individual that:

(a) Is greater than 50 mSv (5 rem) total effective dose equivalent; or

(b) Has resulted in unintended permanent functional damage to an organ or a physiological system of the child, as determined by a physician.

(3) A licensee or registrant shall notify the Division at the number given in Rule 0400-20-04-.07 no later than the next calendar day after discovery of a dose to the embryo/fetus or nursing child that requires a report in paragraph (1) or (2) of this rule.

(4) A licensee or registrant shall submit a written report to the Division within 15 days after discovery of a dose to the embryo/fetus or nursing child that requires a report in paragraph (1) or (2) of this rule.

(a) The written report must include:

1. The licensee or registrant's name;

2. The name of the prescribing physician;

3. A brief description of the event;

4. Why the event occurred;

5. The effect, if any, on the embryo/fetus or the nursing child;

6. What actions, if any, have been taken or are planned to prevent recurrence; and

7. Certification that the licensee or registrant notified the pregnant individual or mother (or the mother's or child's responsible relative or guardian), and if not, why not.

(b) The report must not contain the individual's or child's name or any other information that could lead to identification of the individual or child.

(5) A licensee or registrant shall provide notification of the event to the referring physician and also notify the pregnant individual or mother, both hereafter referred to as the mother, no later than 24 hours after discovery of an event that would require reporting under paragraph (1) or (2) of this rule, unless the referring physician personally informs the licensee or registrant either that they will inform the mother or that, based on medical judgment, telling the mother would be harmful. The licensee or registrant is not required to notify the mother without first consulting with the referring physician. If the referring physician or mother cannot be reached within 24 hours, the licensee or registrant shall make the appropriate notifications

(Rule 0400-20-05-.165, continued)

as soon as possible thereafter. The licensee or registrant may not delay any appropriate medical care for the embryo/fetus or for the nursing child, including any necessary remedial care as a result of the event, because of any delay in notification. To meet the requirements of this paragraph, the notification may be made to the mother's or child's responsible relative or guardian instead of the mother. If a verbal notification is made, the licensee or registrant shall inform the mother, or the mother's or child's responsible relative or guardian, that a written description of the event can be obtained from the licensee upon request. The licensee or registrant shall provide a written description if requested.

(6) A licensee or registrant shall retain a record of a dose to an embryo/fetus or a nursing child in accordance with this rule for 3 years. A copy of the record required shall be provided to the referring physician, if other than the licensee or registrant, no later than 15 days after the discovery of the event. The record must contain the licensee or registrant's name; names of all the individuals involved; social security number or other identification number if one has been assigned to the pregnant individual or nursing child who is the subject of the event; a brief description of the event; why it occurred; the effect, if any, on the embryo/fetus or nursing child; the actions, if any, taken, or planned, to prevent recurrence; and whether the licensee or registrant notified the pregnant individual or mother (or the mother's or child's responsible relative or guardian) and, if not, whether such failure to notify was based on guidance from the referring physician.

Authority: *T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.* ***Administrative History:*** *Original rule filed February 22, 2012; effective May 22, 2012.*